Redesigning Lectures to Improve Student Engagement and Learning

Madan Kharel, PhD
Frederick Tejada, PhD
Patrice Jackson-Ayotunde, PhD
Presentation Learning Objective

By the end of the session, you should be able to:

- Develop a plan for a non-traditional teaching approach in order to:
  
  a) Reduce direct instruction hours
  b) Improve student engagement
  c) Improve student performance
  d) Foster self-directed learning
  e) Foster accountability
Developing a Redesign Plan
Why Redesign Lectures?

- Education is a dynamic field

**Elements subject to continuous change**

  - Student body (composition/size/backgrounds)
  - Lecture content
  - Technology
  - Student needs and expectations
  - Market demand
Goal of Education is Changing

“The goal of science education has shifted from focusing only on content to including teaching how to think critically about scientific information and making sound decisions as citizens” (Kathy Nomme and Gülnur Birol 2014)
Steps of Instructional Redesign

I. Identify the Need for Change

- Have course goals changed?
- Are there changes elsewhere in the curriculum?
  - If yes, are they relevant to your course?
- Has student body (composition/background, class size) changed?
- Has student performance on tests changed?
- Have student reviews of your course changed in recent years?
- Have you learned new ways of instruction?
- Do you want to break the status quo and try out new delivery approaches?
If none of the above questions provide you reasonable justifications for changes, record your lectures couple of times and listen to them.

Or

Join the students in the classroom for a day.

Have an OMG moment!!!
II. Redesign Instruction

- **Analysis**
  - Analyze learners/context
  - Find existing materials/support
  - Conduct instructional analysis

- **Design**
  - Plan and develop instructional strategy (PBL/TBL/Group work)
  - Select delivery method (lone/team)

- **Development**
  - Develop the content
  - Create prototype
  - Create assessment instruments

- **Implementation**
  - Deliver instruction

- **Evaluation**
  - Conduct formative evaluation
  - Conduct summative evaluation
III. Review Your Design

• Have you developed/revised daily learning objectives?

• Does the new instructional approach optimally address learning objectives?

• Has the new design decreased passive lectures and increased student-led study?

• Does new design offer sufficient practice opportunities for students?

• Does new design foster student engagement?

• Does new design foster life-long/self-directed learning?
III. Implement Redesigned Course

• Be vigilant for unforeseen problems (e.g. Blackboard server is down: Be ready to switch computer-based quiz to paper based)

• Do not hesitate to ask for help (fellow faculty/admin)

• Be ready to accept criticism (likely happens at early stage)

• Refrain from making too many adjustments once class is started (wait for the next cycle) → Class may turn into chaos
IV. Evaluate Effectiveness (Instructional Redesign Cycle)

1. Gathering of information
2. Reinvention of delivery approach
3. Implementation
4. Evaluation of the effectiveness

Content adapted from Kathy Nomme and Gülnur Birol (2014) The Canadian Journal for the Scholarship of Teaching and Learning
Points to Consider

- Start with one course or a section of the course
- Gain experience/ learn from mistakes (don’t get discouraged)
- Expand restructuring of instruction gradually
- Pay serious attention to student feedbacks (both in-person or course evaluation)
- Share your experience to fellow faculty
- Keep refining your course and be proud of your accomplishments

“once you stop learning you start dying”
Context
School of Pharmacy Curriculum
UMES-SOP PharmD curriculum (164.5 credits): A three-years accelerated modular curriculum

- **1st year (56 credits):** Biomedical sciences (with 6 credits of clinical experiences)
- **2nd Year (66.5 credits):** Clinical sciences (with 4 credits of clinical experiences)
- **3rd year (42 credits):** Clinical experiences

**Background**

<table>
<thead>
<tr>
<th>Mon</th>
<th>Tues</th>
<th>Wed</th>
<th>Thurs</th>
<th>Fri</th>
<th>Sat</th>
<th>Sun</th>
</tr>
</thead>
<tbody>
<tr>
<td>7h ins.</td>
<td>Longit.</td>
<td>7h ins</td>
<td>Review</td>
<td><strong>Assessment</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Module 1: Week 2**

- Reassessment (morning)
- Module 2 instr. begins (afternoon)
Challenges of Accelerated Curriculum For Students

Poor Student Outcomes

- Long instructions (7h/day)/poor engagement
- Limited time for comprehension
- Fatigue/burnout
- No make up option for emergency
Challenges of Traditional Instruction

- Retention of concepts
- Critical thinking
- Self-directed learning
Challenges of Accelerated Curriculum For Instructors

- Long instructions (7h/day)
- Time management/stringent schedule
- Fatigue/burnout
- No make up option for emergency
Case Study

PHAR530 “Pharmaceutics and Biopharmaceutics” Course
Why PHAR 530 (Introduction of drug action section)?

