The Elements of a Comprehensive Web-Based Testing Program

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Overview of Topics

Item Banking
Secure Examination Delivery
Student Feedback
Impact of CBT/WBT on Curriculum
Future Considerations
The Landscape at UNMC

Five Colleges in Health Sciences Professions

College of Dentistry

College of Medicine

School of Allied Health Professions (Physician Assistant, Physical Therapy, Clinical Laboratory Science, etc.)

College of Nursing

College of Pharmacy

College of Public Health
# The Landscape of Medical Education

<table>
<thead>
<tr>
<th>Time Period</th>
<th>Instructional Focus</th>
<th>Assessment</th>
</tr>
</thead>
</table>
| 18-24 Months | • Basic science foundation  
• Introduction to clinical skills  
• Early clinical experiences (highly supervised) | • Summative, end-of-course examinations  
• OSCEs |

### Step 1 Examination, United States Medical Licensing Examination (USMLE)

<table>
<thead>
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<th>Time Period</th>
<th>Instructional Focus</th>
<th>Assessment</th>
</tr>
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</table>
| 24-36 Months | • Required clinical clerkships (Family Medicine, Pediatrics, Surgery, etc)  
• Elective clinical clerkships | • Clinical evaluations of student performance  
• OSCEs  
• National Board of Medical Examiners Subject Exams (Shelf Exams) |

### Step 2 Clinical Knowledge (CK) Exam & Step 2 Clinical Skills (CS) Exam, USMLE

### Medical Degree Earned

| 3-7 Years | Residency | Training in specialty area  
Step 3 Examination, USMLE |
# The Landscape of Medical Education

## Instructional Focus
- Basic science foundation
- Introduction to clinical skills
- Early clinical experiences (highly supervised)

## Assessment
- Summative, end-of-course examinations
- OSCEs

## Step 1 Examination, United States Medical Licensing Examination (USMLE)
- Required clinical clerkships (Family Medicine, Pediatrics, Surgery, etc)
- Elective clinical clerkships

## Assessment
- Clinical evaluations of student performance
- OSCEs
- National Board of Medical Examiners Subject Exams (Shelf Exams)

## Step 2 Clinical Knowledge (CK) Exam & Step 2 Clinical Skills (CS) Exam, USMLE

## Medical Degree Earned
Web-Based Testing at UNMC COM

<table>
<thead>
<tr>
<th>M1 Year</th>
<th>M2 Year</th>
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<tbody>
<tr>
<td>Fall: 8 Exams</td>
<td>Fall: 8 Exams</td>
</tr>
<tr>
<td>Spring: 8 Exams</td>
<td>Spring: 8 Exams</td>
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</table>

Items are institutionally-developed

Mostly multiple choice items (some short answer, essay)

Include multimedia elements (images, PDFs)

On average 100-125 items per examination

3-3 ½ hours in length
Historical Context

M1 and M2 Exams in paper form

1. Mostly multiple choice; some matching, short answer, and essay items
2. Scantron sheets for grading multiple choice and for item analysis
3. Essay and short answer responses were hand written
Implementation of WBT: Fall 2010

M1 and M2 Exams all computer-based

1. 6 months of research & development
2. Began with M1 students in 2010-2011
3. Expanded to M2 students in 2011-2012
4. All multiple choice items categorized according to USMLE categories for comprehensive student feedback reports
Resources

Technology

1. Respondus 4.0
2. Respondus Lockdown Browser
3. Used with Blackboard (already a campus resource)
4. Four laptop computers

Personnel

1. Program Coordination
2. Programmer

University of Nebraska Medical Center

2010

Ongoing
Enhancements since Initial Launch

Detailed Feedback Reports More Often

1. After each examination and at end of semester
2. Comprehensive report at end of second year that includes every multiple choice item; important preparation for USMLE Step 1 (taken typically June after second year)
Overview of Topics

Item Banking

Secure Examination Delivery

Student Feedback

Impact of CBT/WBT on Curriculum

Future Considerations
**Question Bank**
(database organized by core, includes all exam items from M1 and M2 years)

- Includes:
  - stem
  - foils
  - item writer
  - USMLE categories
  - notes
  - images
  - individual item analysis

**Student Performance Bank**
(database organized by class)

- Includes:
  - longitudinal student records
  - individual responses by item

- Most importantly:
  - generates student feedback reports

**Microsoft Access Database**
Question Bank: Access

Features
1. Handles long text fields
2. Sophisticated querying options
3. Accessible/user-friendly

Drawbacks
1. Slow processing times
2. Limited web capabilities
3. Limited capability for statistical analysis
Which of the following describes the primary function of the structure indicated by the lines in this transmission electron micrograph?

