Developing Outcomes & Data Analysis

DEPARTMENT CHAIR CONFERENCE
June 5 - 7, 2017
Loyola University Chicago, Water Tower Campus
Corbow Law Center, 25 E. Pearson Street, Room 106

June 5, 2017
Dr. Kelly N. Ferguson
Session Objectives

Writing Test Items and Analyzing Test Data

1) This session will examine writing assessment items that are both reliable and rigorous; and

2) Provide information about analyzing testing data to make instructional adjustments as well as assessment adjustments for the next administration.
Test Development

In small groups (grouped by discipline):

- How are test items currently constructed? (Commercial assessments or teacher-produced?)
  - What works? What doesn’t?
- What are your strengths as a group when creating test items?
- What tools do you use for test item development?
- What areas would you like to improve?
Bloom’s Taxonomy of Learning

• Used to **classify** educational **learning objectives** into **levels of complexity and mastery**.
Bloom’s Taxonomy of Learning

<table>
<thead>
<tr>
<th>Level</th>
<th>Description</th>
<th>Verbs</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Knowledge</strong> (Recalling learned material)</td>
<td></td>
<td>recall, underline, list, name, record, label, cluster, match, memorize, define, arrange</td>
</tr>
<tr>
<td><strong>Comprehension</strong> (Understanding the material)</td>
<td></td>
<td>understand, show, summarize, explain, describe, demonstrate, review, cite, restate, locate</td>
</tr>
<tr>
<td><strong>Application</strong> (Using the material)</td>
<td></td>
<td>apply, select, model, organize, illustrate, utilize, choose, imitate, demonstrate, use</td>
</tr>
<tr>
<td><strong>Analysis</strong> (Breaking material down to increase understanding)</td>
<td></td>
<td>analyze, compare, contrast, classify, map, characterize, divide, break down, choose, examine</td>
</tr>
<tr>
<td><strong>Synthesis</strong> (Reshaping material into a new form)</td>
<td></td>
<td>construct, speculate, design, compose, create, develop, invent, blend, propose, formulate</td>
</tr>
<tr>
<td><strong>Evaluation</strong> (Judging the worth of material)</td>
<td></td>
<td>evaluate, convince, argue, judge, criticize, rate, measure, persuade, assess, recommend</td>
</tr>
<tr>
<td>Knowledge</td>
<td>Analysis</td>
<td></td>
</tr>
<tr>
<td>--------------------------</td>
<td>--------------------------</td>
<td></td>
</tr>
<tr>
<td>Recognizing and recalling information, including dates, events, persons, places; terms, definitions; facts, principles, theories; methods and procedures</td>
<td>Identifying the organization and patterns within a system by identifying its component parts and the relationships among the components.</td>
<td></td>
</tr>
</tbody>
</table>

**Sample Question Frames**
- Who invented the...?  
- What is meant by...?  
- Where is the...?  

<table>
<thead>
<tr>
<th>Comprehension</th>
<th>Synthesis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Understanding the meaning of information, including restating (in own words); translating from one form to another; or interpreting, explaining, and summarizing.</td>
<td>Discovering/creating new connections, generalizations, patterns, or perspectives; combining ideas to form a new whole.</td>
</tr>
</tbody>
</table>

**Sample Question Frames**
- Restate in your own words...?  
- Convert fractions into...?  
- List three reasons for...?  

<table>
<thead>
<tr>
<th>Application</th>
<th>Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Applying general rules, methods, or principles to a new situation, including classifying something as a specific example of a general principle or using a formula to solve a problem.</td>
<td>Using evidence and reasoned argument to judge how well a proposal would accomplish a particular purpose; resolving controversies or differences of opinion.</td>
</tr>
</tbody>
</table>

**Sample Question Frames**
- How is...an example of...?  
- How is...related to...?  
- Why is...significant?  

**Sample Question Frames**
- What are the parts of...?  
- Classify ...according to...  
- Outline/diagram...  

**Sample Question Frames**
- What would you infer from...?  
- What ideas can you add to...?  
- How would you create a...?  

**Sample Question Frames**
- Do you agree...?  
- How would you decide about...?  
- What priority would you give...?
• 80-90% of questions posed to students are at the knowledge level…

• Let’s check out an example:

• Biology Lesson
In the video...

