Learner Outcomes: Automated Tracking, Easy Analysis, and Continuous Curriculum Improvement

OsEAN – 31/5/2014

Gerald Thrush, PhD & Scott Helf, DO, MSIT

Western University of Health Sciences
College of Osteopathic Medicine of the Pacific

Terence P. Ma, PhD
Albert Einstein College of Medicine

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Conflict of Interest Disclaimer

ExamSoft Worldwide, Inc. is financially supporting Dr. G. Thrush's travel expenses for this meeting.

Objectives

- Understand the theoretical basis of learner outcomes, and its assessment

- Realize the importance of an interface to "tag" questions

- Recognize how to collect and generate data on student learning outcomes

- Acquire a mental framework of how to analyze and distribute data to drive decision-making

Organization of the Talk

- Why do we need to track and analyze learner outcomes? (Ma)

- How do we manage getting learner outcomes data? (Thrush)

- How do we catch students before they fail? (Helf)

Organization of the Talk

- **Why do we need to track and analyze learner outcomes? (Ma)**

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Goal of medical education is to teach and train the next generation of physicians

- BUT ….

- How do we know we did what we said we do?
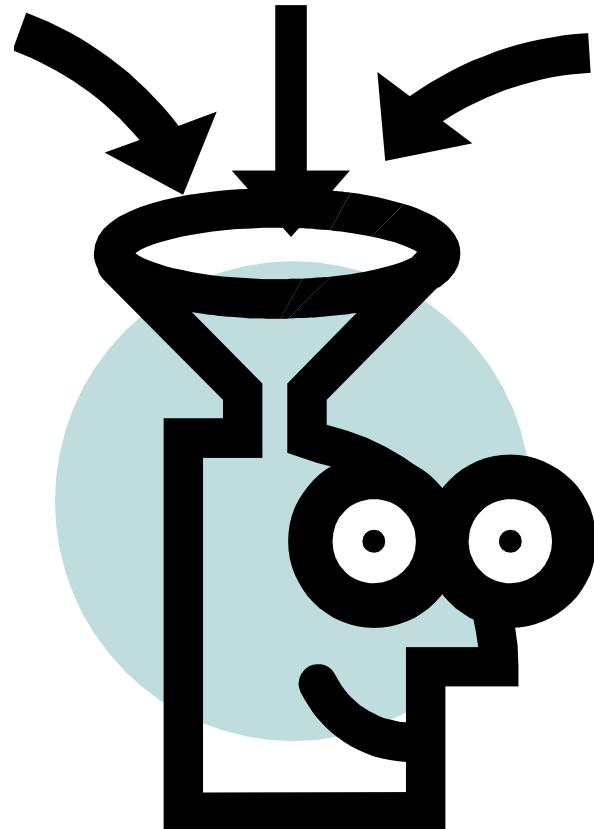
The Framework
Understanding the Buzzwords

Desires (institutional)

- Mission/Goals

- Objectives
  – What is desired
  – How measured
  – Timeframe

Action (learner)

- Competencies
  – Entrustable Activities

- Outcomes
  – Measured result
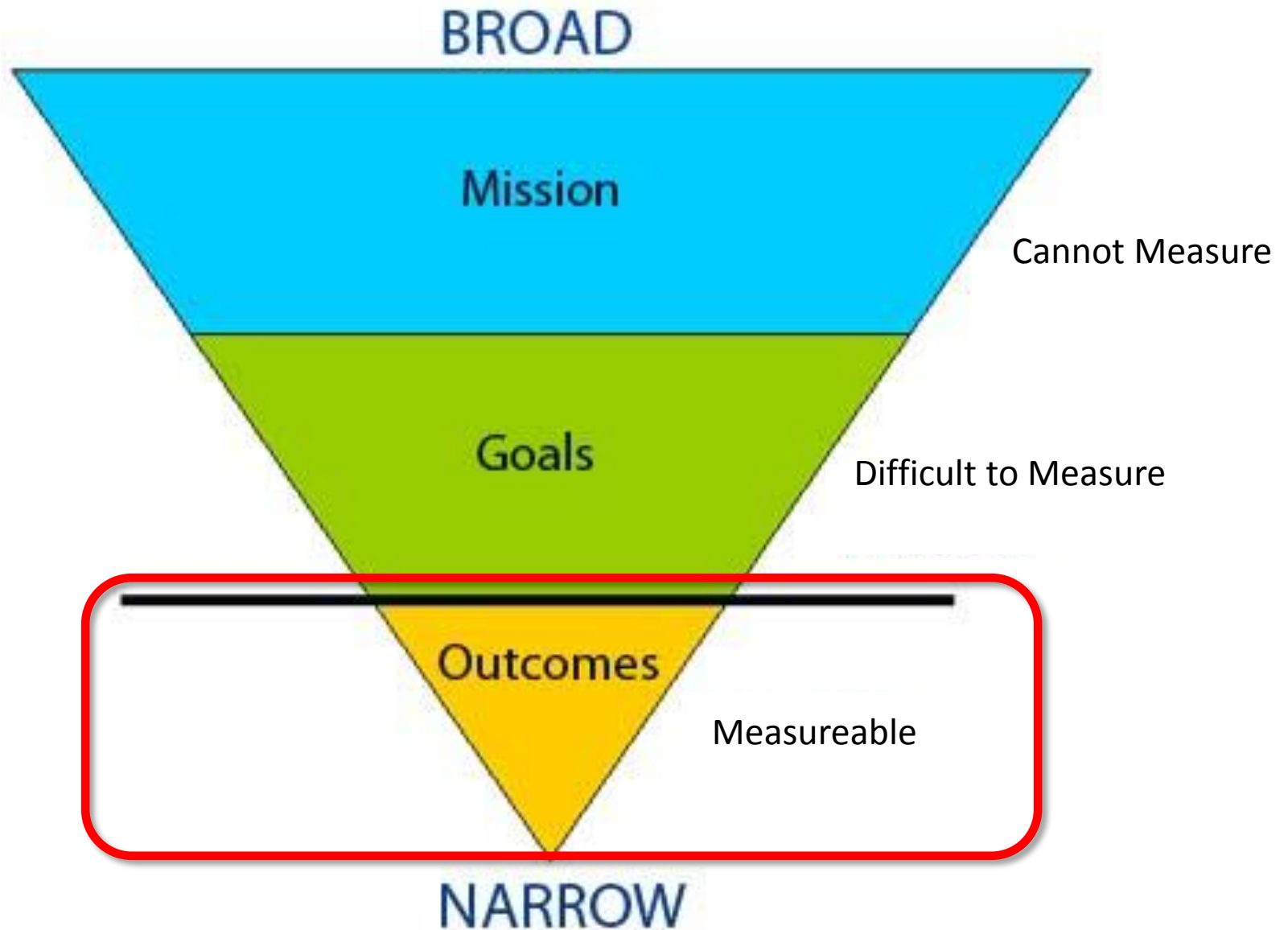 – Effective data collection
  – Timeframe

What Needs to be Assessed for Objectives and Learning Outcomes

- Measurable
  - How do you know if the student has achieved the outcome?
    - Cognitive (know)
    - Affective (think or care about)
    - Behavioral (able to do)
- Meaningful
  - Does it, and why, does it matter if the student has achieved the outcome?
- Manageable
  - How detailed are you going to get?
- Map-able

Learning Pyramid

Thanks to: University of Connecticut

BROAD

Mission

Cannot Measure

Goals

Difficult to Measure

Outcomes

Measureable

NARROW

Thanks to: University of Connecticut

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Another View

Institutional Objectives/Outcomes (ILO)

College Objectives/Outcomes (SLO)

Program Objectives/Outcomes (PLO)

Course Objectives/Outcomes (CLO)

Event Objectives/Outcomes (EvLO)

So What Do You Need To Get?

- Define the data
  - Define the metadata
- Collect data
  - Collect the metadata
- Purpose of the data
  - Do the data matter
- Meaning of the data
  - Significance: Do the data show a difference?
  - Validity: Are the data real?
  - Reliability: Are the data consistent?

