Classroom Assessment Techniques for Student Comprehension Evaluation

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Introduction

- **Classroom Assessment Techniques (CATS)**
  - **Vehicle for instructors to obtain feedback on:**
    - **What students are learning in the classroom**
    - **How well students are learning this material**

- **Many different CATS available for a variety of assessment**
  - **Techniques to assess course related knowledge and skills**
  - **Techniques to assess learner attitudes, values, and self awareness**
  - **Techniques to assess learner reactions to instruction**

Introduction

- **Classroom assessment assumptions**
  - **One of the best ways to improve learning is to improve teaching**
  - **Instructors must be explicit with goals and objectives, then gain specific feedback on the extent to which goals and objectives are being reached**
  - **To improve learning, students must receive appropriate, focused feedback, as well as learn how to assess their own learning**
  - **Assessments most likely to improve teaching are those conducted by faculty to answer questions formulated in response to issues with their own teaching**
  - **Classroom assessment can provide opportunities for systematic inquiry and intellectual challenge**
  - **Classroom assessment does not require special training and can be implemented in a variety of disciplines**
  - **Classroom assessment which involves collaboration with faculty and active student involvement enhances learning**

Source: Angelo and Cross 1993

Objectives

- **Utilize multiple CATS in Farm and Ranch Management courses at two non-land grant colleges of agriculture**
  - **To engage students daily in classroom activities and foster course content comprehension and retention**
- **Analyze CATS results in order to determine:**
  - **Course content areas with a significant level of student comprehension**
  - **Course content areas in which students struggled and/or had lower comprehension**

Conceptual Framework

- A variety of CATS were utilized during the Spring 2017 semester:
  - Pre-course Misconception/Preconception Check
  - Muddiest Point
  - Memory Matrix
  - Minute Paper
  - Categorizing Grid
  - Application Cards
  - Post-course Concept Check

Conceptual Framework

- **Pre-course Misconception/Preconception Check**
  - **Allows for assessment of students' existing knowledge**
  - **Also uncovers prior knowledge which may be inaccurate or misleading, thus hindering correct material comprehension**
  - **Classroom Administration:**
    - **Identify concepts that students tend to have misconceptions/preconceptions about**
    - **Select a few of the most troublesome misconceptions/preconceptions and create short questionnaires**
    - **Once completed, explain to students the reasoning behind the CAT, and select a few responses to discuss in more detail with the class**

Conceptual Framework

- **Muddiest Point**
  - **Very simple and efficient CAT**
  - **Identifies course topics which are unclear or not well understood by students**
  - **Classroom Administration:**
    - **Identify a lecture, discussion, or homework assignment for assessment**
    - **Ask students to answer the question, "What was the muddiest point in _____?"**
    - **Compile responses and readdress the most frequent or common concerns/issues.**

Conceptual Framework

- **Memory Matrix**
  - **Assesses students' memory recall of important information and how well students can categorize information into meaningful collections**
  - **Allows for generalized or specific feedback from students**
  - **Useful for assessing comprehension of a large amount of categorizable information**
  - **Classroom Administration:**
    - **Develop a two-dimensional diagram made up of rows and columns to organize info and demonstrate relationships.**
      - **Row and column headings are given**
      - **Cells are left empty for students to fill in with feedback responses**
    - **Examine frequencies of correct/incorrect info recall**
    - **Look for patterns in correct or incorrect recall and address concerns/issues during next class**

Conceptual Framework

- **Minute Paper**
  - **Most often used at the end of a lecture.**
  - **Students respond to the question, "What was the most important thing you learned in class today?" or alternatively, "What important question from today's lecture remains unanswered?"**
  - **Provides instructor with feedback on which topics students feel are most important or topics that need to be addressed further**
  - **Classroom Administration:**
    - **At the end of a lecture class, students take 2-3 minutes to respond to one of the preceding questions**
    - **Compile responses and address replies at the beginning of the next lecture class**

Conceptual Framework

- Categorizing Grid
  - Students sort specific topics into more broad categories of overall concepts
  - Allows instructors to see if students understand specific procedures in the context of overall concepts or theories
  - Classroom Administration:
    - A handful of broad concepts are listed
    - More specific topics are listed separately, then students sort specific topics via numerical or alphabetical matching with the more broad concepts
    - Instructors then analyze patterns of correct and incorrect categorization.