- Pharmacy curriculum begins with “Introduction of drug action” section of PHAR 530
- This section is representative of other courses that utilize 6-7 hours of lecture-based instruction
- Concepts covered within this section are broadly applied in succeeding blocks/courses
- The first week of PHAR530 covers mostly chemistry concepts
Why PHAR 530 (Introduction of Drug Action Section)?

- Different pre-requisite knowledge of incoming students

<table>
<thead>
<tr>
<th></th>
<th>2016 (n=61)</th>
<th>2017 (n=49)</th>
<th>2018 (n=36)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean Prereq GPA Overall Scores</td>
<td>3.44</td>
<td>3.39</td>
<td>3.39</td>
</tr>
<tr>
<td>Mean Prereq GPA Math/Science Scores</td>
<td>3.35</td>
<td>3.27</td>
<td>3.31</td>
</tr>
<tr>
<td>PCAT Chem</td>
<td>70.80 ± 19.8</td>
<td>62.02</td>
<td>61.55</td>
</tr>
</tbody>
</table>

- Historically, students have struggled with concepts covered during this section

<table>
<thead>
<tr>
<th></th>
<th>2016</th>
<th>2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Students Reassessing</td>
<td>15</td>
<td>9</td>
</tr>
<tr>
<td>Number of Students in Extended Learning</td>
<td>0</td>
<td>2</td>
</tr>
</tbody>
</table>

- Students who struggle with these concepts typically appeared to struggle in succeeding assessments
Redesign of a section of PHAR 530 instruction

<table>
<thead>
<tr>
<th>Mon</th>
<th>Tues</th>
<th>Wed</th>
<th>Thurs</th>
<th>Fri</th>
<th>Sat</th>
<th>Sun</th>
</tr>
</thead>
<tbody>
<tr>
<td>ins.</td>
<td>Longit.</td>
<td>ins</td>
<td>Review</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Mod. 1: Week 1
PHAR 530 (Introduction of drug action section)

Assessment

Reassessment (morning) Module 2 instr. begins (afternoon)

| Mon | Tues | Wed | Thurs | Fri | Sat | Sun | Mon |
|-----|------|-----|-------|-----|-----|-----|
| ins. | Longit. | ins | Review |

Mod. 1: Week 2
Mod. 2
PHAR 530 (Introduction of drug action section)
Redesigning PHAR530’s Introduction of Drug Action Section
Objectives of Redesigned Delivery

1) Reduce direct instruction hours
2) Improve student engagement
3) Improve student performance
4) Foster self-directed learning
5) Foster accountability
**Pre-Req Knowledge Assessment**
- Taken prior to start of course
- MCQ exam
- Divided into 3 main categories
- Based on results, assigned to **Learning Clusters**

**Learning Clusters**
- Assigned to a grad tutor
- Received supplemental online resources
- Assigned before start of course
- Assigned additional assignments during Online Learning

**Active Learning Classroom**
- Discussion of online quiz (30 mins)
- Individual quiz (20 mins)
- **Team quiz (20 mins): learning from peers**
- Discussion (1 hr): **feedbacks**
- Preview next material

**Online Learning**
- Provided few days before class
- Access to grad student tutors
- PowerPoint redesigned to contain guided questions/problem sets
- Access to additional online resources
- Formative online quiz

**Games**
- At the end of block
- Participated in KAHOOT (**Facilitated by seniors**): learning from seniors
- Integration of all topics covered
- Supervised by faculty

**End-of-Block Assessment**
- Comprehensive
Formation of Learning Clusters

Pre-req knowledge assessment (categorized by sub-topics)

New student cohort

Cluster 1
Students scored above 80%

Optional
• Completion of additional quizzes
• Meeting/discussion with tutors

Cluster 2
Students scored below 80%

Mandatory
• Completion of additional quizzes
• Meeting/discussion with tutors
### Previous Format

