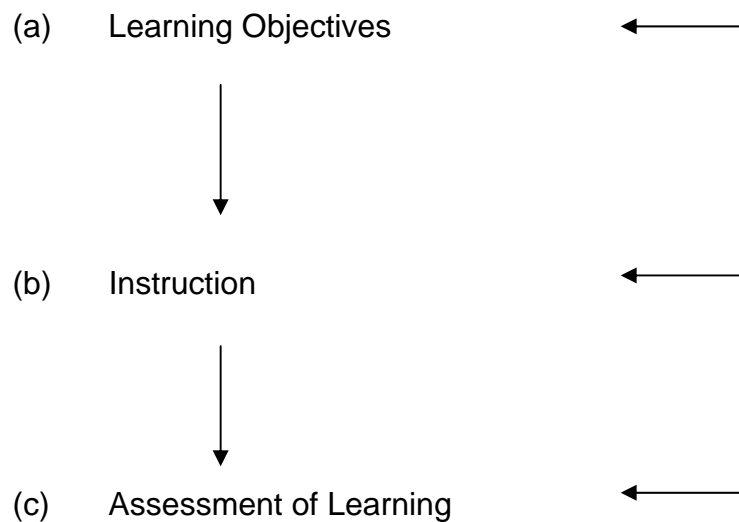


Doing Valid and Reliable Assessment (An Introduction)

[Slide 1]

Model of Classroom Learning and Teaching



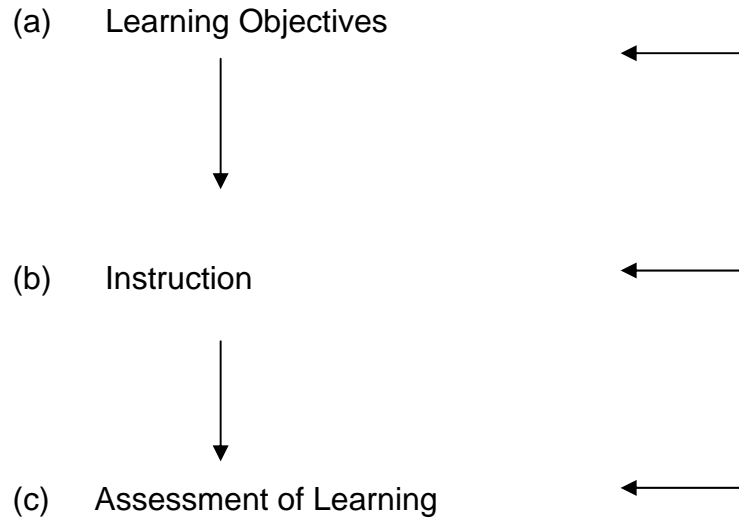
[Comment 1.1]

- (a) *Learning Objectives*: Knowledge and skills students will learn by the end of *Instruction*; “learning targets” for students
- (b) *Instruction*: Environment, activities, and content that support student achievement of Learning Objectives
- (c) *Assessment of Learning*: Decisions about student learning by creating situations requiring students to show how well they are mastering *Learning Objectives*

[Comment 1.2]

Model examples?

[Comment 1.3]



As the arrows show, this Model is a “never-ending” Cycle:

- * *Learning Objectives* determine the nature of *Instruction* and *Assessment of Learning*
- * *Assessment of Learning* determines future *Learning Objectives* and *Instruction*

[Comment 1.4]

Cycle examples?

[Comment 1.5]

This Cycle breaks down when . . .

- Teachers *instruct*...without first establishing *learning objectives*!
- Teachers *assess student learning*...without considering *learning objectives* and *instruction*!
- Students do not know what they are suppose to learn or where they stand... because *learning objectives* have not been established and communicated!