Conceptual Framework

- Application Cards
  - Students complete a reading assignment or hear a lecture on a topic, concept, or theory, then they are asked to write down a real-world example pertaining to what they have just learned
  - Extremely useful for extending a theory or mathematical procedure to a real-world scenario
  - Classroom Administration:
    - Upon completion of a lecture or reading, students write down a real-world example of the concept
    - Instructors analyze responses and categorize them. For example, responses may be labeled as great, acceptable, marginal, and not acceptable
    - Results are discussed during the next class, with particular attention paid to examples of great and acceptable responses, as well as ways in which marginal or unacceptable responses could be improved

Conceptual Framework

- **Post-Course Concept Check**
    - **Conducted similar to a Pre-course Misconception/Preconception Check**
    - **Allows instructors to assess student learning against a baseline established from a Pre-course Misconception/Preconception Check**
    - **Classroom Administration:**
        - **Utilize the same or very similar questionnaire from the Pre-course Misconception/Preconception Check**
        - **Compare student responses and the percentage of incorrect to correct adjustments, correct to incorrect adjustments, and no change in student responses**

Methods

- Sample consisted of undergraduate students enrolled in a junior level Farm and Ranch Management class during the Spring 2017 semester
  - Texas Tech University (47 students)
  - University of Tennessee at Martin (24 students)
- Course topics were covered in lecture, then followed up with either homework assignments or lab exercises
- Various CATS were used to evaluate and reinforce comprehension of course concepts and topics
  - CATS were typically administered at the end of a lecture or at the beginning of the next class lecture following topic completion
  - Some course topics called for CAT administration daily, while multi-day lecture topics required CAT administration upon completion of those topics

Methods

- **Pre-course Misconception/Preconception Check and Post-Course Concept Check**
  - **Students were presented with the same nine questions on the first and last class days of the semester**
    - **Questions focused on micro and production economics principles covered during the semester**
  - **All questions offered the same response options**
    - **A. I'm absolutely certain this is true**
    - **B. I'm pretty sure this is true**
    - **C. I have no idea whether this is true or false**
    - **D. I'm pretty sure this is false**
    - **E. I'm absolutely certain this is false**

Methods

- **Pre-course Misconception/Preconception Check and Post-Course Concept Check Example**

A production function demonstrates the relationship between agricultural input used in production and agricultural output produced.

A. I'm absolutely certain this is true

B. I'm pretty sure this is true

C. I have no idea whether this is true or false

D. I'm pretty sure this is false

E. I'm absolutely certain this is false

In the short run, at least one input is fixed. In the long run, all inputs are variable.

A. I'm absolutely certain this is true

B. I'm pretty sure this is true

C. I have no idea whether this is true or false

D. I'm pretty sure this is false

E. I'm absolutely certain this is false

Methods

- **Muddiest Point**
  - **Utilized multiple times throughout the semester for various topics**
  - **Example**
    - **What was the muddiest point in production principles/production functions?**

Methods

- **Memory Matrix**
  - **Matrix consisted of rows which listed elements comprising an enterprise budget and columns in which students were asked to provide information pertaining to:**
    - The calculation of total revenue, gross margin, total costs, profit or loss, and breakeven prices and yields
    - Alternative definitions/terminology for variable costs and fixed costs

Methods

Memory Matrix Example

	Calculation
Revenue	
Gross Margin	
Total Costs	
Profit (Loss)	

Methods

- **Minute Paper**
  - **Utilized multiple times throughout the semester for various topics**
  - **Example**
    - **What important question about cost concepts remains unanswered?**

Methods

- Categorizing Grid

  - Upon completion of a major section of the course, production economics principles, students were asked to categorize various elements, decision rules, and/or concepts into three broad categories

  - Example

  1. Economic decision-making tools

  2. Substitution Principles

  3. Cost Concepts

  ___ TPP, APP, MPP   ___SR=PR

  ___Price ratio   ___Production function

  ___Least cost input combo   ___Long run

  ___Isoquant   ___Stage I,II,III

  ___Fixed or variable   ___MVP=MIC

Methods

Application Cards

- Data from the index cards converted into symbols based on accuracy, relevance, usefulness, and creativity:
  - G – Great
  - A – Acceptable
  - M – Marginal
  - N – Not acceptable
- 3-5 cards picked to provide a broad range of examples from the symbols assigned.
- Discussed with the students for feedback at the beginning of the next lab session.
- Example
  - Write down at least one real world application of partial budgeting (other than the examples discussed in class).