<table>
<thead>
<tr>
<th>Day</th>
<th>Hours</th>
<th>Topics/activity</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Orientation day</td>
<td>0.5 h</td>
<td>Pre-class-quiz</td>
<td>In-class</td>
</tr>
<tr>
<td><strong>Start of Week 1 of PHAR530 course</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>3.5 h</td>
<td>Review of chemistry concepts/post-class-quiz</td>
<td>In-class</td>
</tr>
<tr>
<td></td>
<td>3.5 h</td>
<td>Topic I (Functional Group)</td>
<td>Lecture</td>
</tr>
<tr>
<td>2</td>
<td>5.0 h</td>
<td>Topic II (Reactions/Acids/Bases)</td>
<td>Lecture</td>
</tr>
<tr>
<td></td>
<td>3.0 h</td>
<td>Lab</td>
<td>Lab</td>
</tr>
<tr>
<td>3</td>
<td>2.0 h</td>
<td>Topic III (Acids/Bases)</td>
<td>Lecture</td>
</tr>
<tr>
<td></td>
<td>3.0 h</td>
<td>Topic IV (Acid/Base Disorders)</td>
<td>Lecture</td>
</tr>
<tr>
<td></td>
<td>3.0 h</td>
<td>Lab</td>
<td>Lab</td>
</tr>
<tr>
<td>Day</td>
<td>Hours</td>
<td>Topics/activity</td>
<td>Location</td>
</tr>
<tr>
<td>---------------------</td>
<td>-------</td>
<td>--------------------------------------------------------------------------------</td>
<td>-----------</td>
</tr>
<tr>
<td>Orientation day</td>
<td>1.0 h</td>
<td>Course introduction</td>
<td>In-class</td>
</tr>
<tr>
<td></td>
<td>0.5 h</td>
<td>Pre-requisite knowledge assessment</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Topic I</strong> (Functional Groups): Online Quiz</td>
<td>Online</td>
</tr>
<tr>
<td>1</td>
<td>3.5 h</td>
<td>Individual and team quiz/discussion topic I</td>
<td>In-class</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Topic II</strong> (Reactions)/online quiz</td>
<td>Online</td>
</tr>
<tr>
<td>2</td>
<td>3.5 h</td>
<td>Individual and team quiz/discussion topic II</td>
<td>In-class</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Topic III</strong> (Acids/Bases)/online quiz</td>
<td>Online</td>
</tr>
<tr>
<td>3</td>
<td>2.5 h</td>
<td>Individual and team quiz/discussion topic III</td>
<td>In-class</td>
</tr>
<tr>
<td></td>
<td>3.0 h</td>
<td><strong>Topic IV</strong> (Acid/base disorders)</td>
<td>In-class</td>
</tr>
<tr>
<td></td>
<td>1.5 h</td>
<td>Games (Integration of all topics)</td>
<td>In-class</td>
</tr>
</tbody>
</table>

**Start of Week 1 of PHAR530 course**
Comparison
Previous Format vs Redesigned Format

Did redesigned instruction make any difference?
### Comparison of Contact Hours

<table>
<thead>
<tr>
<th>Day</th>
<th>2017 Previous Format (Contact Hours)</th>
<th>2018 Redesigned Format (Contact Hours)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre-Course Activity</td>
<td>0.5 (Pre-Quiz: In-Class Activity)</td>
<td>1.5 (Knowledge Assessment: In-Class Activity)</td>
</tr>
<tr>
<td>#1</td>
<td>3.5 (Review/Post-Quiz)</td>
<td>2.5 (Active Learning)</td>
</tr>
<tr>
<td></td>
<td>3.5 (Lecture)</td>
<td></td>
</tr>
<tr>
<td>#2</td>
<td>5 (Lecture)</td>
<td>2.5 (Active Learning)</td>
</tr>
<tr>
<td></td>
<td>3 (Lab)</td>
<td></td>
</tr>
<tr>
<td>#3</td>
<td>5 (Lecture)</td>
<td>2.5 (Active Learning)</td>
</tr>
<tr>
<td></td>
<td>3 (Lab)</td>
<td>3 (Lecture)</td>
</tr>
</tbody>
</table>

#### Contact Hours Breakdown

<table>
<thead>
<tr>
<th>Activity</th>
<th>2017 Previous Format</th>
<th>2018 Redesigned Format</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lecture</td>
<td>13.5 hours</td>
<td>3 hours</td>
</tr>
<tr>
<td>Lab</td>
<td>6 hours</td>
<td>0 hours</td>
</tr>
<tr>
<td>Active Learning (Quiz, Discussion)</td>
<td>4.0 hours</td>
<td>19.5 hours</td>
</tr>
<tr>
<td>Online Learning/In-Class Activity</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>23.5 hours</td>
<td>22.5 hours</td>
</tr>
</tbody>
</table>
Comparison of Student Performance