• How are ?s used during actual teaching?
• What is the frequency of ?s asked?
• What types of questions are asked? (Refer to Bloom’s)
• How many ?s are asked?
How this plays out...

- **Students follow the teaching:**
  - Students generally test at the level of instruction that they receive
    - Sometimes even lower (many times students comprehend one level below)

- **Your instruction has to *exceed* your assessment.**
  - If you want comprehension/application, you should be dealing with analysis/synthesis
    - Akin to how selection of read-aloud books.
    - Need to see happen in daily instruction.
It is **NOT** the intent of Bloom’s Taxonomy that you can’t teach higher level ?s before lower level ?s.
Example

- **Knowledge Level ?:**
  - Where do you build the proteins in your cell?

- **Comprehension Level ?:**
  - Explain why the ribosome a good place to build the proteins in your cell.

- **Synthesis Level?:**
  - How is DNA like…(create an analogy)
Reflection on Your Practice

- How are questions used during actual teaching?
- What percentage of times are questions asked?
- How many questions are asked?
- What types of questions are asked? (Refer to Bloom’s chart)
- Do you script questions?
Suggested Use of Bloom’s Taxonomy

- Display poster in the classroom for quick reference
- Bloom’s for Math
  - Rich questions: Standards as well as accompanying ?s
- Provide a chart for student use
- Incorporate into classroom language
**Fractions**
**Adding and Subtracting, including mixed**

*Remembering:* What is a denominator? What is a numerator?

*Understanding:* Why are equivalent fractions important when adding or subtracting fractions?
   - Is there only one possible common denominator?

*Applying:* What is a common denominator for \( \frac{1}{3} + \frac{1}{4} \)?

*Analysing:* What strategies do you use to find a common denominator when adding or subtracting fractions?
   - What happens if you use a different common denominator?

*Evaluating:* How do you show that fractions are equivalent?

*Creating:* The answer to a fractions question is \( \frac{7}{12} \). What could be the question?

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**Order of operations**

*Remembering:* What rules do you follow?

*Understanding:* What does BIDMAS mean how is it used?

*Applying:* The answer to \( 5 + 2 \times 3 \) is 21. True or False? Why?

*Analysing:* Why do we need bidmas?

*Evaluating:* What clues do you look for when you are reading a calculation and deciding the order of operations?

*Creating:* Create some questions where you would get the answer wrong if you didn’t use BIDMAS.
Writing Effective Test Questions

• “Students report a higher level of test anxiety over teacher-made tests (64%) than over standardized tests (30%).”

• Top 3 reasons why:
  • 1) Poor test construction;
  • 2) Irrelevant or obscure material coverage; and
  • 3) Unclear directions.

  (NCATE, “Summary Data on Teacher Effectiveness, Teacher Quality, and Teacher Qualifications”, 2001.)
General Test Construction

• These three outcomes directly support the standards developed by a joint commission established by the National Education Association, the American Federation of Teachers, and the National Council on Measurement in Education.

• 6 levels of intellectual understanding: knowledge, comprehension, application, analysis, synthesis, and evaluation.
  • These levels of understanding assist in categorizing test questions, with knowledge as the lowest level.
  • Teachers will gain an awareness that certain assessment approaches can be incompatible with certain instructional goals.
Putting it to Work

- ELA Assessment Practice
  - #1-2
  - #3
  - #4-5
  - #10-12
  - #14-15
- Critique the assigned questions
- Modify to reflect more advanced levels of learning
Categories of Test Items

• Two general categories:
  • 1. **Objective items** which require students to select the correct response from several alternatives or to supply a word or short phrase to answer a question or complete a statement
    • Objective items include: 1) multiple choice 2) true-false 3) matching 4) completion
  • 2. **Subjective or essay items** which permit the student to organize and present an original answer.
    • Subjective items include: 1) short-answer essay 2) extended-response essay 3) problem solving 4) performance test items
Multiple Choice Test Items

**Good for:**
- Application, synthesis, analysis, and evaluation levels

**Types:**
- Question/Right answer
- Incomplete statement
- Best answer

**Advantages:**
- Very effective
- Versatile at all levels
- Minimum of writing for student
- Guessing reduced
- Can cover broad range of content

**Disadvantages:**
- Difficult to construct good test items
- Difficult to come up with plausible distractors/alternative responses
Writing Multiple Choice Test Items

1. When possible, state the stem as a direct question rather than as an incomplete statement.
   
   Undesirable: Alloys are ordinarily produced by...
   
