Outcome-Based Education
and Curriculum Design

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Thomas R. Viggiano, M.D., M.Ed.
Professor of Medical Education and Medicine
Associate Dean, Faculty Affairs
Mayo Medical School

Competence - definition

• Competence – “The quality of being capable of performing an act or function”

• “having sufficient knowledge, skill, experience or capacity for some purpose”

Competency - definition

“Professional competence is the habitual and judicious use of communication, knowledge, technical skills, clinical reasoning, emotions, values, and reflection in daily practice for the benefit of the individual and the community being served”

Epstein and Hundert
JAMA 2002; 287:226-235

Competency

Competency is demonstrated when
• an individual’s capabilities
• encounter tasks
• in a context (which may vary)

Competency is a Learner Outcome

Outcome-based Education

Outcome defines Process

Outcome (competency) defines:
• Content
• Instructional methods
• Time allocation and sequence
• Learning strategies
• Assessment strategies
Outcome-based Education
3 key components

1) Communication of explicit learning outcomes and standards that must be achieved
2) Learning experiences designed and directed to facilitate the desired level of achievement of the learning outcomes
3) Assessment processes that ensure that individual students have achieved the learning outcomes and standards

Competency
Competency is demonstrated when
• an individual’s capabilities
• encounter tasks
• in a context (which may vary)

Objectives – 3 Elements
• Behavior – What the learner should be able to do (Capability)
• Performance criteria – describe the criteria for acceptable performance (Task)
• Conditions – The conditions, if any, under which the learner is able to do it (Context)

Behaviors - Bloom’s Taxonomy
Bloom’s taxonomy is an excellent source of verbs that describe learning outcomes as behaviors or capabilities

Bloom’s Taxonomy
• 3 interrelated and overlapping domains of learning behaviors:
  Cognitive (Knowledge)
  Psychomotor (Skills)
  Affective (Attitudes, Values)
• Hierarchy – simple to complex
• Must first learn simple to learn complex
Progression of Cognitive Domain

- Knowledge
- Comprehension
- Application
- Analysis
- Synthesis
- Evaluation

Progression of Cognitive Domain

- Fact
- Understanding
- Application

Progression of Psychomotor Domain

- Imitation
- Manipulation
- Precision
- Articulation
- Naturalization

Progression of Psychomotor Domain

- Imitation
- Practice
- Habit

Progression of Affective Domain

- Receiving
- Responding
- Valuing
- Organization
- Characterization (by Value Complex)

Progression of Affective Domain

- Awareness
- Distinction
- Integration
Objectives – Bloom’s Taxonomy

Bloom’s verbs describe learning behaviors. But what criteria of performance are required to demonstrate competency? Under what conditions, if any, should the behaviors be demonstrated?

Competency and Mastery

• Competency – the minimum standard of performance
• Mastery – the continuous highest standard of performance

Competence → → → → Mastery

Dreyfus Model of Skill Acquisition

• Novice
• Advanced Beginner
• Competent
• Proficient
• Expert

Mind Over Machine

Levels of Professional Development of Knowledge and Performance

• Novice – identifies and uses rules of thumb
• Advanced beginner – connects rules to common aspects of the plan
• Competent – able to plan an approach and execute a plan
• Proficient – regularly uses evidence-based work and makes work efficient
• Expert – capable of using intuition where empirical knowledge does not exist

Mind Over Machine

Dreyfus Levels to Medical Education

What level is appropriate for:
• Undergraduate Medical Education? Advanced Beginner to Competent
• Graduate Medical Education? Competent to Proficient
• Continuing Medical Education? Proficient to Expert

How can educators ensure that programs achieve competency across the continuum?
Outcome-based Education
Key Components

3) Assessment processes that ensure that individual students have achieved the learning outcomes and standards

“Assessment drives learning”

Framework for Clinical Assessment

Assessment Strategies

Assessment Methods

Assessment

Some learning behaviors are not measurable or observable

“...no assessment method can provide all the data required for judgment of anything so complex as the delivery of professional services by a successful physician.”

Assessment strategies

• We must move up the assessment pyramid to succeed at Outcome-based education
• Formative Assessment drives Mastery Learning and Outcome-based Education
Assessment vs Evaluation

Assessment – analysis and use of data to make decisions about improvement

Evaluation – analysis and use of data to make judgments about performance

Student Assessment and Evaluation

• Formative assessment – feedback that “forms” the development of the learner
• Summative evaluation – summarizes the achievement of the learner - grading
• Diagnostic assessment – identifies student deficiencies for remediation

Formative Assessment

3 components of Formative Assessment
• Constructive feedback
• Direction to facilitate desired learning
• Encouragement to create a supportive learning environment

Self-Regulated Professional

As educators, we should:
engage our learners in self-assessment
encourage self-direction
foster the development of self-regulation

