A Case for the Flipped Classroom

A Three-year Longitudinal Study of Student Perception, Engagement and Performance

Russell J. Mumper, PhD
University of Georgia

June 18, 2015
Learning Objectives

• Describe the rationale and motivation for the flipped classroom

• Describe qualitative and quantitative outcomes of the use of the flipped classroom

• Plan ways to implement flipped learning in the participant’s classroom

• Evaluate the role of the flipped classroom in pharmacy education
Why Curricular Change?

• Crisis in Higher Education

• Crisis in Health Care

• The 21st Century Student

• Our School’s New Strategic Plan
Skills Needed in The 21st Century

- Adaptability and agility
- Critical thinking
- Complex problem solving
- Clear communication
- Capacity for continued learning
- Initiative and entrepreneurialism
- Ability to access and analyze information
- Curiosity and imagination
- Ability to contribute to innovation
- Ethical judgment and integrity
- Intercultural awareness
- Collaboration across networks / leading by influence
- Applied knowledge in real-world settings
The Past ... *Forward Engineering*

- Content, Content, Content
- Lecture, Lecture, Lecture

Have you sat in the back of a lecture hall recently ... and just observed?

Average attention span of medical students is 15-20 minutes (Stuart in *Lancet*, 1978)
Our School’s Curriculum Transformation

INVITED COMMENTARY

A Renaissance in Pharmacy Education at the University of North Carolina at Chapel Hill

Mary T. Roth, Russell J. Mumper, Scott F. Singleton, Craig R. Lee, Philip T. Rodgers, Wendy C. Cox, Jacqueline E. McLaughlin, Pam Joyner, Robert A. Blouin

The UNC Eshelman School of Pharmacy is transforming its doctor of pharmacy program to emphasize active engagement of students in the classroom, foster scientific inquiry and innovation, and immerse students in patient care early in their education. The admissions process is also being reengineered.
Defining Elements of Change

- Reengineering the Admissions Process
- Consolidation of Curricular Content and Active Learning
- Early Immersion in Clinical Practice
- Immersion in Inquiry and Scholarship
Shifting the acquisition of knowledge and content outside the classroom and freeing up class time to enable more meaningful faculty-student interaction and student engagement in higher forms of thinking and problem solving.

Flipped classroom = Backwards classroom = Reverse instruction = Reverse teaching

Blooms Taxonomy
A multi-tiered model of classifying thinking according to six cognitive levels of complexity

- Remembering
- Understanding
- Applying
- Analyzing
- Evaluating
- Creating
Value and Feasibility of the Flipped Model

Lecture Halls without Lectures — A Proposal for Medical Education
Charles G. Prober, M.D., and Chip Heath, Ph.D.

The last substantive reform in medical student education followed the Flexner Report, which was written in 1910. In the ensuing 100 years, the volume of medical knowledge has exploded, the complexity of the health care system has grown, pedagogical methods have evolved, and unprecedented opportunities for technological support of learners have become available. Yet students are being taught roughly the same way they were taught when the Wright brothers were tinkering at Kitty Hawk.

It's time to change the way we educate doctors. Since the hours available in a day have not increased to accommodate the expanded medical canon, we have only one realistic alternative: make better use of our students' time. We believe that medical education

The New England Journal of Medicine

Medical Education Reimagined: A Call to Action
Charles G. Prober, MD, and Salman Khan

Abstract
The authors propose a new model for medical education based on the “flipped classroom” design. In this model, students would access brief (~10 minute) online videos to learn new concepts on their own time. The content could be viewed by the students as many times as necessary to master the knowledge in preparation for classroom time facilitated by expert faculty leading dynamic, interactive sessions where students can apply their newly mastered knowledge.