   Desirable: How are alloys ordinarily produced?

2. Present a definite, explicit and singular question or problem in the stem.
   
   Undesirable: Psychology...
   
   Desirable: The science of mind and behavior is called...

3. Eliminate excessive verbiage or irrelevant information from the stem.
   
   Undesirable: While ironing her formal, Jane burned her hand accidently on the hot iron. This was due to a transfer of heat between...
   
   Desirable: Which of the following ways of heat transfer explains why Jane’s hand was burned after she touched a hot iron?
5. Use negatively stated stems sparingly. When used, underline and/or capitalize the negative word.

**Undesirable:**
Which of the following is not cited as an accomplishment of the Kennedy administration?

**Desirable:**
Which of the following is NOT cited as an accomplishment of the Kennedy administration?

6. Make all alternatives plausible and attractive to the less knowledgeable or skillful student.

**Undesirable:**
What process is most nearly the opposite of photosynthesis?
A. Digestion
B. Assimilation
C. Respiration ✓
D. Catabolism

**Desirable:**
What process is most nearly the opposite of photosynthesis?
A. Digestion
B. Relaxation
C. Respiration ✓
D. Exertion

7. Make the alternatives mutually exclusive.

**Undesirable:**
The daily minimum required amount of milk that a 10 year old child should drink is
A. 1 glass.
B. 2 glasses.
C. 3 glasses. ✓
D. 4 glasses.

**Desirable:**
What is the daily minimum required amount of milk a 10 year old child should drink?
A. 1-2 glasses.
B. 2-3 glasses. ✓
C. 3-4 glasses. ✓
D. at least 4 glasses.

8. Make alternatives approximately equal in length.

**Undesirable:**
The most general cause of low individual incomes in the United States is:
A. lack of valuable productive services to sell. ✓
B. unwillingness to work.
C. automation.
D. inflation.

**Desirable:**
What is the most general cause of low individual incomes in the United States?
A. A lack of valuable productive services to sell. ✓
B. The population's overall unwillingness to work.
C. The nation's increased reliance on automation.
D. An increasing national level of inflation.
Most teachers find it easier to construct multiple choice items to test recall and comprehension and to use essay items to test higher-level learning objectives. But other possibilities exist. Multiple choice items that require students to do such things as classify statements as fact or opinion go beyond simple recall of facts.

_Here are two examples of multiple choice test items designed for higher order thinking skills._

A common goal of the Salt March in India, the Boxer Rebellion in China, and the Zulu resistance in southern Africa was to:
A. overthrow totalitarian leaders  
B. force upper classes to carry out land reform programs  
C. remove foreign powers  
D. establish Communist parties to lead the governments

In western Europe, which development caused the other three?
A. decline of trade  
B. fall of Rome  
C. breakdown of central government  
D. rise in the power of the Roman Catholic Church
• One way to write multiple choice questions that require more than recall is to develop questions that resemble miniature "cases" or situations.

• Provide a small collection of data, such as a description of a situation, a series of graphs, quotes, a paragraph, or any cluster of the kinds of raw information that might be appropriate material for the activities of your discipline.

• Develop a series of questions based on that material. These questions might require students to apply learned concepts to the case, to combine data, to make a prediction on the outcome of a process, to analyze a relationship between pieces of the information, or to synthesize pieces of information into a new concept.
Putting It to Work

• Pull up learning standards (CCSS)
• Unpack the standard
• What are the learning targets inside of the standard? What “I Can” statements can be created from the standard?
• Develop 2-3 Multiple-choice ?s that address the learning targets within your group.
  • Use Bloom’s Taxonomy to guide your ? development
Unpacking Info

• Take indicators break them apart. Look for how you teach those things.
  • Ex.: **Indicator:** “Recognize instances of propaganda and persuasive techniques.”
  • How this looks as an English teacher:
    • Identify the knowledge and skills needed to teach different strategies that are used in different mediums like advertisements, essays and letters to the editor and examine carefully to pull out those persuasive techniques.
True-False Test Items

- True-false questions are well suited for testing student recall or comprehension.

