

TIPS FOR WRITING EXAM QUESTIONS

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Today's Outcomes

Following today's session, participants will be able to:

- Articulate the value and limitations of multiple choice and FITB questions.
- Construct effective questions to align with course/lecture outcomes and targeted cognitive levels.
- Examine student responses to individual test questions in order to assess quality of the items and the test as a whole.



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Why test?

Philosophies



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ASSESSMENT PERFORMANCE

90%

Average Score
(44.8/50)

46%

Low Score
(23/50)

100%

High Score
(50/50)

Assessment Score Reliability (KR-20)

0.0

0.77

1.0

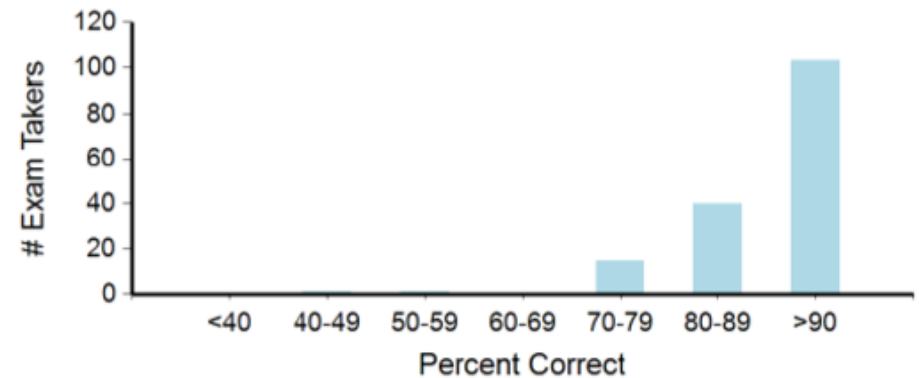
POOR

SATISFACTORY

GOOD

Likelihood of students repeating the same performance.