The authors argue that the modern digitally empowered learner, the unrelenting expansion of biomedical knowledge, and the increasing specialization within the practice of medicine drive the need to reimagine medical education. The changes that they propose emphasize the need to define a core curriculum that can meet learners where they are in a digitally oriented world, enhance the relevance and retention of knowledge through rich interactive exercises, and facilitate in-depth learning fueled by individual students' aptitude and passion. The creation and adoption of this model would be meaningfully enhanced by cooperative efforts across medical schools.
Value and Feasibility of the Flipped Model

**Improved Learning in a Large-Enrollment Physics Class**

Louis Deslauriers, Ellen Schelew, Carl Wieman

We compared the amounts of learning achieved using two different instructional approaches under controlled conditions. We measured the learning of a specific set of topics and objectives when taught by 3 hours of traditional lecture given by an experienced highly rated instructor and 3 hours of instruction given by a trained but inexperienced instructor using instruction based on research in cognitive psychology and physics education. The comparison was made between two large sections (N = 267 and N = 271) of an introductory undergraduate physics course. We found increased student attendance, higher engagement, and more than twice the learning in the section taught using research-based instruction.

Fig. 1. Histogram of student scores for the two sections.

The average scores were 41 ± 1% in the control section and 74 ± 1% in the experimental section. Random guessing would produce a score of 23%, so the students in the experimental section did more than twice as well on this test as those in the control section.
Pair and Share

With your current understanding, what do you see as the most significant **opportunities/advantages** and **challenges/limitations** of the flipped classroom?
Flipped Classroom

Opportunities / Advantages

1.
2.
3.
4.
5.

Challenges / Limitations

1.
2.
3.
4.
5.
The Impact of a Blended-Learning Approach on Student Performance and Satisfaction in a Pharmaceutics Course

This study (# 12-0685) was reviewed by the Office of Human Research Ethics at the University of North Carolina and was determined to be exempt from further review under 45 CFR 46.101(b).

Course Overview

- Drug delivery systems and dosage forms
- Every route of administration
- Biotechnology and nanomedicine prominently profiled
- 162 students (86% had Baccalaureate degree)
  - 140 students met in a large lecture hall in Chapel Hill
  - 22 students attended the course synchronously via video-teleconference from two satellite campuses
Guiding Principles

• We will Reverse Engineer from “The Job to be Done”...
• We will deliver fundamental and foundational content outside of class
• We will emphasize active learning and engagement in class
• We will exploit the unique and differentiating research and/or clinical expertise of our faculty
• We will not teach students everything they need to know
Reverse Engineering for PHCY 411

The Job to be Done
RE: “Pharmaceutics”

Prescribing Info

Contemporary Case

Pharmacokinetics and Absolute Bioavailability of Selegiline Following Treatment of Healthy Subjects With the Selegiline Transdermal System (6 mg/24 h): A Comparison With Oral Selegiline Capsules

Albert J. Azano, PhD, John Ziemniak, PhD, Eva Kemper, Bryan J. Campbell, PharmD, and Chad VanDervog, PharmD

The selegiline transdermal system is a prescription cran- dibose solution that was recently approved by the US Food and Drug Administration for the treatment of major depressive disorder. This current study was conducted during the phase 3 clinical trials to determine the absolute pharmacokinetics and bioavailability of selegiline following transdermal administration of the 6-mg/24-h selegiline transdermal system in healthy volunteers. Selegiline transdermal system results were compared with those obtained after a single 10-mg dose of selegiline HCI. The active metabolite's absolute bioavailability was 15% ± 3%, and peak plasma concentration was 1.2 ± 0.2 μg/mL. The absolute bioavailability of selegiline was 12% ± 4%, and peak plasma concentration was 0.4 ± 0.1 μg/mL. The data demonstrated that the selegiline transdermal system provides a consistent delivery of selegiline and is an effective treatment for major depressive disorder.

Keywords: Selegiline transdermal; oral pharmacokinetics; bioavailability

© 2007 the American College of Clinical Pharmacology

Topicals and Transdermals & Needle-Free Devices
(Class 16-17)

PHCY 411 - Basic Pharmacology II

Spring 2013
Russell J. Mumper, Ph.D.
PHCY 411 – Traditional and Flipped Class

**A. The Traditional PHCY 411 Classroom**
- **Instructor Lecture**
  - 50 min
  - Content: Focus some Application
  - Emphasis: 20% foundational material
  - Occasional Quiz or Pair & Share
  - Engagement: Some Q & A
  - Assessment

- **Off-Loaded Content**
  - Assigned Reading: 45 min

**B. The Flipped PHCY 411 Classroom**
- **Off-Loaded Content**
  - Self-paced Interactive Learning Accelerator Modules (ILAMs): 35 min
  - Assigned Reading: 45 min