- Many educators feel that true-false test items serve little or no measurement purposes because true-false items are subject to guessing. (But the likelihood of obtaining a substantially higher than chance score by guessing alone is very small).

- There is a tendency to write trivial true-false items, which lead students to verbatim memorization. items.
1. Base true-false items upon statements that are absolutely true or false, without qualifications or exceptions.

Undesirable: Nearsightedness is hereditary in origin.

Desirable: Geneticists and eye specialists believe that the predisposition to nearsightedness is hereditary.

2. Express the item statement as simply and as clearly as possible.

Undesirable: When you see a highway with a marker that reads, “Interstate 80” you know that the construction and upkeep of that road is maintained by the state and federal government.

Desirable: The construction and maintenance of interstate highways are provided by both state and federal governments.

3. Express a single idea in each test item.

Undesirable: Water will boil at a higher temperature if the atmospheric pressure on its surface is increased and more heat is applied to the container.

Desirable: Water will boil at a higher temperature if the atmospheric pressure on its surface is increased.

4. Include enough background information and qualifications so that the ability to respond correctly to the item does not depend on some special, uncommon knowledge.

Undesirable: The second principle of education is that the individual gathers knowledge.

Desirable: According to John Dewey, the second principle of education is that the individual gathers knowledge.
5. Avoid the use of extreme modifiers or qualifiers.

Undesirable:
— All sessions of Congress are called by the President. (F)
— The Supreme Court frequently rules on the constitutionality of law. (T)
— An objective test is generally easier to score than an essay test. (T)

Desirable:
— The sum of the angles of a triangle is always 180°. (T)
— The galvanometer is the instrument usually used for the metering of electrical energy used in a home. (F)

6. Avoid lifting statements from the text, lecture or other materials so that memory alone will not permit a correct answer.

Undesirable:
For every action there is an opposite and equal reaction.

Desirable:
If you were to stand in a canoe and throw a life jacket forward to another canoe, chances are your canoe would jerk backward.

7. Avoid using negatively stated item statements.

Undesirable:
The Supreme Court is not composed of nine justices.

Desirable:
The Supreme is composed of nine justices.

8. Avoid the use of unfamiliar vocabulary.

Undesirable:
According to some politicians, the raison d’etre for capital punishment is retribution.

Desirable:
According to some politicians, justification for capital punishment is retribution.

Writing Hint...
One method for developing true-false items is to write a set of true statements that cover the content, then convert approximately half of them to false statements. Remember: When changing items to false (as well as in writing the true statements initially), state the items positively, avoiding negatives or double negatives.
Matching Test Items

• Matching questions provide a most efficient way to test knowledge in courses in which events, dates, names, and places are important. Matching questions are also appropriate for the sciences in which numerous experiments, experimenters, results, and special terms and definitions have to be remembered.
1. Include directions which clearly state the basis for matching the stimuli with the responses.

Explain whether or not a response can be used more than once and indicate where to write the answer.

Undesirable:

**Directions:** Match the following.

Desirable:

**Directions:** On the line to the left of each identifying location and characteristics in Column I, write the letter of the country in Column II that is best defined. Each country in Column II may be used more than once.

2. Use only items that share the same foundation of information.

Unrelated topics included in the same matching item may allow for obvious matches and mismatches.

Undesirable:

**Directions:** Match the following.

1. Water
2. Discovered Radium
3. Salt
4. Ammonia
5. Year of the first Nuclear Fission

   A. NaCl
   B. Fermi
   C. NH3
   D. 1942
   E. H2O
   F. Curie
   G. 1957

Desirable:

**Directions:** On the line to the left of each compound in Column I, write the letter of the compound’s formula presented in Column II. Use each formula only once.

<table>
<thead>
<tr>
<th>Column I</th>
<th>Column II</th>
</tr>
</thead>
<tbody>
<tr>
<td>_____1. Water</td>
<td>A. H2SO4</td>
</tr>
<tr>
<td>_____2. Salt</td>
<td>B. HCl</td>
</tr>
<tr>
<td>_____3. Ammonia</td>
<td>C. NaCl</td>
</tr>
<tr>
<td>_____4. Sulfuric Acid</td>
<td>D. H2O</td>
</tr>
</tbody>
</table>
3. Avoid grammatical or other clues to the correct response.