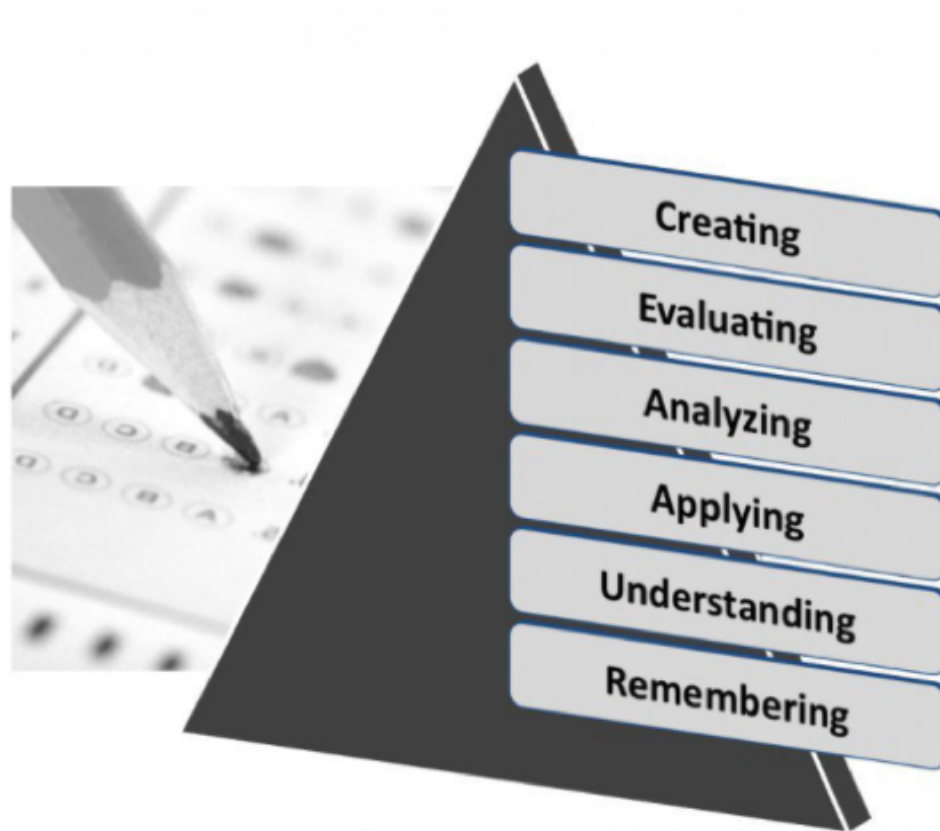
Total Student Performance Histogram



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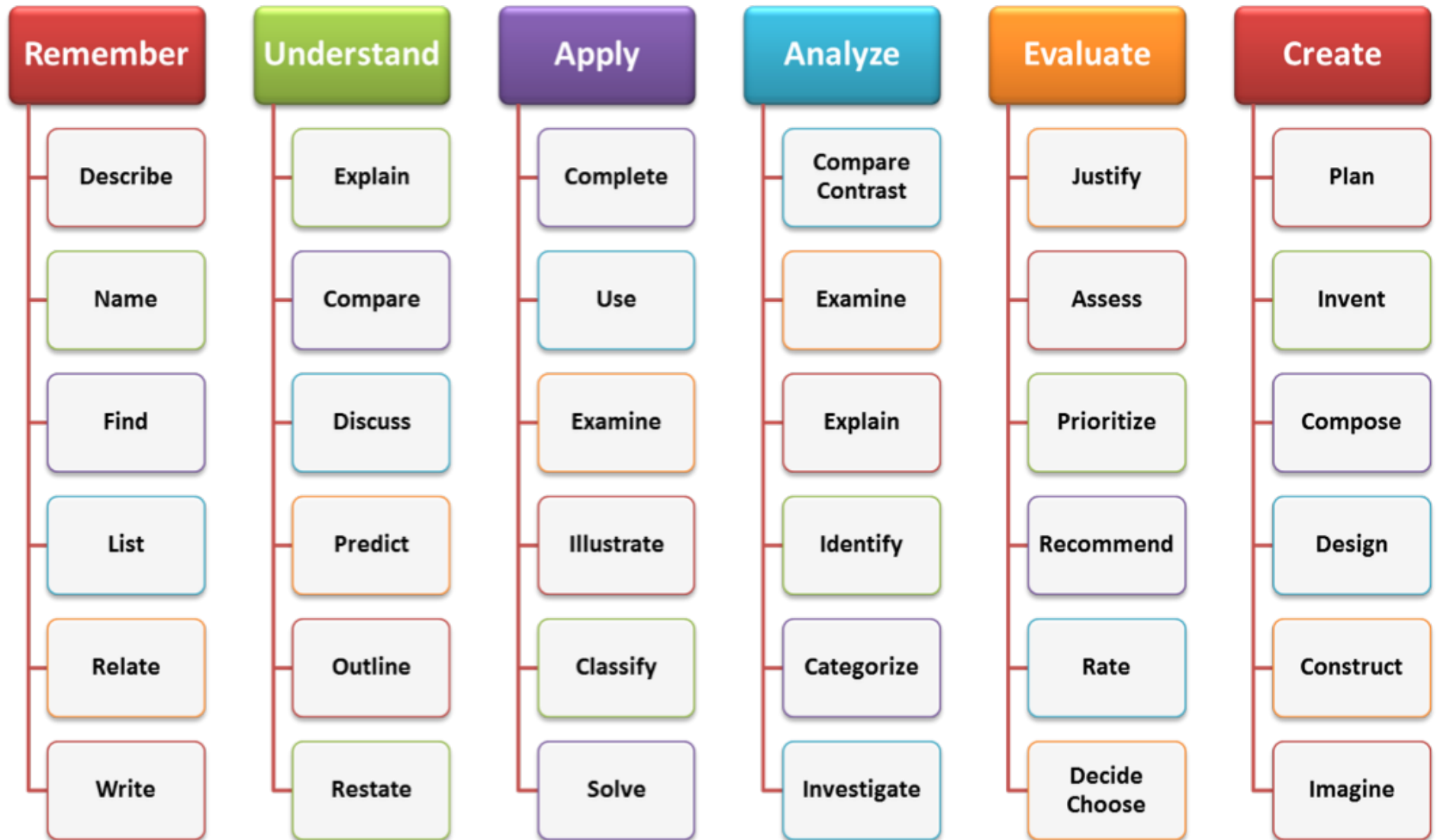
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Back to Bloom's