<table>
<thead>
<tr>
<th></th>
<th>2017 Lecture Format (n=49)</th>
<th>2018 Redesigned Format (n=36)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of exam questions</td>
<td>20</td>
<td>29</td>
</tr>
<tr>
<td>Number of exam questions</td>
<td>20</td>
<td>29</td>
</tr>
<tr>
<td>adjusted*</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Student score (Average ± std dev)</td>
<td>78.1% ± 12.6</td>
<td>84.2% ± 12.9</td>
</tr>
<tr>
<td>Number of students below 80%</td>
<td>27</td>
<td>12</td>
</tr>
</tbody>
</table>

*depending on the exam statistics, questions were adjusted either dropped or given as bonus.
Comparison of Student Performance

Number of Students Reassessed

- 2016: 15
- 2017: 9
- 2018: 9
Student Evaluations
Previous Format vs Redesigned Format
## Comparison of Course Evaluation

<table>
<thead>
<tr>
<th>Survey Questions</th>
<th>2017 (n=33) Lecture Format</th>
<th>2018 (n=28) Redesigned Format</th>
</tr>
</thead>
<tbody>
<tr>
<td>The teaching methods used in this module/course engaged me and helped me to learn</td>
<td>4.42</td>
<td>4.36</td>
</tr>
<tr>
<td>The stated teaching/learning activities for this module/course were used</td>
<td>4.45</td>
<td>4.44</td>
</tr>
<tr>
<td>My responsibilities as a student in this module/course were covered</td>
<td>4.52</td>
<td>4.29</td>
</tr>
<tr>
<td>The stated content and objectives of the module/course were covered</td>
<td>4.39</td>
<td>4.39</td>
</tr>
<tr>
<td>The course (including lectures, <strong>active learning</strong> exercises, labs, <strong>out-of-class</strong> assignments and/or course materials) <strong>contributed to my understanding of the module/course content.</strong></td>
<td>4.3</td>
<td>4.46</td>
</tr>
</tbody>
</table>

**AVERAGE**                                                                                                                                                                                                       | 4.42                       | 4.39                          |
In course review students wrote:

“The most helpful part of this course was having the formative quizzes and the CEA for each day of the self taught material because it helped motivate me to study the material more in-depth and gain a stronger understanding.”

“The first portion of 530 was great; however, NOT the second portion…”

(Second portion was on the traditional lecture format)
2018 Student Feedback (n=27)

- The online quizzes enhanced my learning: 55.6% Strongly Agree, 37% Agree, 5.5% Neutral, 0% Disagree, 1.9% Strongly Disagree
- The PowerPoint Slides enhanced my learning: 59.3% Strongly Agree, 37% Agree, 3.2% Neutral, 0% Disagree, 0.7% Strongly Disagree
- The individual quiz enhanced my learning: 63% Strongly Agree, 29.5% Agree, 6.5% Neutral, 0% Disagree, 1.1% Strongly Disagree

- The team quiz enhanced my learning: 29.6% Strongly Agree, 59.3% Agree, 8.1% Neutral, 0% Disagree, 3.0% Strongly Disagree
- Class discussion enhanced my learning: 25.9% Strongly Agree, 66.7% Agree, 7.5% Neutral, 0% Disagree, 0.2% Strongly Disagree
- The student tutors enhanced my learning: 59.3% Strongly Agree, 14.8% Agree, 22.2% Neutral, 0% Disagree, 3.7% Strongly Disagree
2018 Student Feedback (n=27)

- The self-directed method used helped me identify areas I’m deficient in.
- The self-directed method used motivated me to take ownership of my learning.
- The self-directed method used allowed for deeper understanding of the material.
Challenges

- Time-demanding preparations
  - Logistics
  - Handouts/reading materials
  - Quizzes
  - Feedbacks (group and individualized)

Rewards

- Less lectures and more interactions
- Better connection with students
- Better student/faculty satisfaction
- Positive classroom experience
Acknowledgements

• Funding: UMES Office of the Provost and Vice President for Academic Affairs Course Redesign

• Graduate Student Tutors: Isis Amaye, Kingsley Chukwueze, Patrick Makary and Pharmacy Student

• Tutors (Seniors): Annah Brittingham, Devanshi Gandhi, Nancy Wambi and Joseph Dean

• Dr. Lynn Lang, Assessment Coordinator
THANK YOU

Questions?