So What Do You Need To Get?

- **Define the data**
  - **Define the metadata**
- Collect data
  - Collect the metadata
- Purpose of the data
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  - Reliability: Are the data consistent?

http://erwin.sandhill.co.uk/data-lineage-vs-metadata-lineage

# What Metadata Do You Need?

- Work with institutional/administration/accreditation needs …
  - MedBiquitous Curriculum Inventory XML Standards
  - Use commonly accepted language such as MeSH (Medical Subject Headings from the National Library of Medicine)
- Work with faculty needs …
  - Who wrote the question?
  - When was it used? And reused?
  - How well did the students do?
  - What learning objectives does it test?
  - And more as defined by your faculty …

Sidestep
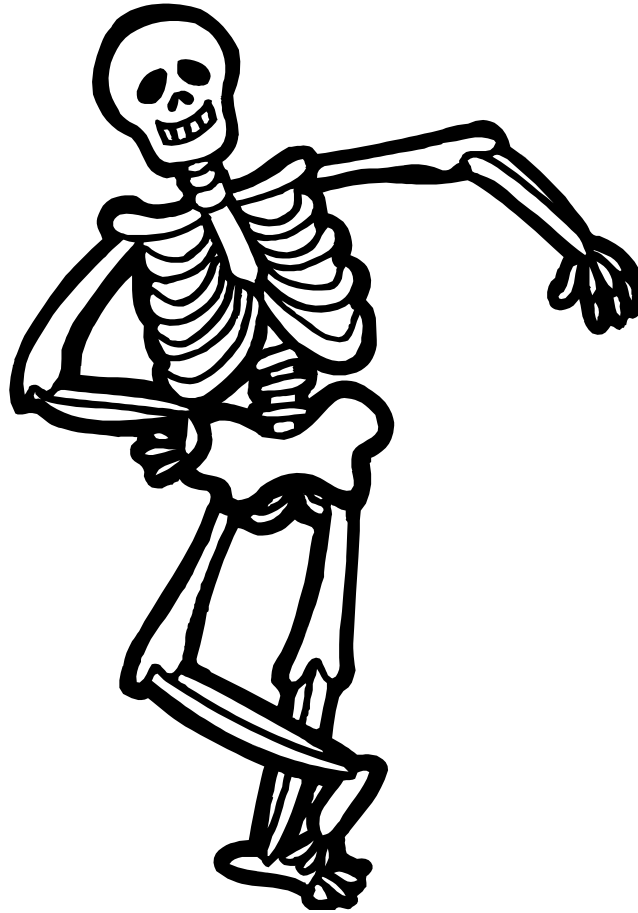
Bloom's Taxonomy
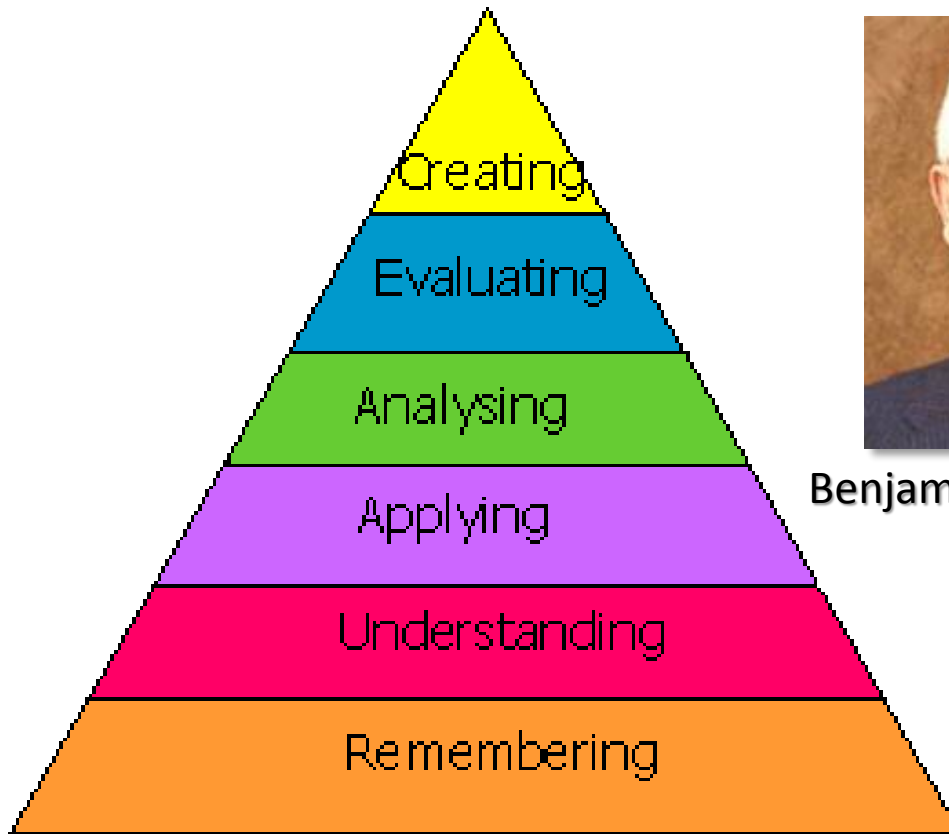
(Revised)

Benjamin Bloom (1956)

Lorin Anderson (1990s)

http://www.odu.edu/educ/llschult/blooms_taxonomy.htm

Year 2 Semester 2	1.1	1.2	1.3	1.4	1.5	1.6	1.7
Reproduction	Develop	Develop	Develop	Develop	Develop	Introduce	
	Develop	Develop	Develop	Develop	Develop	Introduce	
Growth and Development							
Medical Skills	Develop	Develop	Develop	Develop	Develop	Introduce	
Masters Colloquium	Develop	Develop	Develop	Develop		Introduce	Develop
Scholarly Project	Develop	Develop					Develop
Year 3							
Family Medicine	Apply	Apply	Apply	Apply	Apply	Develop	Apply
Internal Medicine 1	Apply	Apply	Apply	Apply	Apply	Develop	Apply
Internal Medicine 2	Apply	Apply	Apply	Apply	Apply	Develop	Apply
Neurology	Apply	Apply	Apply	Apply	Apply	Develop	Apply
Obstetrics and Gynecology 1	Apply	Apply	Apply	Apply	Apply	Develop	Apply
Obstetrics and Gynecology 2	Apply	Apply	Apply	Apply	Apply	Develop	Apply
Pediatrics 1	Apply	Apply	Apply	Apply	Apply	Develop	Apply
Pediatrics 2	Apply	Apply	Apply	Apply	Apply	Develop	Apply
Psychiatry	Apply	Apply	Apply	Apply	Apply	Develop	Apply
Surgery 1	Apply	Apply	Apply	Apply	Apply	Develop	Apply
Surgery 2	Apply	Apply	Apply	Apply	Apply	Develop	Apply
Year 4							
Emergency Medicine	Apply	Apply	Apply	Apply	Apply	Apply	Apply
Sub Internship	Master	Master	Master	Master	Master	Master	Master

Mapping at the Program Level

Institutional Objectives/Outcomes (ILO)

College Objectives/Outcomes (SLO)

Program Objectives/Outcomes (PLO)

Course Objectives/Outcomes (CLO)

Event Objectives/Outcomes (EvLO)

So, how do we know whether or not we are achieving our educational objectives and compare them with other institutions?