Results

- Pre-Course Misconception/Preconception Check and Post-Course Concept Check (TTU Results)

| Pre-Course Assessment (Percentage of Overall Responses for all Questions)				
I'm absolutely certain this is true	I'm pretty sure this is true	I have no idea whether this is true or false	I'm pretty sure this is false	I'm absolutely certain this is false
30%	42%	14%	11%	3%

Post-Course Assessment (Percentage of Overall Responses for all Questions)				
I'm absolutely certain this is true	I'm pretty sure this is true	I have no idea whether this is true or false	I'm pretty sure this is false	I'm absolutely certain this is false
59%	24%	5%	10%	2%

Results

- **Muddiest Point (TTU Results)**

MUDDIEST POINT - PRODUCTION ECONOMICS PRINCIPLES

Legend: TPP, APP, MPP | LDMR | Other | All Clear

- 23% (TPP, APP, MPP)
- 13% (LDMR)
- 14% (Other)
- 50% (All Clear)
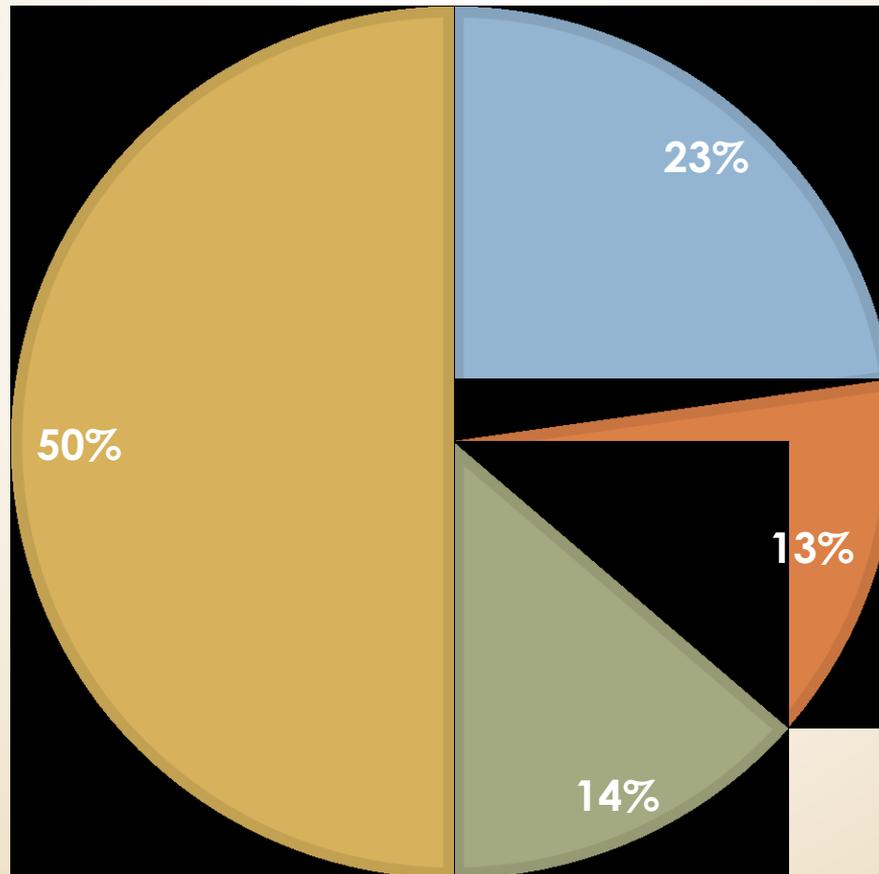
Results

▶ **Memory Matrix (UTM Results)**

	% Correct	% Incorrect
Revenue	38%	63%
Gross Margin	4%	96%
Total Costs	88%	13%
Profit (Loss)	38%	63%
Breakeven price to cover variable costs	17%	83%
Breakeven yield to cover variable costs	17%	83%
Breakeven price to cover total costs	42%	58%
Breakeven yield to cover total costs	42%	58%
Variable costs may also be referred to as _____ costs	42%	58%
Fixed costs may also be referred to as _____ costs	67%	33%

Results

- **Minute Paper (TTU Results)**

MINUTE PAPER - COST CONCEPTS

Average and Total Costs · When to Produce · Economics of Size · Application · All Clear · Other