- **Assessment of Foundational Learning**
  - Audience Response (Clicker) Questions: 15 min
  - Pair & Share: Rapid, Reflective, or Proactive
  - Micro-Lecture: 15 min, as needed

- **Student Presentations & Discussion**
  - Quiz: 20 min
  - Student Presentations: 25 min

- **Assessment**

- **Course Projects**
  - (due at end of semester)

- **Assessment**

- **Three Mid-term Exams:**
  - 75% multiple-choice
  - 20% short answer
  - 5% essay

- **A few Quizzes**

- **PHCY 411 Cumulative Final**

**Keys:**
- At home
- Instructor
- Students
PHCY 411 Sakai Site
PHCY 411 iLAMs

*iLAMS = Integrated Learning Accelerator Modules*

- Condensed about 29 hours of Powerpoint lectures to 25 iLAMs
- Average iLAM 34.6 min (range 21-55 min); total time = **14.4 hours**
Audience Response – Clicker Questions

• A critical assessment tool to verify student learning

To date, what has been the biggest limitation of adeno-associated virus (AAV) for gene therapy?

1. Insert capacity of 4.5 kb
2. Lower titers
3. Integration
4. 1 and 2
5. All of the above

“micro-lecture” 1-3 minutes

Human Factor VIII protein: The protein contains 2332 amino acids and is unusually large at 330 kDa. It is comprised of three different domains, an A-domain which is repeated three times, a central B-domain, and a C domain which is repeated twice. The total combined protein requires about 7000 coding bases or 7.0 kb which is too large for the insert capacity of the AAV.

However, it has been demonstrated that a mixture of two AAVs could be utilized: one containing a heavy chain and one containing a light chain (with the B-domain deleted).

Heavy chain: $A_1 + A_2 = 2.5$ kb
Light chain: $A_2 + C_1 + C_2 = 2.4$ kb

Expression of factor VIII for ~5 years; >90% of the expected bleeding episodes were prevented.

Sabatino et al. (Molecular Therapy, 2010)
Audience Response – Clicker Questions

- A database of hundreds of Clicker Questions has now been built and validated for each course topic.
**Pair & Share Exercises**

- Rapid, Reflective, and Proactive types

---

**PAIR AND SHARE (3/18/2013)**

Despite decades of research and development, only ~20 different drugs are currently approved by the FDA for transdermal delivery. Why?

---

**STUDENT THOUGHTS (3/18/13)**

- Inter- and intra-patient variability – skin thickness
- Difficult to control delivered dose – variations in total exposure
- Specific PC requirements of the drug that make it ideally suited: MW, Kow/w, hydrophilic/lipophilic balance
- Slow delivery: viable strategy (primarily) for chronic diseases
- Environmental challenges: temperature, rip or cut patch, accidental exposure to a removed patch, dislodged patches from clothing, etc. – not getting necessary exposure
- Drugs requiring high Cmax are not good candidates for TDSs
- Adverse effects:
  - Immune: Langerhans cells, Mast cells, other DCs
  - Inflammatory: could be due to limited absorption and relatively long period of time interacting with/on the surface of the skin (high local concentration)
  - Hypersensitivity reactions

---

**“micro-lecture”**

1-3 minutes

---

**Passive Diffusion (Fick’s Law) Cont.**

- Ideal physiochemical properties:
  - Solubility: $>1 \text{ mg/mL}$
  - $K_c: 10 < K < 1000$
  - $M_W: < 500-800 \text{ Da}$
  - pH of solution $pH 5-9$
- Balance of hydrophilicity and lipophilicity
- Low Cmax required
- Therapeutic blood levels is the pg/mL to ng/mL range: not > ug/mL range
- Dose needed per day ($<$ 10 mg/day)
- Not prone to enzymatic degradation
- Used in chronic diseases (limitation of diffusion)
- Veneability
- Skin sensitivity
- Complexity and cost

---

**At steady-state**

- Input rate = Output rate
- $A = J_D = C_L$

**Acetylsalicylic acid (aspirin)**
- Glycerin trinitrate (nitroglycerin)

---

$C_t =$ therapeutic plasma concentration
$C_d =$ drug clearance rate ($\text{cm}^3 \text{hr}^{-1}$)

Pair & Share Exercises

• A database of dozens of Pair & Share questions and Case Studies has now been developed for each course topic.
Sakai Forum – Reflective Pair & Share
Reflective Pair & Share Example


Answers are due by 10 pm Sunday night 2/19. Post your answer (limited to 400 words) directly on the Forum or put in the Drop Box. Up to 5 points will be awarded for well-thought answer.