AAMC Approach:
Curriculum Inventory Project

- All AAMC-accredited medical schools are to upload their curriculum to AAMC using a common language

- Use of the Medbiquitous Curriculum Inventory Specification

- Curriculum Inventory portion of AAMC Medical Academic Performance Services (MedAPS)

Instructional Methods

Case-Based Instruction/Learning
Clinical Experience - Ambulatory
Clinical Experience - Inpatient
Concept Mapping
Conference
Demonstration
Discussion, Large Group (>12)
Discussion, Small Group (≤12)
Games
Independent Learning
Journal Club
Laboratory
Lecture
Mentorship
Patient Presentation - Faculty
Patient Presentation - Learner
Peer Teaching
Preceptorship
Problem-Based Learning (PBL)
Reflection
Research
Role Play/Dramatization
Self-Directed Learning
Service Learning Activity
Simulation
Team-Based Learning (TBL)
Team-Building
Tutorial
Ward Rounds
Workshop

Assessment Methods

Clinical Documentation Review
Clinical Performance Rating/Checklist
Exam - Institutionally Developed, Clinical Performance
Exam - Institutionally Developed, Written/Computer-based
Exam - Institutionally Developed, Oral
Exam - Licensure, Clinical Performance
Exam - Licensure, Written/Computer-based
Exam - Nationally Normed/Standardized, Subject
Multisource Assessment
Narrative Assessment
Oral Patient Presentation
Participation
Peer Assessment
Portfolio-Based Assessment
Practical (Lab)
Research or Project Assessment
Self-Assessment
Stimulated Recall

Resource Types

Audience Response System
Audio
Cadaver
Clinical Correlation
Distance Learning - Asynchronous
Distance Learning - Synchronous
Educational Technology
Electronic Health/Medical Record (EHR/EMR)
Film/Video
Key Feature
Mannequin
Plastinated Specimens
Printed Materials (or Digital Equivalent)
Real Patient
Searchable Electronic Database
Standardized/Simulated Patient (SP)
Task Trainer
Virtual Patient
Virtual/Computerized Laboratory
Wet Laboratory

Basic MedBiquitous Terms

Everything Is Linked to an Event and Expectations for the Event

MedBiquitous Curriculum Inventory Specifications February, 2013
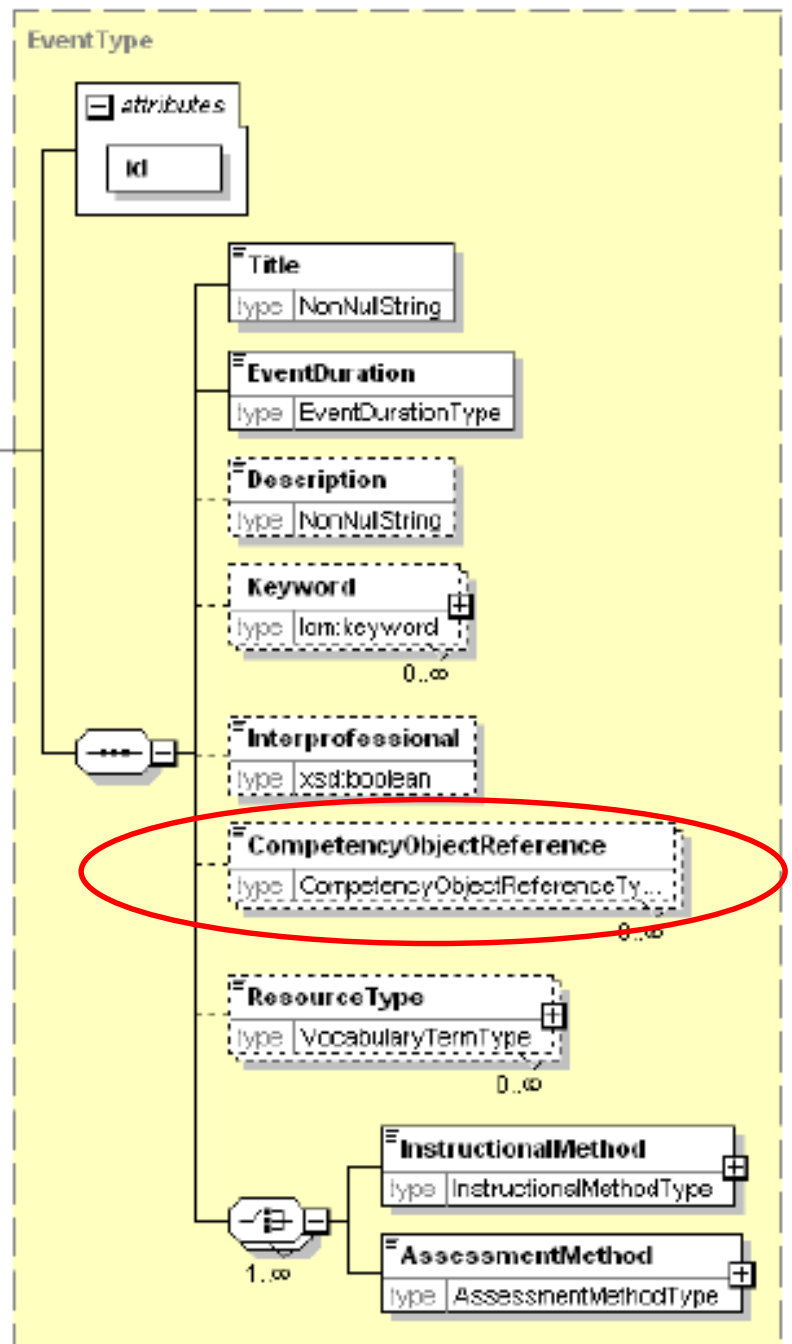
AAMC Physician Competencies Reference Set

- 8 Competencies
- Multiple sub-competencies
- For LCME Accredited Schools:
  - To be reported to AAMC
  - Must be matched to the institutional competencies
  - Must show curricular data for each (including assessments)

Competency Domains

AOA Competencies	ACGME Core Competencies	Physician Competency Reference Set
Patient Care	Patient Care	Patient Care
Medical Knowledge	Medical Knowledge	Knowledge for Practice
Practice-Based Learning and Improvement	Practice-Based Learning and Improvement	Practice-Based Learning and Improvement
Interpersonal and Communication Skills	Interpersonal Skills and Communication	Interpersonal and Communication Skills
Professionalism	Professionalism	Professionalism
Systems-Based Practice	Systems-Based Practice	Systems-Based Practice
Osteopathic Philosophy and Osteopathic Manipulative Medicine		
		Interprofessional Collaboration
		Personal and Professional Development

Outcomes Hierarchy

Institutional Competency

Accreditor Competency

College Competency

Program Competency

Course Competency

Event Competency

How Do You Collect What You Need?

- Data management
- Define data needs
- Define metadata needs
- Develop data collection systems
- Collect the necessary reports

Next Generation Healthcare
"Putting the Pressure on Data Management"

Organization of the Talk

- Why do we need to track and analyze learner outcomes? (Ma)

- **How do we manage getting learner outcomes data? (Thrush)**

- How do we catch students before they fail? (Helf)

Need for Elegance

Students COCA Faculty PLOs

CLOs

Outcomes & Competencies

APP AOA COMLEX/USMLE

Objectives & WU / College Mission

USDE ACGME

LCME

Rotations

OR DoE Residency

ExamSoft

Administration

IT/AI SLOs WASC ILOs

SPC Assessment

Metadata Pre-clinical

Curriculum

Admissions

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Process of Change at WesternU/COMP

- How to get 100% faculty buy in?
  - **COMMUNICATION!!**
  - Start slow
    - One course at a time
      - Allow the faculty of that course to be the beta-testers
      - Listen carefully to their advice
    - Provide a training workshop for the faculty/staff
  - Share the data
    - Faculty "buy-in" is easier if they understand the benefits
  - Make improvements along the way

Learning Outcomes

- What do we want our students to become?
  - **WU ILOs**
    - *Critical thinking*
    - *Breadth and depth of knowledge in discipline*
    - *Interpersonal communication skills*
    - *Collaboration skills*
    - *Ethical and moral decision making skills*
    - *Life-long learning*
    - *Evidence-based practice*
    - *Humanistic practices*
  - **COMP PLOs**
  - **CLOs**