Undesirable:

Directions: Match the following in order to complete the sentences on the left.

___1. Plato insisted that government was A. The Prince.
___2. Machiavelli wrote about achieving political B. desirable and inevitable
    unity in C. a science requiring experts.
___3. Hobbes argued that human nature made D. organized along industrial lines.
    absolute monarchy E. Communism.
___4. Marx was a German philosopher and
    economist who founded

Desirable:

Directions: On the line to the left of each statement write the letter of the philosopher
from the right hand column that the statement describes. Use each philosopher once.

___1. Thought government was a science requiring experts. A. Hobbes
___2. Described methods of achieving political unity. B. Marx
___3. Founded Communism. C. Machiavelli
___4. Believed that human nature made absolute D. Durkheim
    monarchy desirable and inevitable E. Plato
4. The column of stimuli on the left should set the question clearly.

Undesirable:

Directions: Match the following.

___ 1. City dwellers
___ 2. Hunter-gatherers
___ 3. Pastoral nomads

A. Wild animals
B. Farm
C. Apartment buildings
D. Graze animals

Desirable:

Directions: On the line to the left of each definition, write the letter of the term in the right hand column that is defined. Use each term only once.

___ 1. Live in areas of high population density.
___ 2. Move from one place to another in search of wild animals.
___ 3. Move from one place to another with grazing animals.
___ 4. Till land for cash crops.

A. Pastoral nomads
B. Ranchers
C. Hunter-gatherers
D. City dwellers
E. Farmers
Higher Levels of Learning

### Keylists or Masterlists Example

<table>
<thead>
<tr>
<th></th>
<th>A (Na(^{11}))</th>
<th></th>
<th>B (Cl(^{17}))</th>
<th></th>
<th>C (H(^{1}))</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>22.9898</td>
<td>35.453</td>
<td>1.00797</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I</td>
<td>(Ne)35</td>
<td>+1, 3, 5, 7</td>
<td>I</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>892</td>
<td>(Ne) 3(^{2})3p(^{5})</td>
<td>Is'</td>
<td></td>
<td></td>
</tr>
<tr>
<td>97.5</td>
<td>-34.7</td>
<td>-102</td>
<td>-252.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.97</td>
<td>-1.56</td>
<td>0.259</td>
<td>0.071</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Refer to the chemical symbols above to answer the following:

__1. Which of the above elements has the largest atomic weight?
__2. Which of the above elements has the largest atomic number?
__3. Which of the above elements has the lowest boiling point?
__4. Which of the above elements has the lowest melting point?
__5. Which of the above elements has the highest density?
__6. Which of the above elements has the least number of electrons?
__7. Which of the above elements has the least number of protons?
__8. Which of the above elements represents chlorine?
__9. Which of the above elements represents sodium?

### Ranking Example

**TOPIC:** Social Studies, Western Civilization

**Directions:** Number (1-8) the following events in the history of ancient Egypt in the order in which they occurred, using 1 for the earliest event.

- Egypt divided; ruled by Libyan kings, Nubian pharaohs, Assyrians, and Persians
- Seizure of power by Hyksos kings
- Upper and Lower Egypt are united by Menes
- Alexander the Great conquers Egypt
- Reunification of Egypt under pharaoh Mentuhotep II
- Rise of feudal lords leads to anarchy
- Thutmos III expands empire to the Euphrates
- Many kings with short reigns; social and political chaos

Note in the above example the implied column of responses is 1, 2, 3, 4, 5, 6, 7, 8.
Completion or Fill-in-the-Blank Test Items

**Good for:**
- Knowledge levels
- Recall and memorization of facts

**Advantages:**
- Good for *who, what, where, when* content
- Minimizes guessing
- Encourages more intensive study. Student must know the answer vs. recognizing the answer.
- Can usually provide an objective measure of student achievement or ability

**Disadvantages:**
- Difficult to assess higher levels of learning because the answers to completion items are usually limited to a few words
- Difficult to construct so that the desired response is clearly indicated
- May overemphasize memorization of facts
- Questions may have more than one correct answer
- Scoring is time consuming
1. Omit only significant words from the statement.

