Evidence based teaching and learning
Is it practical?

STA 2017

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Session goals

After completing this activity the participant will be able to

1. Describe the 2 sigma problem in education
2. Analyze evidence for effective use of blended learning techniques
3. Critically appraise evidence for spaced repetition practice in learning
4. Synthesize current evidence to design a program that works in their institution
SCENARIO 1

• You have been tasked by your chairperson to create a curriculum for the CA1 residents.
• The overwhelming complaint from the faculty is that the residents do not read text books.
• You have only one hour in a week to accomplish this goal.
• What is the evidence, how can you use it to create a curriculum that will engage the learner and be acceptable to your faculty.
National Endowment for the Arts

• Americans are spending less time reading.
• Reading comprehension skills are eroding.
• These declines have serious civic, social, cultural, and economic implications.

To Read or Not To Read
A Question of National Consequence

ResearchReport#47, ExecutiveSummary, November2007
YouTube is the Most Frequently Used Educational Video Source for Surgical Preparation

Allison K. Rapp, BS, * Michael G. Healy, MS, † Mary E. Charlton, PhD, ‡ Jerrod N. Keith, MD, † Marcy E. Rosenbaum, PhD, § and Muneera R. Kapadia, MD, MME †

Percent of Learners and Faculty Reporting Use of Videos by Source (n=70)
The 2 Sigma Problem: The Search for Methods of Group Instruction as Effective as One-to-One Tutoring

BENJAMIN S. BLOOM
University of Chicago and Northwestern University

*Teacher-student ratio

Summative Achievement Scores

June/July 1984
Evaluation of Evidence-Based Practices in Online Learning
A Meta-Analysis and Review of Online Learning Studies
Methods

- Published literature from 1996-2008
- 1000 studies evaluated
- Only 176 had good experimental design and objective measured student outcomes
- 50 independent effects subjected to Meta analysis
Blended Learning

Online Format
- Portable
- Asynchronous
- Speed can be tailored
- Scalable

Highly Effective

Face-to-Face Format
- Personalized
- Feedback
- Inspiring
What material can be taught best using online format

Using Online Lectures to Make Time for Active Learning

Amy J. Prunuske,*† Janet Batzli,*† Evelyn Howell,*‡ and Sarah Miller§

*Department of Biomedical Sciences, University of Minnesota, Duluth, Minnesota 55812, and †Biology Core Curriculum, ‡Department of Landscape Architecture, and §Madison Teaching and Learning Excellence Program, University of Wisconsin, Madison, Wisconsin 53706
Methods

• Introductory biology class
• Online lectures were recorded powerpoint presentations
• Required viewing before the class
• To assess understanding, ARS used
Summary

• Learning gains are similar whether material taught using didactic or blended approach (lower order cognitive skills)

• Combination of online and face-to-face teaching works better than either alone

• Students value face to face interaction with faculty

• Online format is best for imparting lower order cognitive skills and face to face format best for modeling higher order cognitive skills
The model for flipping includes:

- Synthesis
- Analysis
- Application
- Comprehension
- Knowledge

In class

At home
Yale Anesthesia

The Flipped Classroom Model

During
Analysis & synthesis of Information

IN CLASS

Before
basic Information about topic

AT HOME

After
Reinforce concepts

Yale Anesthesia Media Lab
Cognitive theory of multimedia learning

- Limited capacity principle
- Dual channel principle
  - Words/sounds
  - Pictures/video
- Active processing principle
  - Understand
  - Organize
  - Integrate
- Extraneous overload
- Essential overload
- Motivation
# Research based principles for instructional design of lessons

<table>
<thead>
<tr>
<th>Principle</th>
<th>Effect Size</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Decrease extraneous processing</strong></td>
<td></td>
</tr>
<tr>
<td>Coherance: Eliminate extraneous material</td>
<td>0.97</td>
</tr>
<tr>
<td>Signalling: Highlight essential material</td>
<td>0.52</td>
</tr>
<tr>
<td>Contiguity: Place words near corresponding graphics</td>
<td>1.19</td>
</tr>
<tr>
<td><strong>Manage essential processing</strong></td>
<td></td>
</tr>
<tr>
<td>Pre-training: Pre-exposure to words/concepts</td>
<td>0.98</td>
</tr>
<tr>
<td>Segmenting: Break lessons in small chunks</td>
<td>0.85</td>
</tr>
<tr>
<td>Modality: Present words in spoken form</td>
<td>1.02</td>
</tr>
<tr>
<td><strong>Foster generative processing</strong></td>
<td></td>
</tr>
<tr>
<td>Multimedia: Words and pictures</td>
<td>1.39</td>
</tr>
<tr>
<td>Personalization: Conversational tone</td>
<td>1.11</td>
</tr>
</tbody>
</table>