Assessment of outcomes

- Collect the data

- *How can we do this?* **EXAMS**

Assessment of outcomes

- Collect the data

- *How can we do this?*

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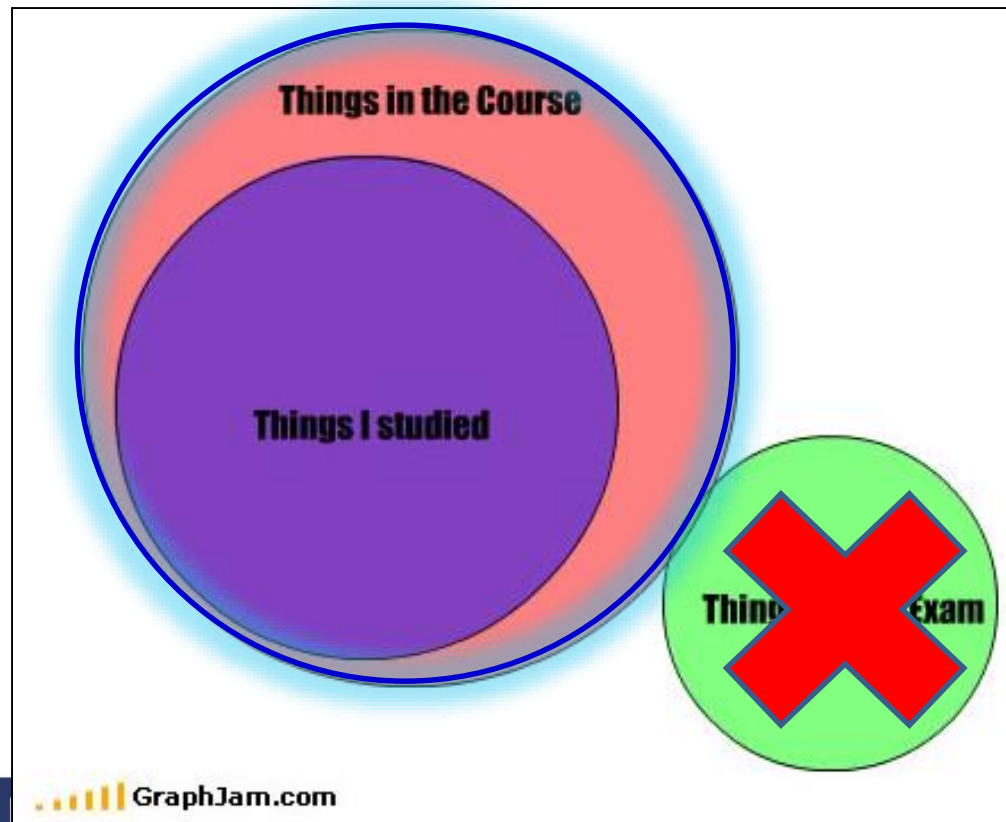
– Computer-based testing

– Began with entering 1st year students, summer 2012

– Courses are team-taught

(up to 30 faculty *per course*!)

Assessment of outcomes

- Collect the data

- How can we do this? *Make it "easy" on the faculty*

Microsoft®
SharePoint® 2010

 – **Question submission site (online form)**

  - Went live in November, 2012

Screen shots of
Question Submission Site:

Toolbar

Save	Cancel	Paste	Cut / Copy	Attach File	Spelling
Commit		Clipboard		Actions	Spelling

Item Title *

Lecture Title *

Instructor *
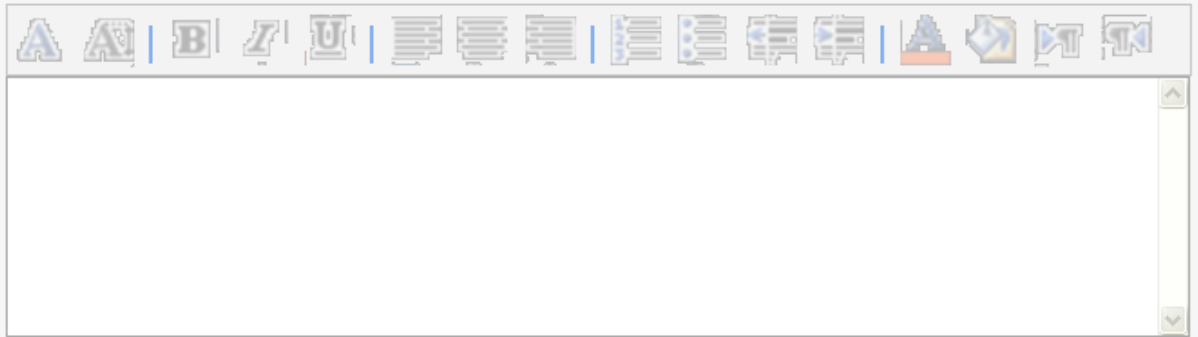
Location *

- ○ Lebanon
- ○ Pomona
- ○ Pre-recorded

Question Text *

M/C Ans Choice A *

M/C Ans Choice B *

M/C Ans Choice A *

Sample answer choice. Edit functions are possible.

M/C Ans Choice B *

Correct Answer *

Distractor Order

Linked Questions

Comments/Feedback

A
B
C
D
E

Correct Answer *   [▼]

Distractor Order   Scramble answer choi [▼]
                    Scramble answer choices
Linked Questions   DO NOT scramble answer

Comments/Feedback

[A | A̅ | **B** | *I* | U̲ | ≡ | ≡ | ≡ | ≣ | ≣ | ⊟ | ⊟ | A | ◇ | ⊠ | ⊠]

This question from slide #25 and is from textbook page 32.

ILO

- ☐ Institutional:(1)Critical Thinking
- ☐ Institutional:(2)Breadth and Depth of Knowledge in the Discipline/Clinical Competence
- ☐ Institutional:(3)Interpersonal Communication Skills
- ☐ Institutional:(4)Collaboration Skills
- ☐ Institutional:(5)Ethical and Moral Decision Making Skills
- ☐ Institutional:(6)Life Long Learning
- ☐ Institutional:(7)Evidence Based Practice
- ☐ Institutional:(8)Humanistic Practice

PLO

- ☐ Program:(1)Osteopathic Philosophy and Osteopathic Manipulative Medicine
- ☐ Program:(2)Medical Knowledge
- ☐ Program:(3)Patient Care
- ☐ Program:(4)Interpersonal and Communication Skills
- ☐ Program:(5)Professionalism
- ☐ Program:(6)Practice Based Learning and Improvement
- ☐ Program:(7)Systems based Practice

CLO

- ○ IDIT:Microbiology
- ○ IDIT:Immunology
- ○ IDIT:Pharmacology
- ○ IDIT:Pathology

Licensing exam topics

- ○ NBOME:Anatomy
- ○ NBOME:Behavioral science
- ○ NBOME:Biochemistry
- ○ NBOME:Microbiology
- ○ NBOME:OPP
- ○ NBOME:Pathology
- ○ NBOME:Pharmacology
- ○ NBOME:Physiology

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Category, Faculty Defined

Save	Cancel

Others?

Bloom's taxonomy

Demo

What happens next?

- **The Exam - Collect the data**

And you think YOU have stress?