15% · 17% · 5% · 15% · 40% · 8%
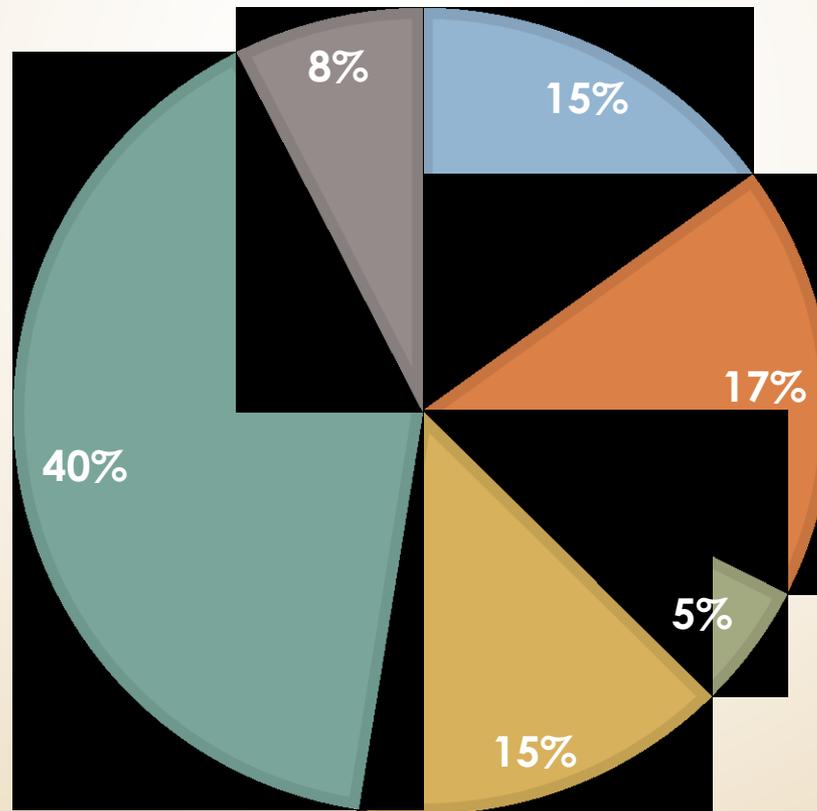
Results

- **Categorizing Grid (TTU Results)**

	% Correct	% Incorrect
Economic Decision-Making Tools	**52%**	**48%**
Substitution Principles	**38%**	**62%**
Cost Concepts	**42%**	**58%**

Results

- **Application Cards (UTM Results)**

UTM APPLICATION CARDS - PARTIAL BUDGETING RESULTS

Great   Acceptable   Marginal   Not Acceptable
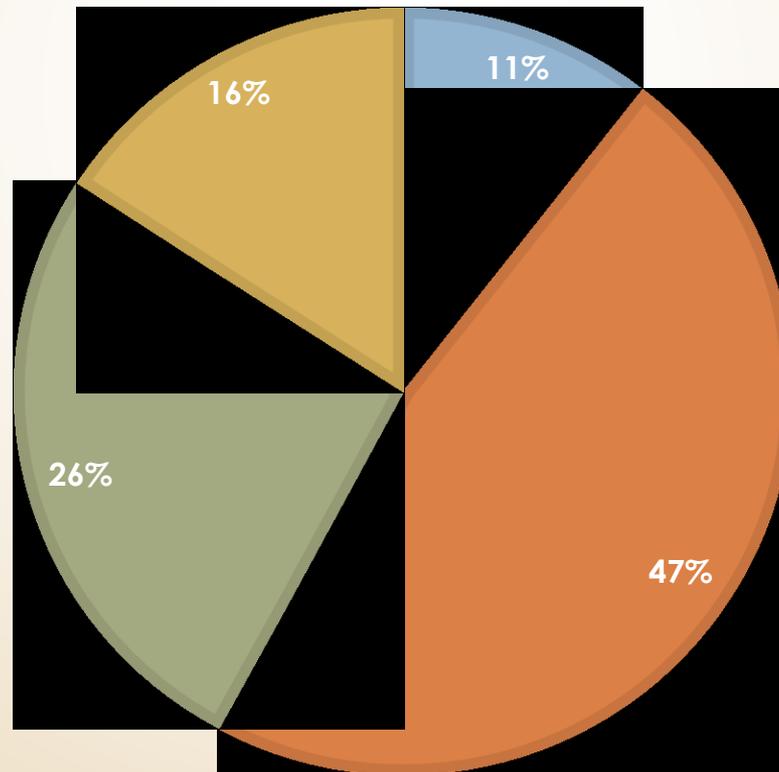
Conclusion

- Assess different potential learning styles and develop lectures, CATS, and labs to address a variety of learning styles

- Look at differences between more/less quantitative, graphical, step-by-step or listed processes

  - Different concepts will require utilization of different CATS

- Use CATS to evaluate differences in comprehension between concepts covered with lecture only, lecture plus homework, and lecture plus lab.

- Based on CATS feedback, acknowledge commonly confused concepts and prepare students for common pitfalls

- Using CATS feedback, look at homework and lab exercises periodically to determine if they are really addressing what you want them to