Hide Full Description

Critical Limb Ischemia (CLI) is a severe obstruction of the arteries which significantly decreases blood flow to the extremities such as the leg. Although graft bypass surgery has increased the rate of limb salvage in these patients, amputation of the affected limb remains a common outcome for many patients. Gene therapy may eliminate the need for surgery and potentially save the leg from amputation. Propose a gene therapy protocol to treat CLI. What are the potential advantages and disadvantages of your approach?
Selected Outcomes

Post-course Survey
- **97%** (Strongly) Agreed that the pre-recorded lectures greatly enhanced their learning
- **93%** (Strongly) Agreed that the flipped methods promoted understanding and application
- **91%** (Strongly) Agreed that the flipped method greatly enhanced their learning
- **98%** (Strongly) Agreed that the developed skills would be useful in their careers

\[ p < 0.001 \text{ for all} \]

Course Evaluation
- Students reported spending **no additional time**
- **11/14** course evaluation metrics increased
- Students at satellite campuses were most enthusiastic
- A small, but vocal cohort of students (~**15%**) did not prefer the new format

Performance
- Increase in Cumulative Final Exam Score:
  - 2011 (80.0% ± 7.3%)
  - 2012 (82.7% ± 6.7%); \( p = 0.001 \)
  - 2013 (85.1% ± 6.9%); \( p < 0.001 \)
Satellite Campuses

**Student Preference**

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Pre-Course Survey</th>
<th>Post-Course Survey</th>
</tr>
</thead>
<tbody>
<tr>
<td>Traditional Format</td>
<td>1.0</td>
<td>0.1</td>
</tr>
<tr>
<td>Flipped Format</td>
<td>0.8</td>
<td>0.9</td>
</tr>
</tbody>
</table>

“I would love for this type of class to be demonstrated in other courses. I think it’s really helped me learn the material.”

— Kristina Blanquiz
Asheville Campus

“As far as being a satellite student with this course, this is a dream come true.”

— Alan Stover
Elizabeth City State Campus

---


**INSTRUCTIONAL DESIGN AND ASSESSMENT**

Pharmacy Student Engagement, Performance, and Perception in a Flipped Satellite Classroom

Jacqueline E. McLaughlin, PhD, MS, LaToya M. Griffin, PhD, Denise A. Esserman, PhD, Christopher A. Davidson, ME, Dylan M. Glatt, Mary T. Roth, PharmD, Nastaran Gharkholonarehe, PharmD, and Russell J. Mumper, PharmD
### Analysis of Required Outside Class Time

**2012**

<table>
<thead>
<tr>
<th>Time Commitment</th>
<th>per Week</th>
<th>per Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>Required Reading</td>
<td>2.0</td>
<td>28.0</td>
</tr>
<tr>
<td>iLAMs</td>
<td>1.0</td>
<td>14.4</td>
</tr>
<tr>
<td>Group Presentations (2x per semester)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Project 1 (due at end)</td>
<td>0.5</td>
<td>7.0</td>
</tr>
<tr>
<td>Project 2 (changed to bonus near the end)**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>4.2⁺</td>
<td>58.4⁺</td>
</tr>
</tbody>
</table>

**2011**

<table>
<thead>
<tr>
<th>Time Commitment</th>
<th>per Week</th>
<th>per Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>Required Reading</td>
<td>2.0</td>
<td>28.0</td>
</tr>
<tr>
<td>Total</td>
<td>2.0</td>
<td>28.0</td>
</tr>
</tbody>
</table>

**2011 Course Year**

<table>
<thead>
<tr>
<th>On average, how many hours/week did you devote to this course outside of class time?</th>
<th>2011</th>
<th>2012</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;3 hr</td>
<td>37</td>
<td>16</td>
<td>53</td>
</tr>
<tr>
<td>3-5 hr</td>
<td>81</td>
<td>102</td>
<td>183</td>
</tr>
<tr>
<td>6-9 hr</td>
<td>30</td>
<td>39</td>
<td>69</td>
</tr>
<tr>
<td>&gt;10 hr</td>
<td>5</td>
<td>3</td>
<td>8</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>153</td>
<td>160</td>
<td>313</td>
</tr>
</tbody>
</table>