Ex. Individual student report
Strengths and Opportunities

◆ MY SCORE   ◆ AVERAGE/MEAN   [ ] SCORE RANGE   ▲ DOING WELL   ● NEEDS REVIEW   ▼ NEEDS IMPROVEMENT

Course LO

→ IDIT-Immunology
| 0 | 50 | 100 |
Correct: 16/26   ●

→ IDIT-Microbiology
| 0 | 50 | 100 |
Correct: 26/31   ▲

→ IDIT-Pathology
| 0 | 50 | 100 |
Correct: 15/21   ●

→ IDIT-Pharmacology
| 0 | 50 | 100 |
Correct: 8/12   ▼

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Single Exam report
Faculty/Administration

Course LO / Discipline *
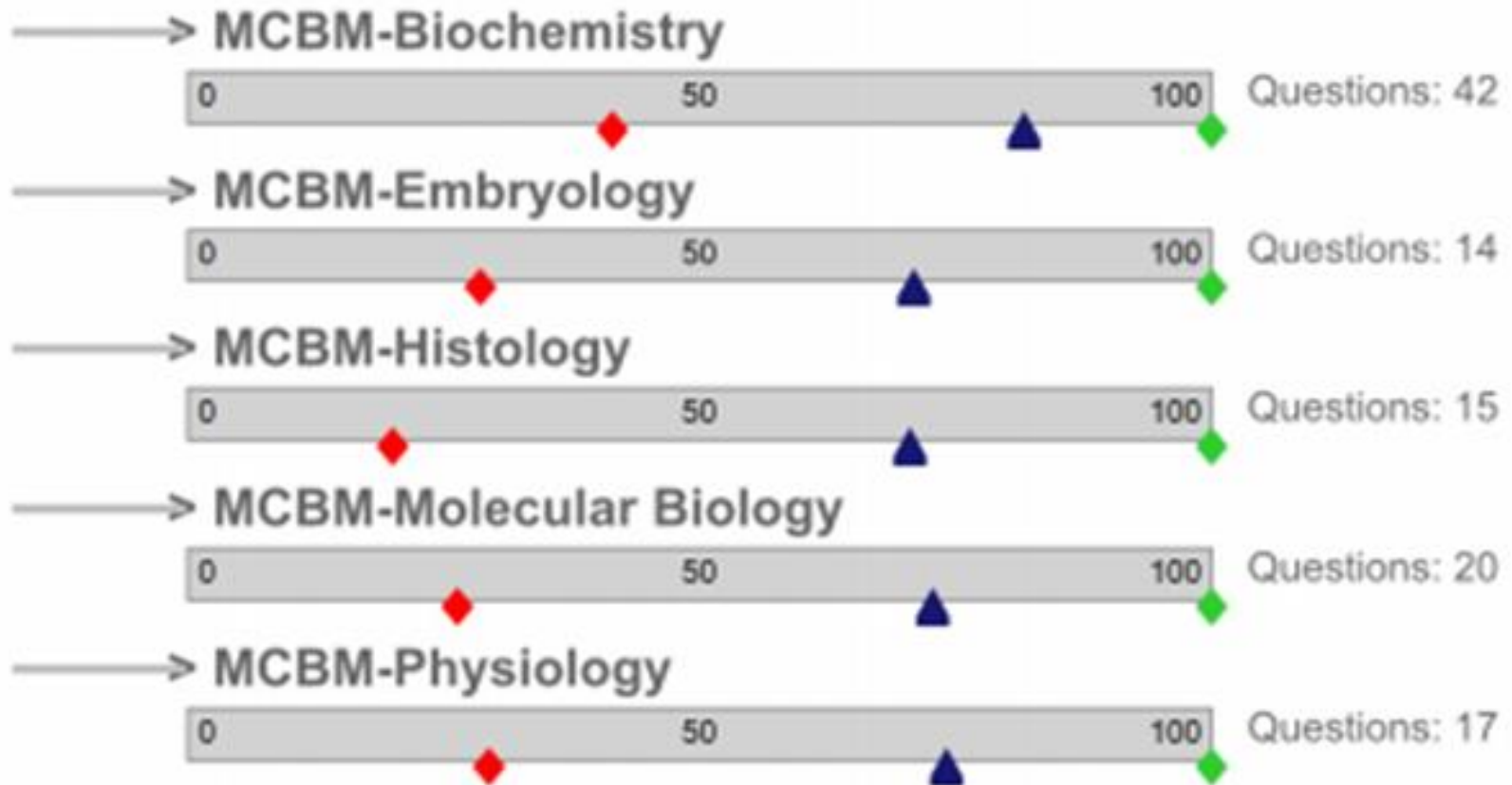
Single Exam report
Faculty/Administration

Faculty

*individual faculty

Questions: 12

> Gerald Thrush

Questions: 19

Questions: 3

Questions: 15

Questions: 24

Questions: 13

Questions: 6

Questions: 21
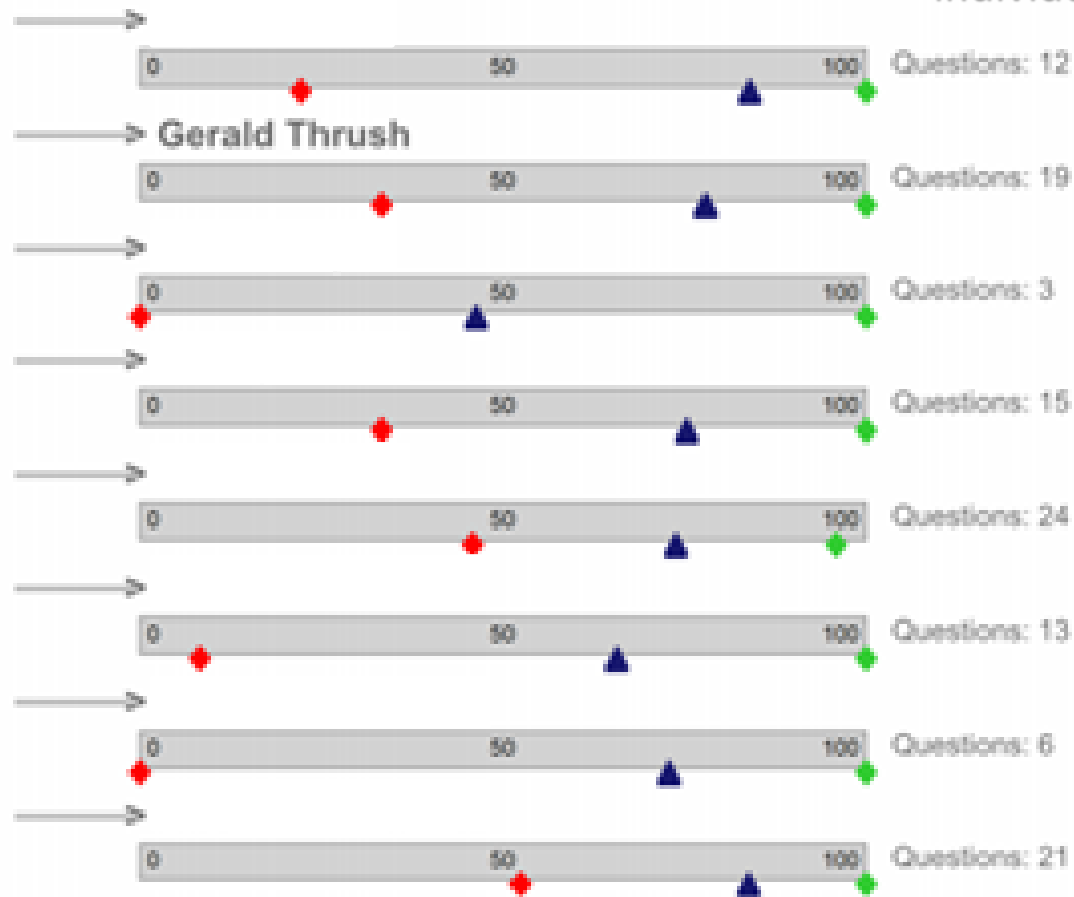
Collect and analyze data on....