Desirable:
Every atom has a central ________ called a nucleus.

Undesirable:
Every atom has a central core called a(n) _________.

2. Do not omit so many words from the statement that the intended meaning is lost.

Undesirable:
The ________ were to Egypt as the ________ were to Persia and as ________, were to the early tribes of Israel.

Desirable:
The Pharaohs were to Egypt as the ________ were to Persia and as ________ were to the early tribes of Israel.

3. Avoid obvious clues to the correct response.

Undesirable:
Most of the United States’ libraries are organized according to the ________ decimal system.

Desirable:
Which organizational system is used by most of the United States’ libraries? ________.

4. Be sure there is only one correct response.

Undesirable:
Trees which shed their leaves annually are ________.

Desirable:
Trees which shed their leaves annually are called ________

5. Avoid grammatical clues to the correct response.

If the indefinite article is required before a blank, use a(n) so that the student does not know if the correct answer begins with a vowel or a consonant.

Undesirable:
A subatomic particle with a negative electric charge is called an ________.

Desirable:
A subatomic particle with a negative electric charge is called a(n) ________.

6. If possible, put the blank at the end of a statement rather than at the beginning.

Asking for a response before the student understands the intent of the statement can be confusing and may require more reading time.

Undesirable:
_________ is the measure of central tendency that is most affected by extremely high or low scores.

Desirable:
The measure of central tendency that is most affected by extremely high or low scores is the _________.

Essay Test Items

- A typical essay test usually consists of a small number of questions to which the student is expected to recall and organize knowledge in logical, integrated answers. An essay test item can be an extended response item or a short answer item. An example of each type follows.

**Extended Response**

Compare the writings of Bret Harte and Mark Twain in terms of settings, depth of characterization, and dialogue styles of their main characters. (10 pts. 20 minutes)

**Short Answer**

Identify research methods used to study the S-R (Stimulus-Response) and S-O-R (Stimulus-Organism-Response) theories of personality. (5 pts. 10 minutes)
Essay Test Items

Standard Phrases for Writing Essay Test Items

Agreement or Disagreement: The student is being asked to assert and support a thesis with evidence.

Analyze: Analyzing is a picking apart of the whole.

Classification and Division: Grouping items into a category according to a consistent principle.

Compare/Contrast: Comparing shows similarities, while contrasting points out differences.

Cause and Effect: Establishes a link between two things and also to describe the outcome.

Define: Consists of three parts: term, class, and differentiating characteristics.

Define and give an example of: Asks students to not only define the term, but to supply an example.

Describe: Requires students to explain something in detail.

Illustrate: Give examples and/or analogies to demonstrate a particular process/idea or steps in a series.

Summarize: The overall view of some process, speech, play, concept, etc.
1. Formulate the question so that the task is clearly defined for the student.

Use words that aim the student to the approach you want them to take. Words like discuss and explain can be ambiguous. If you use discuss, then give specific instructions as to what points should be discussed.

Undesirable:
Discuss Karl Marx's philosophy.

Desirable:
Compare Marx and Nietzsche in their analysis of the underlying problems of their day in 19th century European society.

2. Pay attention to the number of items.

In order to obtain a broader sampling of course content, use a relatively large number of questions requiring shorter answers (one-half page) rather than just a few questions involving long answers (2-3 pages).

3. Avoid the use of optional questions on an essay test.

When students answer different questions, they are actually taking different tests. If there are five essay questions and students use the same answers for all, then the test becomes one of copying rather than one of the student's ability.

Use of optional questions also affects the reliability of the scoring. If we are going to compare students for scoring purposes, then all students should perform the same tasks. Another problem is that students may not study all the course material if they know they will have a choice among the questions.
5. Write essay items at different levels of learning.

The goal is to write essay items that measure higher cognitive processes. The item should represent a situation that tests the student's ability to use knowledge in order to analyze, justify, explain, contrast, evaluate, and so on.

Try to use verbs that elicit the kind of thinking you want the students to demonstrate. Instructors often have to use their best judgment about what cognitive skill each question is measuring. Ask a colleague to read the questions and classify them according to Bloom's taxonomy.
Using Student Achievement Data to Support Instructional Decision Making
Data Analysis

In small groups:

• How are data collected and managed (i.e. learning management platforms)?
• What works? What doesn’t?
• What are your strengths as a group when analyzing data?
• What areas would you like to improve?
Framework for Effective Use of Data

*How* data are used is critical!