*All out of class time was self-directed*

In 2013...All out of class time was self-directed.
Student Perspective
Changes Made in the 2013 Flipped Class

Off-Loaded Content
- Self-paced Interactive Learning Accelerator Modules (iLAMs)
  - 80% foundational material
  - 20% complex concepts & application
- Contemporary Reading
  - 35 min
- Quiz
  - Alone or Paired
  - 40 min

The Flipped PHCY 411 Classroom
1. Assessment of Foundational Learning
   - Audience Response (Clicker) Questions
   - 20 min
2. Pair & Share
   - Rapid or Reflective
   - 20 min
3. Discussion of Contemporary Reading
   - Group / Faculty
   - micro-lecture (1-3 min, as needed)
   - 35 min

Course Project
- (due at end of semester)

Assessment
- 3 Three Mid-term Exams:
  - 50% multiple-choice
  - 25% short answer
  - 25% essay
- Quizzes
- Engagement
- Projects
- PHCY 411 Cumulative Final
Contemporary Reading

- Very carefully selected Research or Review paper
- No more than one assigned reading per week
- Students are to address the following five questions

**Research Paper**

1. What **technical or scientific problem** does the dosage form or delivery system attempt to address?
2. What are the **major findings**?
3. What questions remain **unanswered** by the published paper?
4. Do the studies have any **flaws or gaps**?
5. What are the **opportunities** to improve the dosage form or delivery system further?

**Review Paper**

1. What is the **state-of-the-science** with respect to the field the review is addressing?
2. What has been the biggest **breakthrough** or enabling technology described by the review?
3. What remains the most **significant challenge or barrier** for advancement as described by the review?
4. What do you consider to be the most significant **shortcoming** of the review in terms of gaps, errors, or omissions?
5. What is the most important information learned from the review from the point of view of a **practicing pharmacist**?
411 Pharmacopedia

- Created and maintained by PY1 students on volunteer/extra-credit basis
- Edited and monitored by Faculty and TA
- 91 students (53%) contributed
- >30,400 views from Jan 2013 – present

https://learn.pharmacy.unc.edu/pharmacopedia
“Pharmaceutics and Dosage Forms”
"I found [411 Pharmacopedia] when I looked for some information on buccal formulations. I was astonished what students can do and to what level they can be inspired... "Class of 2016", that means they are in the first year of their PharmD program. You really should be proud of your students..."

Pharmaceutics Faculty Member, Peer College of Pharmacy

"Hi Dr. Mumper,

So I read the news (this) morning, and today this was in the health section. It is an article about the FDA approving (the) conjugated Herceptin. Thought I would share. Anyways, enjoy the weekend!"

PY1 Student, Saturday 2/23/2013 at 8:27 AM
Flipped Model Affords Strategic Flexibility to Respond to Current Events

Case Study - Meningitis Outbreak of 2012

- Fungal meningitis outbreak
- Linked to tainted batches of steroid injection
- 650 people in 19 states have become ill
- 39 people have died
- New England Compounding Center (NECC)

- Panel of experts
- Wednesday Jan 16th
  8:30-9:20 am in PHCY 411
- Implications for you and the pharmacy profession
What it Meant to Me

“The entire experience of flipping the classroom, from design to implementation to assessment, has been one of the most profound educational experiences of my career. For me personally, it was a collective ‘aha’ experience where I finally realized that for years I had it all wrong. Never before had I engaged with professional students in the manner in which this course provided, and demanded. It was an incredibly rewarding experience. I will never return to the traditional lecture format as I feel that this would be cheating both me and the students.”

“Related, this flipped classroom experience reinforces the potential value of the engagement between research-intensive instructors and students within a research-intensive university.”

The Atlantic

The Post-Lecture Classroom: How Will Students Fare?
A new study finds moderate student gains in courses where lectures take place at home and “homework” happens in the classroom.