- Course, Student, & Faculty
  - **ILOs**
  - **PLOs**
  - **CLOs**

    ...and....
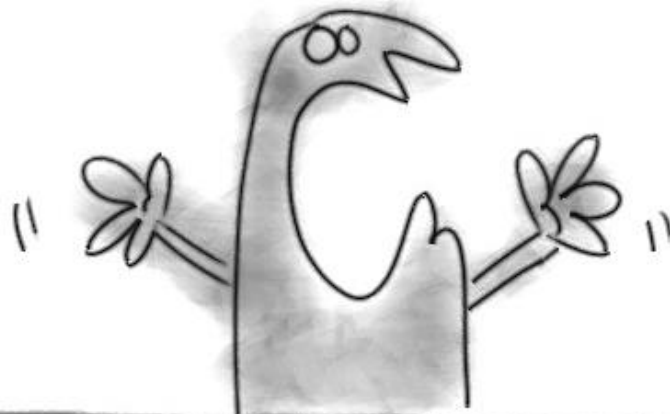
Organization of the Talk

- Why do we need to track and analyze learner outcomes? (Ma)

- How do we manage getting learner outcomes data? (Thrush)

- **How do we catch students before they fail? (Helf)**

Academic Progress Portal (APP)

- Data warehousing platform
- Now includes *learner outcomes*
- To:
  - Catch students BEFORE they fail
  - Analyze (and correct) the curriculum
  - Feedback into admissions decisions

The Point
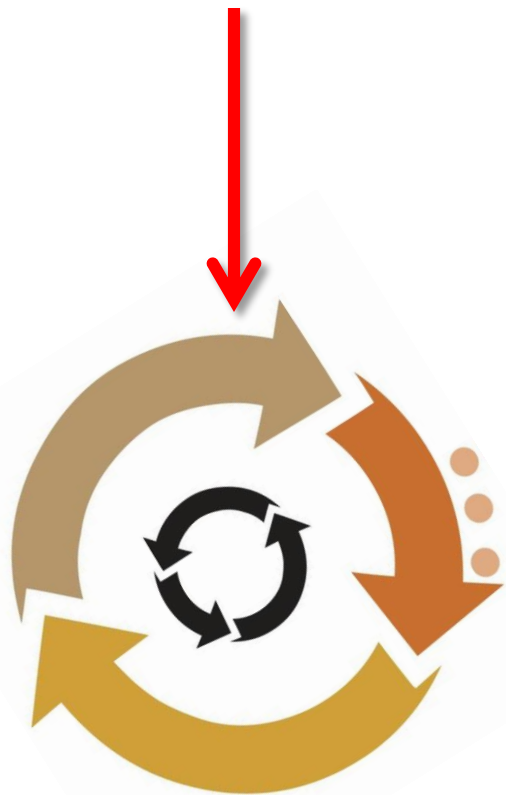
Continuous Improvement
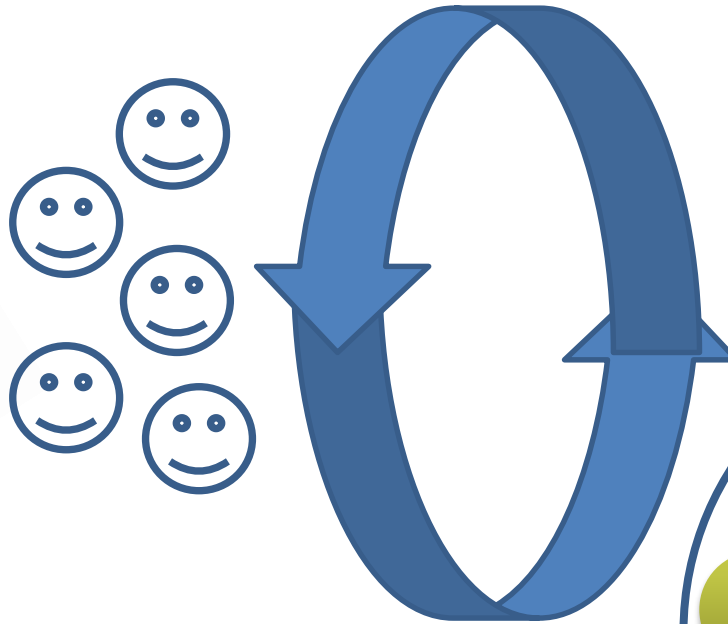
Analytics

APP
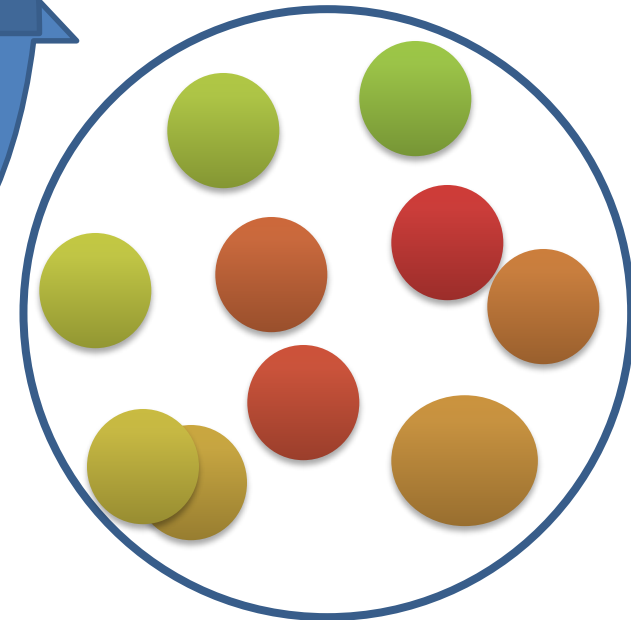
Flow

SharePoint
- Web form submission
- Tag all items: *easy* & *accurate*
- ILO, PLO, CLO, etc.

ExamSoft
- Online examination
- Data collection
- Data export

APP
- Results dissemination
- Running tally
- Analytics

Longitudinal Analysis

NBOME Subject Areas Per Student

ACADEMIC PROGRESS PORTAL
COLLEGE OF OSTEOPATHIC MEDICINE OF THE PACIFIC

NBOME LO (OM 9000)

DO 2016

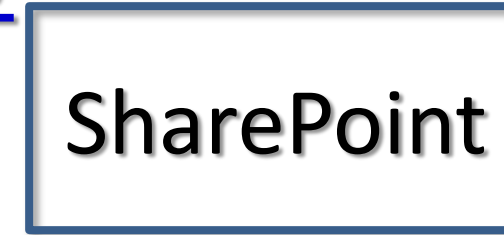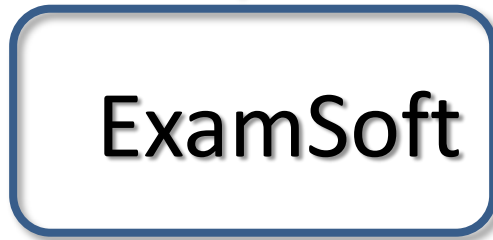| Item:	Grade:	Average:	Possible:
Course Score		-	-
Course Percent		-	-
Recorded Alpha Grade		-	-
Recorded Percent Grade		-	-
Cumulative NBOME Outcomes	(%)	(%)	(N)
Anatomy	73	78	924
Biochemistry	74	83	123
Physiology	80	80	220
Pathology	88	82	298
Microbiology	76	78	236
Pharmacology	73	72	219
OPP	86	81	70
Behavioral science	87	82	103

Home Snapshot Course Rank Photo Roster Administration SharePoint Red Alert Analysis

Student Snapshot
Comprehensive profile of student.
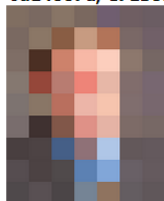
1. Class: DO 2016

2. Student: 212872

6a14887d, e71b07af

General | Admissions | MCAT | Personal

Student ID:	4128a5a1e
Preferred Name:	
E-Mail:	bb141ce2563544c6a2380d@westernu.edu
Current Class:	DO 2016
Admitted Class:	
Cohort:	COMP-NW
OMM:	
Status:	Active / Eligible to Register
Matriculation Date:	08/13/2012
Official Comment:	

Advisor: Kate McCaffrey

Click here for instructions

Semester 1

Name	Alpha Grade	Percent Grade	Course Scores	Course Details
IPE 5000	Credit	Credit		
Intro Study of Med	HNR	100		
MCBM	P	77		
Gross Anatomy	P	83		
PAS I	HNR	95		
OPP I	P	88		
SL I	HNR	94		
Learning Outcomes 1				
ECM I	HNR	93		

Semester 2

Name	Alpha Grade	Percent Grade
IPE 5100	Credit	Credit
Neuroscience	P	82
Musculoskeletal	P	81
IDIT	P	85
Behavioral Med & Psych	P	89
Blood & Lymph	P	81
ECM II	HNR	91
OP&P II	HNR	92
SL II	HNR	99
Learning Outcomes 2		