SELF-ASSESSMENT EXERCISE

In terms of the Model of Classroom Learning and Teaching, what is missing in the following situations:

1. You are teaching your first course in Fashion Design, and it starts next week. You want your students to be highly motivated and learn a lot from the course. In planning the course, you begin by pulling together the most interesting content and interactive learning activities you can find to fill up a semester's worth of instruction. WHAT'S MISSING?
2. You have been teaching an Introduction to Psychology course for three weeks, and things have been going well. It is time for the first test, and you want to give it first thing tomorrow in class. It is now 5 PM and you have several errands to do on your way home, but you need to develop the test first. You quickly flip through the Teacher's Manual that accompanies the textbook, and pick out 30 test questions provided for the three chapters you have covered thus far. There, you have the test ready to go (and it only took 20 minutes)! WHAT'S MISSING?
3. The semester is half over in the Microsoft Office Applications course you are teaching. Your students have started coming up to you after class, complaining they do not have a "big picture" of what they are supposed to be learning and how well or poorly they are doing. WHAT'S MISSING?

[Slide 2]

Focus on Learning Objectives

Learning Objectives . . .

- (a). . . student learning outcomes as a result of instruction
- (b). . . control what happens throughout *Instruction* and *Assessment of Learning*
- (c). . . stated in terms of learning behaviors that you can see and measure

[Comment 2c]

Examples of Learning Objectives that are **not** behavior-based:

1. Students will know the dates of the first three constitutional amendments.
2. Students will understand how to use the 'rule of complimentary angles' to solve geometry problems.
3. Students will appreciate the role of solar energy in the design of architectural models.

Examples of Learning Objectives that **are** behavior- based:

1. Students will list the dates of the first three constitutional amendments.
2. Students will solve geometry problems involving the 'rule of complimentary angles'.
3. Students will create an architectural model that incorporates solar energy.

A Question...

In light of the Model of Classroom Learning and Teaching, why is it important that Learning Objectives be stated in behavior-based language?

- (d). . . specify content AND "level of learning" you want students to practice and develop

[Slide 3]

Three different “levels of learning”:

- (a) (*First Level*) Foundational Content– learning outcomes in the form of (1) *knowledge* (producing memorized facts, definitions, rules, steps in a procedure, etc.) or (2) *comprehension* (restating the meaning of new content in student’s own words)

[Comment 3a]

Examples of Foundational Content:

Recalling number facts (like multiplication tables)

Stating the definitions of technical vocabulary words

Summarizing the causes of global warming previously reviewed in class

Explaining the meaning of a mathematical formula [e.g., $C = \pi (D)$] using students’ own words

Giving an example of a general principle

- (b) (*Second level*) Application– learning outcomes in the form of using Foundational Content to apply to new situations or solve new problems

[Comment 3b]

Examples of Application:

Solving new math problems using knowledge and comprehension of math formulas

Figuring out which punctuation rules apply to written text

Using knowledge and comprehension of C++ software language to solve a programming problem

- (c) (*Third Level*) Higher Order Process –learning outcomes in the form of (a) analysis of ideas or concepts into component parts, (b) bringing together *component* ideas or concepts to form original *whole* idea or concept, or (c) judgments about the acceptability of ideas or concepts

[Comment 3c]

Examples of Higher Order Processes:

Analyzing facts and assumptions to determine which do and do not support an argument's main thesis

Finding an original way to use conventional design elements in a fashion design project

Evaluating which of two urban development plans best satisfies the criteria of economic renewal and quality of life

[Slide 4]

THREE STEPS FOR CREATING LEARNING OBJECTIVES. . .

- (a) (First Step) Decide the content and "level of learning" for each Learning Objective

[Comment 4a]

Examples:

For an Introduction to Psychology course, some of the content and level of learning a teacher wants students to learn might include:

- Knowing the names and neurological functions of the brain's major regions [**Foundational Content**]
- Using different psychological theories to explain human behavior [**Application**]
- Determining the pros and cons of different counseling approaches for various mental health problems [**Higher Order Processes**]

- (b) (Second Step) Make sure Learning Objectives are stated in terms of learning behaviors that you can actually see happen; use "action verbs"

[Comment 4b]

Examples:

- Students will *label* the brain's major regions with the appropriate scientific name, and *list* at least one major function for each labeled region **[Foundational Content]**
- Students will *apply* alternative psychological theories in explaining a given example of human behavior **[Application]**
- Students *will analyze and evaluate* the advantages and disadvantages of alternative counseling approaches for a given mental health problem **[Higher Order Process]**

(c) (Third Step) Make sure Learning Objective's "level of learning is reflected in "action verb"

[Comment 4c]

Examples:

<u>Level of Learning</u>	<u>Possible Action Verbs</u>
Foundational Content	<i>list, name, recite, give examples of, define, paraphrase, summarize, etc</i>
Application	<i>solve, modify to fit, apply, etc</i>
Higher Order Processes	<i>compare and contrast, analyze, create, justify, evaluate, etc</i>

[Self-Assessment 4.0]

SELF-ASSESSMENT EXERCISE

Evaluate the following Learning Objectives, and specify which “levels of learning” they represent:

- Ia. Students will understand the five principles of design.
- Ib. Students will recite the formal definition for each of the five principles of design.
- Ic. Students will determine which one of five design principles applies to a newly presented design object.
- Id. Students will use five design principles in creating an original item of clothing.

- Ila. Students will know technical vocabulary associated with C++ programming.
- Ilb. Students will define, using their own words, the technical vocabulary associated with C++ programming.
- Ilc. Students will use correctly technical vocabulary associated with C++ programming in presenting their Final Project.
- Ild. Students will evaluate how well their peers use technical vocabulary in presenting Final Projects, including analysis of alternative vocabulary to improve communication clarity.

[Slide 5]

Focus on Assessment and Content Validity

Assessment is. . .

. . . creating and implementing assessment techniques for observing, measuring, and making decisions about student learning

Different assessment techniques are a better or worse *match* for different “levels of learning”

[Slide 6]

Foundational Content (level of learning)

Learning Objective: Students will recognize the distinction between a series and a parallel electric circuit.

Assessment Technique (this question is presented to students):

Which statement describes the difference between a series and a parallel electric circuit? (circle one)

- a) In a series circuit, there is only one path for the electrons to flow; in a parallel circuit, there is more than one path for electrons to flow.
- b) In a series circuit, there is more than one way for electrons to flow; in a parallel circuit, there is only one way for electrons to flow .
- c) In a series circuit, electrons flow in a clockwise direction; in a parallel circuit, they flow in a counter-clockwise direction.
- d) In a series circuit, electrons flow in a counter-clockwise direction; in a parallel circuit, they flow in a clockwise direction.

[Comment 6.1]

This is a “multiple choice”, or “select-type”, assessment technique. It matches well a Foundational Content level of learning, where the student has to recognize and select the correct answer from a set of given alternatives

[Slide 7]

Application level of learning

Learning Objective: Students will apply the principle of series vs. parallel to various electric circuits.

Assessment Technique (this question is presented to students):

You have a string of lights. When one particular light burns out, all the lights beyond that point fail to light up. This is an example of _____. (circle one)

- a) a parallel circuit
- b) a series circuit
- c) a dual circuit (both series and parallel)
- d) neither a series or parallel circuit

[Comment 7.1]

This “select-type” assessment technique matches well the Application level of learning; it requires the student to apply the series vs. parallel distinction to a new situation by choosing the correct answer from a set of given alternatives.

[Slide 8]

Higher Order Processes level of learning

Learning Objective: Students will design electric circuits that capitalize on the distinctive characteristics of series vs. parallel.

Assessment Technique (the question below is presented to students):

Given specifications about an electrical source and a required set of electrical tasks, evaluate whether a series or parallel design optimally satisfies the situation, justify this evaluation, and design and build the electric circuit.

[Comment 8.1]

This is a performance-based assessment technique, requiring the student to demonstrate a skill or produce a product, which the teacher then evaluates. It matches well the Higher Order Processes level of learning.

[Slide 9]

Content Validity

. . . if your assessment techniques collect information about student learning that **matches** both Learning Objectives and Instruction, then decisions about student learning will have **strong content validity**.

. . . If your assessment techniques collect information about student learning that **does not match** Learning Objectives and Instruction, then your decisions about student learning will have **weak content validity**.