- 5 recommendations for putting student achievement data to the best possible use:

  - Make data part of an ongoing cycle of instructional improvement
  - Teach students to examine their own data and set learning goals
  - Establish a clear vision for schoolwide data use
  - Provide supports that foster a data-driven culture within the school
  - Develop and maintain a districtwide data system

- A districtwide data system allows teachers to aggregate data by classroom, content areas, or assignment type to identify patterns in performance.
Checklist for carrying out the recommendations

Recommendation 1. Make data part of an ongoing cycle of instructional improvement

☐ Collect and prepare a variety of data about student learning.
☐ Interpret data and develop hypotheses about how to improve student learning.
☐ Modify instruction to test hypotheses and increase student learning.

Recommendation 2. Teach students to examine their own data and set learning goals

☐ Explain expectations and assessment criteria.
☐ Provide feedback to students that is timely, specific, well formatted, and constructive.
☐ Provide tools that help students learn from feedback.
☐ Use students’ data analyses to guide instructional changes.

Recommendation 3. Establish a clear vision for schoolwide data use

☐ Establish a schoolwide data team that sets the tone for ongoing data use.
☐ Define critical teaching and learning concepts.
☐ Develop a written plan that articulates activities, roles, and responsibilities.
☐ Provide ongoing data leadership.

Recommendation 4. Provide supports that foster a data-driven culture within the school

☐ Designate a school-based facilitator who meets with teacher teams to discuss data.
☐ Dedicate structured time for staff collaboration.
☐ Provide targeted professional development regularly.

Recommendation 5. Develop and maintain a districtwide data system

☐ Involve a variety of stakeholders in selecting a data system.
☐ Clearly articulate system requirements relative to user needs.
☐ Determine whether to build or buy the data system.
☐ Plan and stage the implementation of the data system.
Data Analysis: A Collective Effort

• Interpret data collaboratively in grade-level or department-specific teams.
  • Teachers can begin to adopt some common instructional and assessment practices as well as common expectations for student performance.
  • Allows teachers to develop a collective understanding of the needs of individual students in their school, so that they can work as an organization to provide support for all students.

• Common planning times
• Common formative assessments
Central message: Effective data practices are *interdependent* among the classroom, school, and district levels.
Data Sources

• Collect and prepare a variety of data about student learning:
  • Annual state assessments
  • Interim district and school assessments
  • Classroom performance data, and other relevant data.

Examples of classroom and other data
• Curriculum-based unit tests
• Class projects
• Classwork and homework
• Attendance records
• Records from parent meetings and phone calls
• Classroom behavior charts
• Individualized educational plans (IEPs)
• Prior data from students’ cumulative folders
What the Data Can Tell You…

• Data can answer the:
  • WHO?
  • WHAT?
  • WHEN? and
  • WHERE?

• It CANNOT answer the:
  • HOW or the WHY
Data Analysis

• Interpreting data allows teachers to identify the strengths and weaknesses of an entire class as well as individual students.

• As they examine the data, teachers can *develop hypotheses about factors that affect students’ learning and ways to improve instruction to help all students achieve.

• It is important for teachers to slow down and ask why during this phase of the cycle of instructional improvement.
Data Analysis with Dummy Data
How Will You Analyze the Data?

There are a number of key questions that an examination of classroom data should address.

- Which content standard indicator(s) was the teacher assessing?
- What percent of students demonstrated proficiency?
- What implications does that have for instruction?
- Which students have not demonstrated that they can do this?
- What diagnostic information did an examination of student work provide?
- Based on individual student performance, what do I need to do next to move the student to proficiency?
- Based on the class performance, what re-teaching do I need to do?
- After reassessing, did my students demonstrate proficiency?
- Is my re-teaching or other intervention resulting in improved student performance?
- When we compare performance by subgroups (e.g., by racial group, gender, students with disabilities, ESL students, or students in the free and reduced meals program), do we see any groups not performing as well as the whole group? If so, what are we going to do about that?
- Do we have any students who are not attaining proficiency across indicators?
- What diagnostic information do we have about them to inform instruction?
- What interventions have we tried? What interventions do we plan to try next?
• **Feedback to Students:**
  - Timely, specific, well formatted, and constructive