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NBOME Subject Areas Per Cohort (e.g., DO Class of 2016)

NBOME LO (OM 9000)

DO 2016

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PLOs Per Student

PLOs Per Cohort (e.g., DO Class of 2016)

Program LO (OM 8995)

DO 2016

Item:	Average:	Possible:
Course Score	-	-
Course Percent	-	-
Recorded Alpha Grade	-	-
Recorded Percent Grade	-	-
Cumulative COMP Outcomes	**(%)**	**(N)**
(1) OMM & OPP	83	93
(2) Knowledge	78	1641
(3) Patient Care	79	100
(4) Communication	77	26
(5) Professionalism	73	15
(6) Practice-Based Learning	87	31
(7) Systems-Based Practice	86	28

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PLOs Per Cohort

Program LO (OM 8995)

DO 2016

Item:	Possible:
Course Score	-
Course Percent	-
Recorded Alpha Grade	-
Recorded Percent Grade	-
Cumulative COMP Outcomes	**(N)**
(1) OMM & OPP	93
(2) Knowledge	1641
(3) Patient Care	100
(4) Communication	26
(5) Professionalism	15
(6) Practice-Based Learning	31
(7) Systems-Based Practice	28

Curriculum Gaps?

ILOs Per Student

Institutional LO (OM 8990)

DO 2016

Item:	Grade:	Average:	Possible:
Course Score	-	-	
Course Percent	-	-	
Recorded Alpha Grade	-	-	
Recorded Percent Grade	-	-	
Cumulative WU Outcomes	(%)	(%)	(N)
(1) Critical Thinking	76	75	374
(2) Knowledge	79	79	1578
(3) Interpersonal	75	78	28
(4) Collaboration	100	95	3
(5) Ethical and Moral	69	69	13
(6) Life Long Learning	100	90	3
(7) Evidence-Based	69	74	30
(8) Humanistic Practice	72	75	18

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COLLEGE OF OSTEOPATHIC MEDICINE OF THE PACIFIC

Home Snapshot Course Rank Photo Roster Administration SharePoint Red Alert Analysis Advisor List

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Comprehensive profile of student.

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6a14887d, e71b07af

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SL I	HNR	94		
Learning Outcomes 1				
ECM I	HNR	93		

Semester 2

Name	Alpha Grade	Percent Grade	Course Scores	Course Details
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Musculoskeletal	P	81		
IDIT	P	85		
Behavioral Med & Psych	P	89		
Blood & Lymph	P	81		
ECM II	HNR	91		
OP&P II	HNR	92		
SL II	HNR	99		
Learning Outcomes 2				

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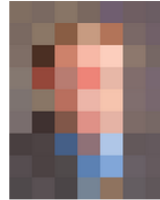*The discipline of learning. The art of caring.*

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ILOs Per Cohort

Institutional LO (OM 8990)

DO 2016

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Institutional LO (OM 8990)

DO 2016

Item:	Possible:
Course Score	-
Course Percent	-
Recorded Alpha Grade	-
Recorded Percent Grade	-
Cumulative WU Outcomes	**(N)**
(1) Critical Thinking	374
(2) Knowledge	1578
(3) Interpersonal	28
(4) Collaboration	3
(5) Ethical and Moral	13
(6) Life Long Learning	3
(7) Evidence-Based	30
(8) Humanistic Practice	18

Curriculum Gaps?

Analytics

Inter-LO Correlation
E.g. Anatomy vs. other NBOME Subjects:

		R^2
Strong	Biochemistry	0.50
	Physiology	0.59
	Pathology	0.56
	Microbiology	0.59
Moderate	Pharmacology	0.47
	OPP	0.29
	Behavioral Science	0.24
Modest	MCAT_AvgMax	0.07
	MCAT_AvgMin	0.05
	PreAdmission_GPA	0.05

Data Visualization

Correlation: Anatomy Vs. Biochemistry

$R^2 = 0.5$
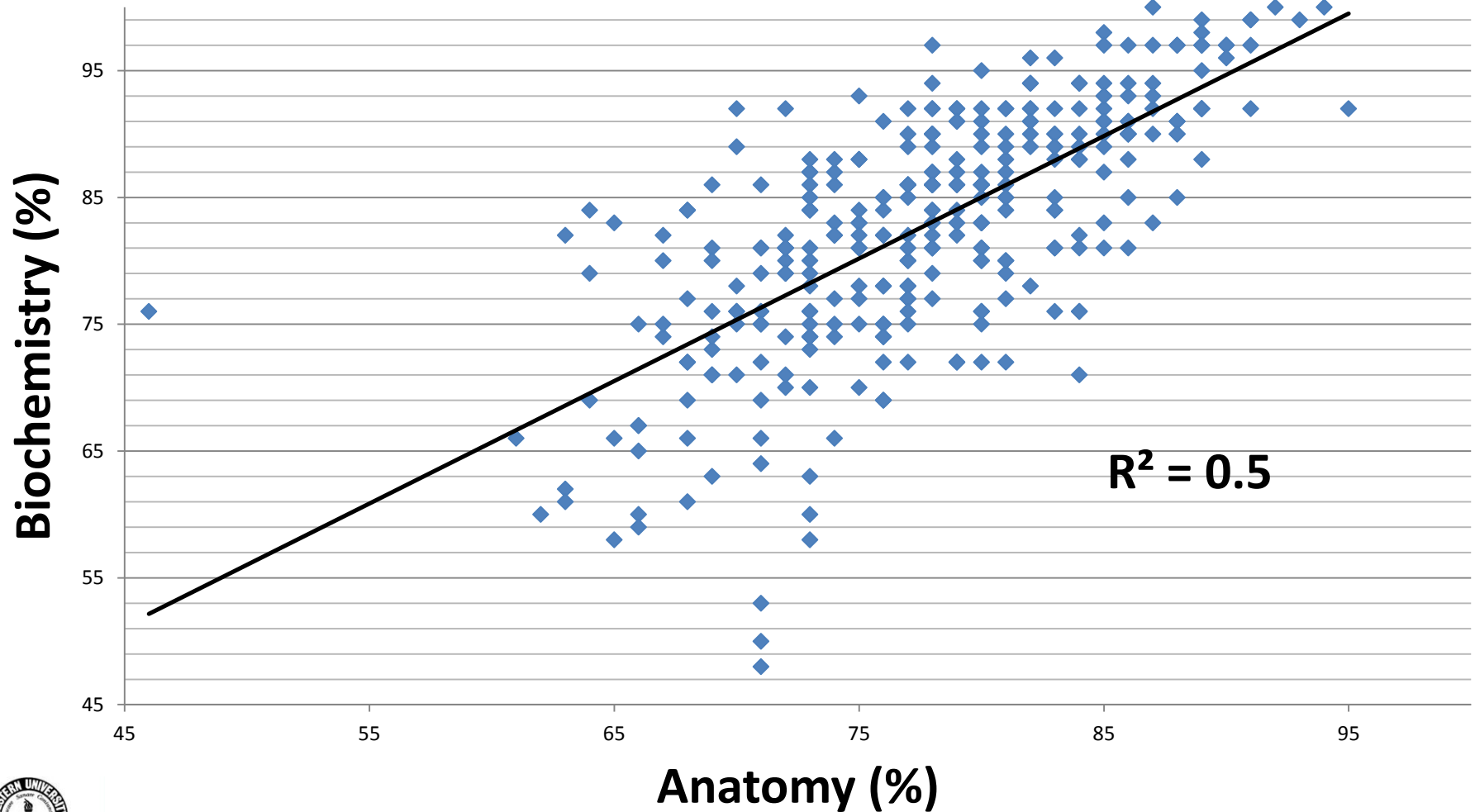
Demo

Closing the Loop

Technology to Track Learner Outcomes

Submission

Agree on Data

Collection

-Ontology
-Taxonomy
-Vocabulary

Analyze & Disseminate

Western University OF HEALTH SCIENCES
The discipline of learning.
The art of caring.