Faculty mentors should model these behaviors and help develop these skills

Mentoring for Self-Regulation

• How are you doing in school? How are you progressing on your goals? (self-assessment)
• What opportunities for improvement have you identified? (self-direction)
• What plans do you have for working on these improvement opportunities? (self-regulation)
• Provide feedback from actual performance and progress on previous self-improvement plans. Provide direction as appropriate.
• How can we help? (support)
**Outcome-based Education**

**Key Components**

2) Learning experiences designed and directed to facilitate the desired level of achievement of the learning outcomes

**Curriculum**

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**Compact of Learning**

Our responsibility, as educators, is to design effective learning experiences, direct the learning, ensure that the standard of learning has been achieved, and demonstrate the behaviors of Professionalism

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**Evidence-Based Education**

**Goals of Learning Activities**

What do we want students to do with the knowledge, skills, and attitudes they learn?

1) Retain them → Retention

2) Apply them to new “on the job” situations (or new contexts) → Transfer

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**Evidence-Based Education**

We should integrate existing knowledge from the neurobiology and science of learning into the design of learning experiences and the curriculum

**Acad Med 2011;86:415-420**

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**Evidence-Based Education**

Prior Knowledge and Experience, and Meaning

- Learning is strongly influenced by meaning
- “Construction of knowledge” is organizing and storing new information in a meaningful context
- Learners incorporate meaning into new material by relating it to prior knowledge and experience
Prior Knowledge and Experience, and Meaning

- Retention and transfer improve if new material is related to prior knowledge and experience
- Learning in the same context (clinical) in which application will occur constructs knowledge to support practice

Implications for Curriculum Design

- Students will learn basic sciences more effectively if they understand the relevance to patient care or current research theory or efforts
- Construct rigorous cases to reinforce the essential importance of basic science to clinical reasoning and problem solving

Implications for Curriculum Design

- Readiness assurance testing – testing prior knowledge before new learning activities (from Team-based Learning)
- Assign pre class work that activates relevant prior knowledge and experience

Dual Coding Theory

“Dual Coding Theory” – Humans process information by 2 channels, and store information in 2 corresponding formats
1) auditory-verbal
2) visuospatial

Dual Coding and Knowledge Representation

- Information stored in both auditory-verbal and visuospatial formats improves retention and transfer of learning more than information stored in either format alone

Implications for Curriculum Design

- Combine auditory-verbal and visuospatial formats to present materials
- Have students construct graphics and concept maps to organize information and depict relationships of concepts especially if primarily verbal
- Have students write verbal descriptions or summaries of information especially if primarily visuospatial
Active Learning and Retention

- The more actively involved a learner is in learning activities, the greater the retention of learning.

Retention and Involvement

We remember
- 10% reading
- 20% listening
- 30% seeing pictures
- 50% observing and hearing movie, video, or demonstration
- 70% presenting, or active participation in a discussion
- 90% high fidelity simulation, doing

Our involvement
- Passive
- Active

Passive
- 10% reading
- 20% listening
- 30% seeing pictures
- 50% observing and hearing movie, video, or demonstration
- 70% presenting, or active participation in a discussion
- 90% high fidelity simulation, doing

Active Learning and Cognition

- Active learning achieves higher level learning comprehension, application, analysis “transforming” → “knows how”
- Passive learning results in shallow processing and lower level learning “transmitting” → “knows”
- Understanding is an interpretive process in which students must actively participate

‘Tell me, and I will forget.
Show me, and I may remember.
Involve me, and I will understand’

Confucius 450 B.C.

‘What is important is not just the ‘performance’, but the understanding of why they are doing what they are doing, and what they are learning from it.”

Keith Morrow 1997

Implications for Curriculum Design

Active Learning and Cognition

- Ask students to compare and contrast concepts or apply concepts in different contexts
- Pose deep reasoning questions or problems to engage and direct the learner
- Encourage learners to ask questions and allow sufficient time to answer and discuss
**Implications for Curriculum Design**

**Active Learning Methods**

- Problem-Based Learning
- Team-Based Learning
- Case Method Teaching – Discussion
- Application of Knowledge Exercises
- Simulations
- “Debriefing”

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**Motivation to Learn**

- Adults learn best in a supportive environment
- Praise which focuses on the process of learning motivates the student and improves learning of difficult tasks
- Formative Assessment
- Constructive corrective feedback

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**Implications for Curriculum Design**

**Motivation to Learn**

- Stimulate curiosity by asking probing questions of important concepts
- Team learning activities provide support for learners
- Provide formative feedback by praising and constructively critiquing the process of student learning → “Coach”

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**Stress**

- Moderate levels of stress can facilitate synaptic potentiation in brain circuits involved in memory and reinforce learning
- High levels of stress inhibit memory brain circuits and interfere with learning
- Balance learners challenges with support

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**Interference**

**Interference** – when “other” information or activities interfere with learning new information

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**Implications for Curriculum Design**