Russell Mumper, Vice Dean of the University of North Carolina Eshelman School of Pharmacy, teaches his “flipped” Pharmacology class. (Echo360)

If college professors spent less time lecturing, would their students do better?
A three-year study examining student performance in a “flipped classroom” — a class in which students watch short lecture videos at home and work on activities during class time — has found statistically significant gains in student performance in “flipped” settings and significant student preference for “flipped” methods.
Design & Execution – *Lessons Learned*

**• Offloading Content for Self-Directed Learning Outside of Class:**

**Faculty:** Faculty should “let go”; engage students around experiences/applications and not content

**Content:** “Less is more”; offloading process/method must be easy and sustainable; students’ grasp of content must be **constantly assessed**

**Students:** Challenge and reward; every minute outside of class must be valued/rewarded; students become **intrinsically motivated**

**• Active-Learning in Class:**

**Method:** Choose established/effective method(s) that’s right for the faculty; **chaos/tension in the class is good**

**Faculty:** Moderate; encourage risk taking; share experiences; **settle chaos/tension** as required; build trust

**Students:** Allow to take risks; don’t force introverts to be extroverts
Content, Methodology, and Technology Should Not be Barriers

Biotargeted nanomedicines for cancer: six tenets before you begin

Biotargeted nanomedicines have captured the attention of academic and industrial scientists who have been motivated by the theoretical possibilities of the ‘magic bullet’ that was first conceptualized by Paul Ehrlich at the beginning of the 20th century. The Biotargeting Working Group, consisting of more than 20 pharmaceutical scientists, engineers, biologists and clinicians, has been formed as part of the National Cancer Institute to address the conceptual and practical challenges in developing biotargeted nanomedicines for cancer. In modern science and medicine, it is desirable for any individual to be an expert in every aspect of biology, chemistry, material science, pharmacology, toxicology, chemical engineering, imaging, physiology, oncology and regulatory affairs. Drawing on the expertise of leaders from each of these disciplines, this commentary highlights six tenets of biotargeted cancer nanomedicines in order to enable the translation of basic science into clinical practice.

Keywords: cost-effectiveness analysis, good manufacturing practice, lipid nanoparticles, targeted drug delivery

Michael S. Goldberg, Todd S. Marks

Purchasing Foreign Medications

The Emerging Problems of the Counterfeit Drug Market
Content, Methodology, and Technology Should Not be Barriers

From Academic Medicine: “…we recognize that a wide array of offloading and active learning methods can be employed. For example, offloading of content may utilize high level animated e-books with built in assessment tools after chapters or modules, captured video, instructor handouts, or textbooks.”

“As it pertains to active learning methods, there are a plethora of different tools available to engage students in the classroom. We offer that the actual practice of offloading content and engaging in active learning in the classroom is far more important than the specific methodologies we used.”

Method Must Be:
✓ Simple
✓ Matched to Instructor’s Style
✓ Cost-effective
✓ Educationally-effective
✓ Sustainable
✓ Fun
Creating the Culture...

• Faculty Offer Letters – Educational Renaissance

• Appointment, Reappointment, Promotion, and Tenure Guidelines

• The Scholarship of Education

• Recruitment of Tenure Track Faculty in Educational Research

• Educational Technology R&D

• The Academy

• Instructional Innovation Policy and Participation Agreement
Is the Flipped Model Applicable to Graduate Education?

Design by Reverse Engineering

The Job to be Done
- Academia
- Industry
- Government

Real-World Context

Multidisciplinary Environment

Blended Learning
- Self-directed
- Active learning
- The “flipped” classroom
- Increased faculty-student engagement

Learning Fundamentals and Understanding New Concepts

Contemporary Training Paradigm
- “On-demand”
- Coached
- Mentored
- Team-based
- Tailored
- Efficient & Effective
- Assessed

Thinking Critically & Solving Problems in Real-World Settings
Summary

• Move away from content/knowledge transfer in the classroom

• Be confident that students will learn on their own

• Faculty’s challenge is to relay their experiences and approach, and inspire

• Course design and execution must be carefully considered and monitored; there are many viable approaches to offload content and free up class time

• Constant and continuous assessment is critical

• Faculty development and support is essential

• Acknowledgements... many!

Grant: Toward an Educational Renaissance: The Role of Lecture Capture in Fostering Innovative Learning Environments for Aspiring Health Professionals. Echo360 Inc.