EINSTEIN
Albert Einstein College of Medicine
OF YESHIVA UNIVERSITY
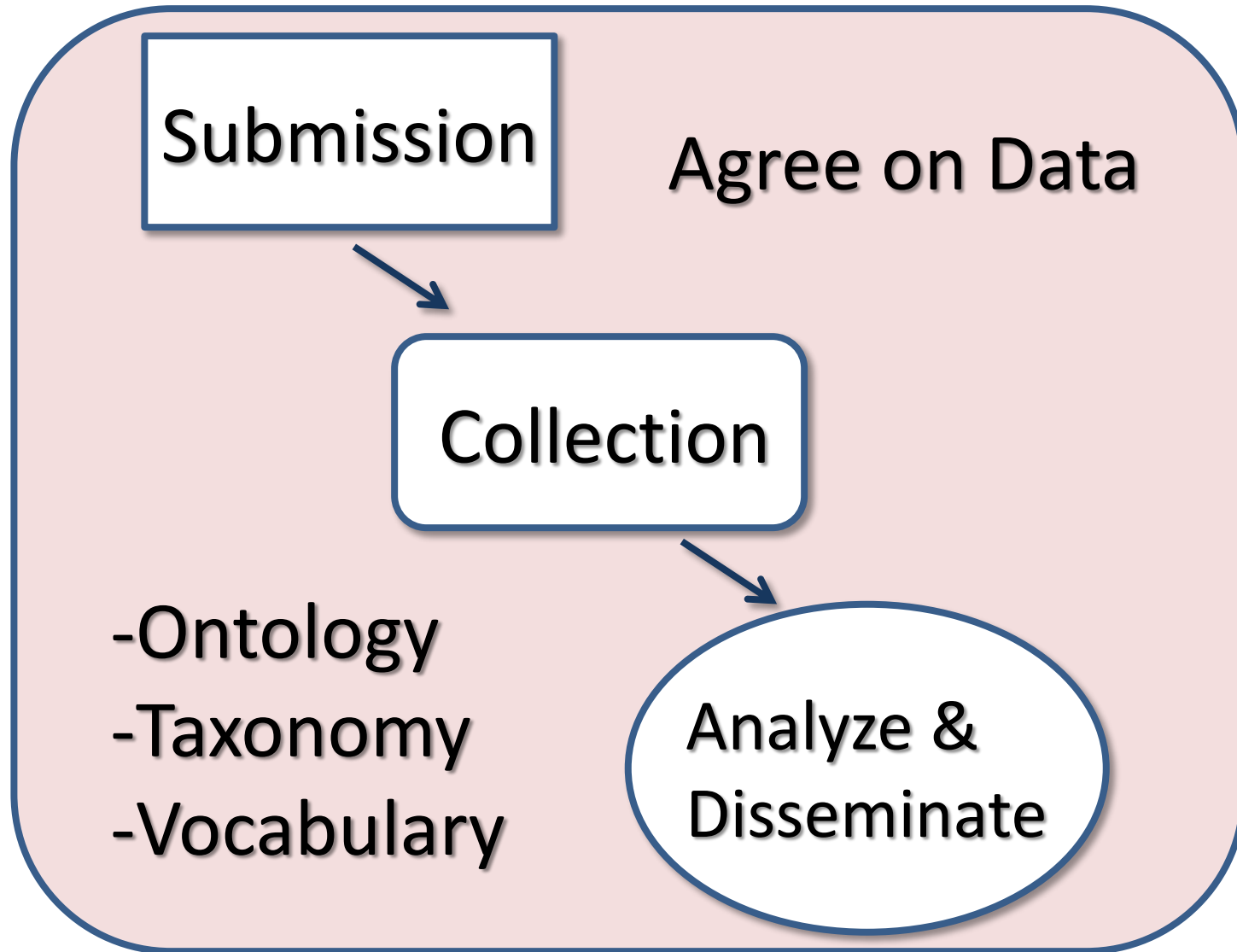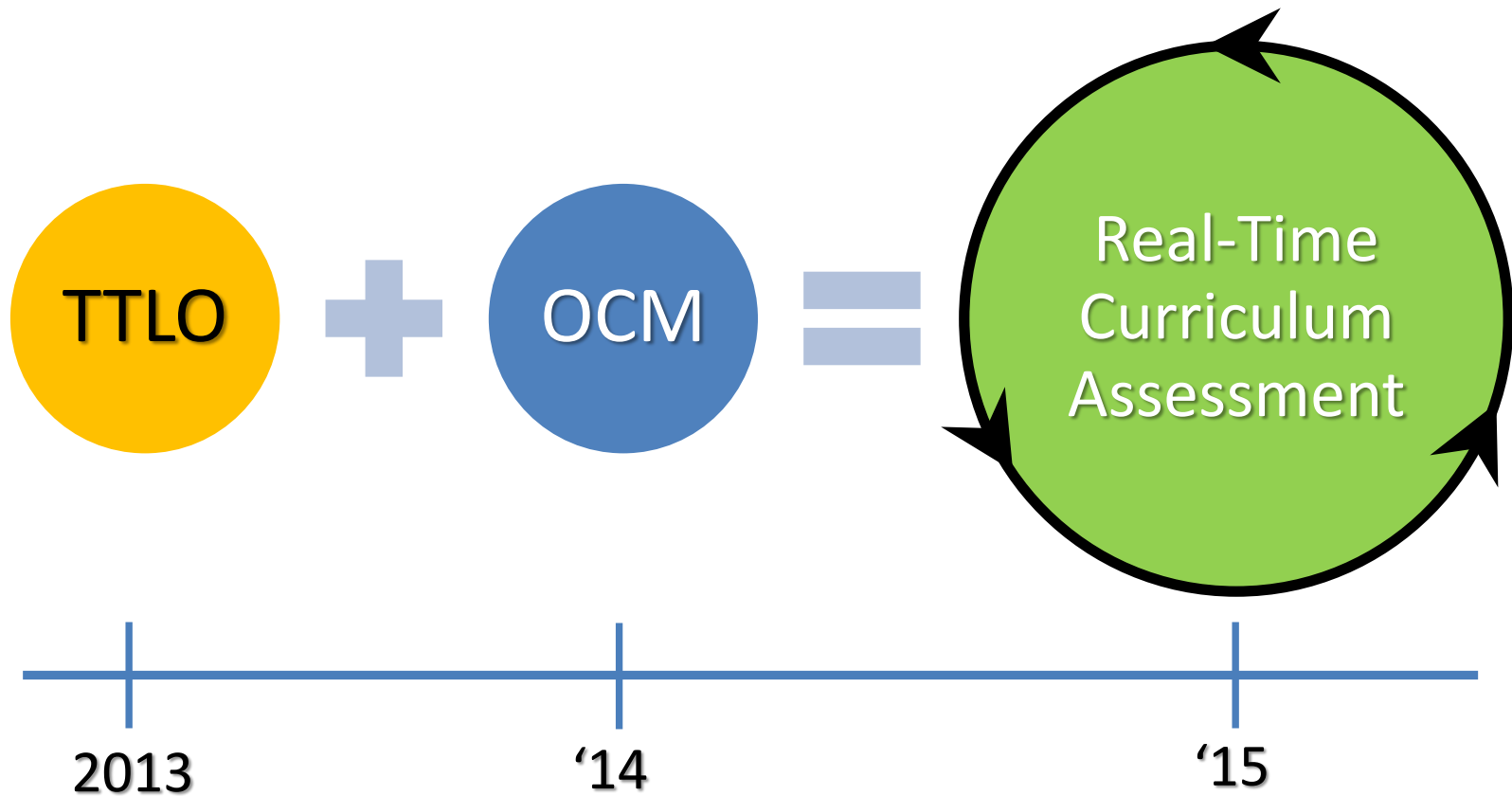
Discussion

Thank You

Please feel free to contact us!

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