A: Post-translational modification of secretory proteins
B: Regulation of cytoplasmic ionic concentrations
C: Protein trafficking by small vesicles
D: Generation of cellular energy
E: Detoxification of drugs
Test Construction

Curriculum Office

1. Manages item bank
2. Provides technical support
3. Communicates with ITS
4. Item analysis and scoring

Course Director

1. Oversees exam content
2. Serves as proctor
3. Final scoring decisions and assignment of grades
Item Analysis Outside of Item Bank

SAS for Scoring and Item Analysis

1. Was in use previously to score scantron sheets; faculty are familiar with its reports
2. Powerful analysis and reporting tools that are highly customizable
3. Steep learning curve ~ requires programmer support or extensive training for non-programmers
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<td>92</td>
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Blackboard Item Analysis

Recently Released Feature

1. Fairly robust set of item analysis features as part of assessment section of Blackboard
2. Customization not available; still a good place to start
3. Available in the Grade Center
Overview of Topics

Item Banking

Secure Examination Delivery

Student Feedback

Impact of CBT/WBT on Curriculum

Future Considerations
Technology Labs

1. Two separate labs in close proximity (72 seats, 60 seats)
2. Four laptop computers

1010: 72 Seats
1012: 60 Seats
Blackboard to Administer Exams

Items Imported to Bb via Respondus 4.0

1. Seamless importing functionality
2. Adding images or other media easier in Respondus 4.0 than in Blackboard
3. Provides print functions to generate a key or print version
4. Purchase available as site license or as individual user licenses

www.respondus.com
Items Divided Into Testlets

1. 40-55 items each; MCQ separate from constructed response items
2. Students must complete and submit a testlet before starting another
3. Items randomized within testlets
4. Board examinations presented to students in this way
Intro Exam 2

Intro Exam 2 -- Testlet A - Requires Respondus LockDown Browser
Multiple Choice (46)

Intro Exam 2 -- Testlet B - Requires Respondus LockDown Browser
Multiple Choice (46)

Intro Exam 2 -- Testlet C - Requires Respondus LockDown Browser
Multiple Choice (47)
Multiple Choice

Question 2
How old is the oldest oceanic crust?
- a. 200 million years
- b. 500 million years
- c. 2 billion years
- d. 8 billion years

Short Answer

Question 14
Which ocean species did you find most interesting? Give three facts about it.

Question 1
Explain what a tombolo is and where you might find one.

Students answer the question by typing in the box.
Features

1. Instructor can easily monitor progress through exam
2. Familiar interface for students

Drawbacks

1. Timing function unstable; rely on room clocks instead
2. No strikethrough or marking options
Respondus Lockdown Browser

A Deterrent to Cheating

1. Prevents student from copying, pasting, printing
2. Cannot access links outside the exam (unless provided)
3. Available for Macs and PCs and just recently for iPads
4. Optional password to access the examination
Institutional Security Procedures

Exam Password

1. Held secure until test day
2. Must be present in room to receive password and access examination

Scratch Paper

1. Provided to students and considered a secure document that must be returned
Respondus Monitor

Allows Monitoring at Remote Locations

1. Requires student to have webcam
2. Records student as she completes examination
3. Option to require student to validate her identity
Overview of Topics

Item Banking
Secure Examination Delivery

Student Feedback

Impact of CBT/WBT on Curriculum
Future Considerations
Initial Feedback Reports

Based on Broad USMLE Categories

1. For example: Cardiovascular System, Normal Processes
2. Student response was negative, too broad
Current Feedback Reports

Exam Feedback Report

1. After each exam, based on USMLE’s detailed content categories
2. Includes individual performance and class performance

Comprehensive Feedback Report

1. Aggregate data at broad levels
2. Provided at end of each semester and at end of second year in preparation for Step 1 Examination
Generating Reports