**Preventing Interference**

- Reduce interference by monitoring
- Workload of simultaneous courses
- Similar information presented in disjointed, inconsistent, contradictory manner
- Frequent summative testing – “binge and purge” information for grades
Practice at Retrieval

“Practice at retrieval” – the learner accesses memory to retrieve information
• Information that is frequently retrieved becomes more retrievable
• Practice at retrieval is the single most important variable in promoting long term retention and transfer

Practice and Time

• Spacing practice over longer intervals of time is preferable to mass practice over a shorter or limited time
• “Distributed practice” (practice distributed over time) results in better long term retention and transfer

Implications for Curriculum Design

Practice at Retrieval

• Important concepts should be integrated into the learning experiences repetitively over time to provide distributed practice at retrieval

Testing is Practice at Retrieval

• “Testing effect” – Tests improve retrieval of information but only for information that was recalled for the test, not for all information studied for the test
• Testing enhances learning and retention

Implications for Curriculum Design

Testing as Practice at Retrieval

• Examinations should be constructed with “Key concept questions” as testing effect will enhance retrieval
• Important concepts should be tested over time to provide practice at retrieval
• Provide “key concept” review questions to guide studying and exam preparation

Practice and Context

• Practice at retrieval occurs within a context
• Altering the context for retrieval increases the transfer of learning across multiple contexts
Implications for Curriculum Design
Multiple and Varied Contexts

• Use multiple and varied contexts for learning experiences
• Mix different types of problems and solutions in the same learning experience

Learning and Context

• Learning occurs most effectively when it occurs in the context of future tasks
• Context facilitates construction of knowledge that supports practice
• Contextual learning facilitates retrieval, application and retention
• Cases provide real world context

Patients as Cases
Patients or (Cases) are the “unit” of:
• Clinical work
• Clinical teaching
• Consultation
• Continuing education
• Clinical examinations
• Clinical memory – expertise

Cox. Med Ed 2001; 35, 862-866

Learning and Context

“It is a safe rule to have no teaching without a patient for a text, and the best teaching is that taught by the patient himself”

Sir William Osler

Case-based Teaching
Case-based teaching

• a meaningful problem
• that requires authentic action on the part of the learner
• in the process of understanding
• and resolving the problem.

Educational Benefits of Cases
A Case is

• A patient based context for discussion
• That allows students to recall previous knowledge and experience
• Assess limits of their knowledge
• Learn from others
• Engage in collaborative inquiry and
• Formulate questions that lead to learning, understanding and problem solving
“A good case
takes a routine event
and
explodes its complexity”

C. Roland Christensen
Harvard Business School

Implications for Curriculum Design
Learning and Context

- Meaning, learning, retention, and transfer of
  basic and clinical sciences will occur most
effectively if learned in a patient or case
based context
- Cases are simulations of real patients and
  should be used as often as possible

Learning occurs best in the context of
meaningful service to real patients

There is no substitute for early,
longitudinal, and high quality clinical
experiences

Our patients are the best teachers
throughout our careers

Implications for Curriculum Design
Methods for Contextual Learning

- Case method learning
- Standardized patients
- OSCE
- Simulation and Debriefing
- Clinical Teaching (Microskills, SNAPPS)

Experiential Learning
(Reflective Thought and Action)

Concrete Experience
(What happened)

Reflective Observation
(What was learned, future
implications)

Planning for Implementation
(What will be done differently)

Activity Experimentation
(What is done differently)

Abstract Conceptualization
(Ethical/moral (macro),
technical (micro))

Experiential Learning
(Reflective Thought and Action)

Experience

- Experience alone can be a poor teacher
- Experience with formative and corrective
  feedback (“guided practice”) is the best
  teacher
- Authentic experience, similar in content
  and context to the real world, is most
effective
The currency of mastery is distributed, deliberate (or guided) practice.

Deliberate Practice
- Identify well-defined task
- Appropriate level of difficulty
- Informative feedback
- Opportunity for repetition
- Opportunity to correct errors

Ericsson. Psychological Review. 1993

Implications for Curriculum Design Experience
- Guide or “coach” → Deliberate Practice
- Correct misconceptions, erroneous thinking, faulty behaviors → Formative Assessment

Clinical Education
“Health Professions students and their faculty should learn in clinical settings that reflect the best achievable patient care”

AAMC Institute for Improving Clinical Care

Exemplary Clinical Education
- Active, experience-based learning
- Interdisciplinary teams, collaboration
- Learning in context of meaningful work
- Teachers as coaches
- Reflection

Interdisciplinary Professional Education Collaborative

Clinical Education - Residents
- Residents are in the best position to guide student practice
- We should develop residents as educators who understand the learning objectives, expectations and responsibilities of students, and the criteria for performance evaluation
Faculty as Role Models

- Faculty are role models in an apprenticeship system
- We must be what we want our students to become

“3 R’s” of New Curriculum

- Rigor
- Relevance
- Relationship

Thank You

Best Wishes