SELF-ASSESSMENT EXERCISE

- I. You teach an Art History and Appreciation course. You have established ten Learning Objectives for this course. Five of the Learning Objectives emphasize *knowledge* of facts: dates, artists, materials, and the cultural contexts of famous paintings throughout various artistic periods. The other five Learning Objectives emphasize use of art design principles to *analyze and evaluate* paintings.

True to your Learning Objectives, throughout the course you have spent about 50% of your instructional time helping students develop Foundational Content, and 50% of your time helping students develop High Order Processes.

It is now the end of the semester, and you are developing your Final Exam.

In general, what mixture of assessment techniques should you use to make sure your decisions about how much students have learned throughout your course have *strong* rather than *weak* **content validity**?

- II. You teach a course in Fashion Design. One-third of the Learning Objectives you have established for this course relate to students knowing and understanding the basic elements of design. The other two-thirds of the Learning Objectives relate to students using these basic design elements to create their own original work.

It is now three weeks into the course. All of your instructional time with students thus far has been spent helping them achieve the Learning Objectives related to knowing and understanding basic design elements.

You want to decide how well students are progressing in the course thus far. In general, what kind of assessment technique should you use to make sure your decision has *strong*, rather than *weak*, **content validity**?

When you develop your Final Exam to give students at the end of the course, what mixture of assessment techniques should you use to make sure your decisions about how much students have learned have *strong* rather than *weak* **content validity**?

[Slide 10]

Focus on Assessment and Reliability

Reliability: *accuracy* of assessment technique in measuring true level of knowledge or skill.

[Comment 10.1]

Content Validity refers to how well your assessment techniques match your Learning Objectives and the nature of your Instruction in arriving at *valid* educational decisions.

Even if you achieve the “match”, you won’t make valid decisions about student learning unless your assessment techniques are accurate...that is, unless they are RELIABLE!

[Slide 11]

. . . **NO ASSESSMENT TECHNIQUE IS 100% ACCURATE; NO ASSESSMENT TECHNIQUE IS 100% RELIABLE**

. . . The score you put on top of your student’s paper is NEVER student’s true score

[Slide 12]

. . . All assessment approaches have more or less measurement error; the *more* measurement error, the *less* reliability

. . . Measurement error happens:

- (1) every time a student gets a question right when he or she truly doesn’t know the answer, or
- (2) every time a student misses a question when he or she truly does know the right answer

[Comment 12.1]

More measurement error...

[Anthropology course; Foundational Content regarding historical date for inhabiting the Philippines]

The first inhabitants of the Philippines: (circle one)

- a) arrived approximately 40,000 years ago
- b) for certain were the ancestors of people known today as Aeta
- c) probably also settled in Australia and New Guinea
- d) are completely unknown

Less measurement error...

[Anthropology course; Foundational Content regarding historical date for inhabiting the Philippines]

The period in history for the first inhabitants of the Philippines was: (circle one)

- a) approximately 40,000 years ago
- b) approximately 80,000 years ago
- c) approximately 120,000 years ago
- d) approximately 160,000 years ago

[Comment 12.2]

More measurement error ...

[Psychology course; Foundational Content regarding relationship between IQ and school performance]

TRUE or FALSE (circle one) In her study of intelligence, Dr. Smith found a high correlation between intelligence and school grades.

Less measurement error...

[Psychology course; Foundational Content regarding relationship between IQ and school performance]

TRUE or FALSE (circle one) In her study of intelligence, Dr. Smith found a correlation of +.65 between intelligence and school grades.

[Comment 12.3]

More measurement error...

[Literature course; Higher Order Processes regarding comparison of character development in two different stories]

Giving students 30 minutes to write an essay regarding the above topic, but in a classroom environment that is very distracting.

Less measurement error...

[Literature course; Higher Order Processes regarding comparison of character development in two different stories]

Giving students 30 minutes to write an essay regarding the above topic, but in a classroom environment that is very focused.

[Reference: Chase, C.I. (1999). Contemporary Assessment for Educators. New York: Longman]