• **Provide tools that help students learn from feedback**
  - Effective tools and strategies include [student-developed assessment rubrics](#) and [peer review](#)
  - Students need time and tools to help them analyze the data, diagnose their own errors, and learn from feedback
  - Tools such as teacher- and student-generated [graphs](#) and [reflective questions](#) guide students’ data analysis and help them make data-based decisions to improve their performance
  - Students can keep [learning logs](#) in individual folders (hard copy portfolios or e-versions) with a variety of formats for [self-monitoring and tracking progress](#)
  - **Online gradebooks**
    - Teachers can [aggregate statistics](#) by classroom, content area, or assignment type
    - Can be useful for identifying [patterns in students’ classroom-level performance](#) and for identifying [students whose classwork performance is inconsistent](#) with their performance on annual or interim assessments
Math

Define the Problem
- 20% of all students are in yellow on NWEA 6/30
- 57% of all students are in orange and red on NWEA 17/30

Problem Analysis
- lack of identifying learning statements for small group instruction
- lack of understanding and implementation of small group instruction with learning continuum statements

Plan Implementation
- Teacher and ILT/Admin planning session on Learning Continuum for small group instruction.
- Clear directions for all teachers to follow (*idea* 3 days a week of learning continuum statements during small group instruction)
- Use of Compass Learning for PM

Plan evaluation (How is it monitored)
-
Testing Hypotheses

**Figure 1. Data use cycle**

- Collect and prepare a variety of data about student learning
- Interpret data and develop hypotheses about how to improve student learning
- Modify instruction to test hypotheses and increase student learning
- Collect and prepare a variety of data about student learning

**Forming testable hypotheses**

**Situation:** Based on data from your 3rd-grade class’s assignments and assessments, it appears that more than half of the students struggle with subtraction. As their teacher, you ask yourself how they can better master subtraction skills. To answer this question, you hypothesize that the students’ subtraction skills might improve if they were taught to use the “trade first” method for subtraction, in which students regroup from the tens to ones column at the beginning, rather than at the end, of the problem. You determine that this hypothesis can be tested by (1) working with these students in a group to teach them the trade first method and (2) examining changes in their subtraction scores on the interim assessment.

**Characteristics of testable hypotheses**

- Identify a promising intervention or instructional modification (teaching the trade first method for subtraction) and an effect that you expect to see (improvement in the subtraction skills of struggling students)
- Ensure that the effect can be measured (students’ subtraction scores on the interim assessment after they learn the trade first strategy)
- Identify the comparison data (students’ subtraction scores on the interim assessment before they were taught the strategy)
Resource: Doing What Works

- A variety of tools and templates, including an instructional integrity checklist and collaborative conference protocol,
- Each tool is a downloadable document that principals can adapt to serve their particular needs.

Doing What Works. Doing What Works (DWW) helps educators understand and use research-based practices through interviews with researchers and practitioners, multimedia examples and sample materials from real schools and classrooms, and tools that can help educators take action.

Doing What Works – WestEd
https://www.wested.org/project/doing-what-works/
Clarifying Goals & Indicators

• Establish Criteria for the knowledge & skills that the students should know and be able to do
  • Students should know and be able to…

• Take indicators break them apart. Look for how you teach those things.
  • Ex.: **Indicator:** “Recognize instances of propaganda and persuasive techniques.”
  • How this looks as an English teacher:
    • Identify the knowledge and skills needed to teach different strategies that are used in different mediums like advertisements, essays and letters to the editor and examine carefully to pull out those persuasive techniques.
Data Analysis...
YOU'VE GOT THIS!
I TEACH
WHAT'S YOUR SUPERPOWER?
Resources

• Writing Effective Test Items
  • http://www.k-state.edu/ksde/alp/resources/Handout-Module6.pdf
• Math w/ Bloom’s
  • https://www.ncetm.org.uk/public/files/5977103/TEFP1001+Appendix+1+-+questioning+Unit+2.pdf
• Data Informing Instruction
  • http://www.naesp.org/sites/default/files/Student%20Achievement_blue.pdf