Back to the Question ID

1. Student Performance Bank stores responses by question and student
2. Each item is already categorized
3. Reports tally and display performance by category
## Exam Feedback: Neurology/Ophthalmology/Psychiatry Exam 1

**Year(s):** 13-14 thru 13-14  
**Semester:** All  
**Core:** All  

**Central and Peripheral Nervous Systems**

**Principles of therapeutics**

*mechanisms of action and use of drugs for treatment of disorders of the nervous system*

<table>
<thead>
<tr>
<th>Drug Category</th>
<th>Number of Questions</th>
<th>Your Performance</th>
<th>Class Average</th>
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</thead>
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<tr>
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<td>1</td>
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<td>70.97</td>
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<tr>
<td>Anticonvulsants</td>
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<tr>
<td>Antimigraine agents</td>
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<td>100.00</td>
<td>86.69</td>
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<td>Antimicrobials, antineoplastic drugs, and antiparasitics</td>
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<td>Drugs used to treat cerebrovascular disorders</td>
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<td>Treatment for substance abuse disorders</td>
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## Comprehensive Feedback Report

**Year(s)**: 13-14 thru 13-14  
**Semester**: Fall  
**Core**: INTRO  
**Mailbox**:  

**Friday, November 08, 2013**

### General Principles

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<th>Topic</th>
<th>Your Performance</th>
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<td>Biology of tissue response to disease</td>
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<td>Gender, ethnic, and behavioral considerations affecting disease treatment and prevention, including psychosocial, cultural, occupational, and environmental</td>
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<td>Biochemistry and molecular biology</td>
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### Hematopoietic and Lymphoreticular Systems

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### Central and Peripheral Nervous Systems

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### Skin and Related Connective Tissue

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Applying This to Your Field

Identify the Gold Standard

1. Standards, Competencies, Objectives,
2. Determine an approach to categorizing current examination items according to the gold standard
3. With the help of a programmer, reports fairly easy to generate
4. Consider total software package that does item banking and generates reports for you (ExamSoft, etc)
Overview of Topics

Item Banking
Secure Examination Delivery
Student Feedback

Impact of CBT/WBT on Curriculum
Future Considerations
Student Remediation

Focused, Personalized Approach

1. Course Director can identify specific areas of weakness
2. Rather than remediating an entire course, student can focus on remediating only the sections he did not master
Preparation for Licensure

Step 1 Examination

1. Considered the gateway to residency; scores increasingly being used to identify quality applicants (instead of just determining whether the student passed or failed)

2. Students can identify areas of weakness and focus efforts on reviewing those areas in more depth

3. Because feedback reports match up directly to content of board exam, easy for students to locate practice questions focused on specific areas
Informing Curriculum Development

Direct Ties Between Teaching & Assessment

1. Course objectives categorized using the same content outline for examination items
2. Can easily identify strengths and weaknesses in curriculum
3. With a quick query, able to locate the places where a specific topic is assessed (and hopefully taught)
Overview of Topics

Item Banking
Secure Examination Delivery
Student Feedback
Impact of CBT/WBT on Curriculum

Future Considerations
Growth Opportunities

Web-Based Application for Editing & Revising

1. Reduce human error
2. Place responsibility in faculty member’s hands
3. Software companies offer solutions to this challenge (ExamSoft, ExamMaster)

Expansion of Media Types

1. Video and audio (heart sounds, etc)
Educational Research

Correlation with Licensure Examinations

1. Students report close correlation between UNMC feedback reports and licensure feedback reports
2. Formal study must be conducted to validate

Examinee Fatigue

1. Exams typically 2-4 hours in length
2. Software tracks time on item, changes to answers, etc
Challenges

Bring Your Own Device

1. Increases number of platforms to support
2. Greater flexibility
3. Possible additional security concerns

Cloud & Wireless Computing

1. Increased flexibility
2. Stability required
Conclusions

Applicable to all Fields of Study

Let your curriculum goals guide the approach you take to implementing computer-based testing in your setting.

Big Return on Investment

Total software packages have a lot to offer and may very well be the most cost-effective approach, depending on your situation. Whether you contract with a software company or utilize existing resources like we have, the information you gain about your curriculum is priceless.
Acknowledgements

Hugh Stoddard, Ph.D.
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University of Nebraska Medical Center
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