Our experience

https://medicine.yale.edu/anesthesiology/media/flipped_classroom.aspx
Algorithm

Blunt Abdominal Trauma

1. Haemodynamically Unstable
   - FAST (intraperitoneal fluid)
     - +
       - Laparotomy
     - - / ?
       - Consider:
         - Other sites of blood loss
         - Non-haemorrhagic shock
       - Consider:
         - Repeat FAST or DPL

? : indeterminate

www.trauma.org
In class

• Divided into 4 teams

• ATLS- Primary survey, secondary survey
• Pre-operative- warmers, calling blood bank
• Intra-operative- damage control resuscitation
• ICU- trauma coagulopathy, compartment syndromes
SCENARIO 2

• A CA1 resident comes to you and asks for advice regarding board prep for the Basic exam.
• He has failed it the first time and is devastated.
• He has been watching podcasts and reading books, but does not seem to remember the material although he has highlighted the material in multiple colors.
• What are some evidence-based tips that you can give him in terms of learning, that he can use to help him remember the material better and feel better prepared for the exam
Evidence for efficient learning techniques

Spaced repetition

Testing effect
Learning and forgetting

The Ebbinghaus Forgetting Curve
Spaced repetition
The Spacing Effect

A Case Study in the Failure to Apply the Results of Psychological Research

Frank N. Dempster  University of Nevada, Las Vegas

ABSTRACT: The spacing effect would appear to have considerable potential for improving classroom learning, yet there is no evidence of its widespread application. I consider nine possible impediments to the implementation of research findings in the classroom in an effort to determine which, if any, apply to the spacing effect. I conclude that the apparent absence of systematic application may be due, in part, to the ahistorical character of research recent sampling of practitioner-oriented textbooks suitable for use in teacher education programs. I found either little or no mention of the practical benefits of the spacing effect, and in some cases the spacing effect was confused with other phenomena (e.g., Good & Brophy, 1986; Mayer, 1987; Slavin, 1986; Woolfolk, 1987). One well-known educator, in fact, advised against spaced practice at least in the early stages of learning (Hunter, 1983).
Recall/Testing

REPORT

The Critical Importance of Retrieval for Learning

Jeffrey D. Karpicke¹, Henry L. Roediger III²

+ Author Affiliations
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Science 15 Feb 2008:
Vol. 319, Issue 5865, pp. 966-968
DOI: 10.1126/science.1152408
Repeateed Testing versus Repeated Study

Fig. 1. Cumulative performance during the learning phase.

Jeffrey D. Karpicke, and Henry L. Roediger III Science 2008;319:966-968

Fig. 2. Proportion recalled on the final test 1 week after learning.
Retrieval Practice Produces More Learning than Elaborative Studying with Concept Mapping

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Science 11 Feb 2011:
Vol. 331, Issue 6018, pp. 772-775
DOI: 10.1126/science.1199327

Jeffrey D. Karpicke, and Janell R. Blunt Science 2011;331:772-775
Journals for medical education

• Academic Medicine
• Medical Education
• Medical Teacher
• Education for Health,
• Evaluation & the Health Professions
• Advances in Health Science Education
• Health Professional Education
• Medical Education Online
• BMC, Medical Education
Thank You Questions??

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Resources

• Kurup V. Hersey D. The changing landscape of anesthesia education- Is Flipped Classroom the answer?. Current Opinion in Anesthesiaology. Dec 2013


• Prunuske AJ, Batzli J et al. Using online lectures to make time for active learning. Genetics, 192; 2012: 67-72


• Mayer, Richard E. Applying the science of learning to medical education. 2010. 44(6); 543-49.

• Karpicke. Retrieval practice produces more learning than elaborative studying with concept mapping. Science 2011. 331