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<https://elearningindustry.com/how-to-write-multiple-choice-questions-based-on-revised-bloom-s-taxonomy>



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Bloom's Simplified for MC



Recall

Application

Evaluation



Examples of Objectives and MCQs for Three Levels of Learning

Level	Objective	Question
<i>Knowledge</i> (learner must recall memorized information but not explain or apply it)	State the average effective radiation dose from chest CT	What is the average effective radiation dose from chest CT? a. 1 mSv b. 8 mSv c. 16 mSv d. 24 mSv
<i>Combined comprehension and application</i> (learner must demonstrate an ability to use, not just explain, new information, applying rules, methods, concepts, principles, laws or theories)	Compare the radiation exposures from different radiologic examinations	Which of the following imaging examinations is associated with the highest effective radiation dose? a. Abdominal and pelvic multidetector CT b. Coronary artery multidetector CT c. Conventional pulmonary angiography d. Digital pulmonary angiography
<i>Problem solving</i> (learner must understand components of a concept, and their relationships to each other, and analyze information)	Explain the effects that various factors have on radiation dose from chest CT	Which of the following actions would decrease the radiation dose from chest CT the least? a. Decreasing mA from 250 to 125 b. Decreasing kVp from 140 to 120 c. Decreasing the pitch from 2 to 1 d. Decreasing scan time from 1 to 0.5



Recall

What is an outbreak? (the epidemiologist's definition)

- a) A higher number of cases of a disease than is expected in a particular population.
- b) A higher number of cases of a disease than should be in a particular population.
- c) A rapid increase in the number of cases of a particular disease.
- d) A disease that is spread between continents.



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Application

A 9-year-old domestic short-haired cat is presented for dyspnea (difficulty breathing). Radiographs reveal marked pleural effusion (fluid in the space around the lungs). A fine needle aspirate of the fluid was performed and the results are as follows:

Test (units)	Patient Results	Reference Interval
Appearance	Cloudy, White	Clear, colorless
Total protein (g/dL)	4.5	<2.5 g/dL
Specific gravity	1.035	<1.018
Nucleated cells/ μ L	35,000	<1,000/ μ L

The majority of the cells are neutrophils, some of which appear degenerate. Which of the following is the most likely diagnosis in this cat?

- a) A transudate due to liver failure
- b) A modified transudate due to chylous effusion
- c) Neoplastic effusion due to mediastinal lymphoma
- d) *Neutrophilic inflammation due to bacterial infection
- e) Pyogranulomatous inflammation due to fungal infection



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Table 1. The Knowledge Dimension – major types and subtypes

concrete knowledge →			abstract knowledge
factual	conceptual	procedural	metacognitive*
knowledge of terminology knowledge of specific details and elements	knowledge of classifications and categories knowledge of principles and generalizations knowledge of theories, models, and structures	knowledge of subject-specific skills and algorithms knowledge of subject-specific techniques and methods knowledge of criteria for determining when to use appropriate procedures	strategic knowledge knowledge about cognitive tasks, including appropriate contextual and conditional knowledge self-knowledge

(Table 1 adapted from Anderson and Krathwohl, 2001, p. 46.)



About Exams at CVM – AU17

- Core exams administered in ExamSoft: 56
- Total questions used in exams: 2,573
 - Multiple-choice Questions: 2,140 (83%)
 - True/False Questions: 33 (1%)
 - Fill-in-the-blank Questions: 313 (12%)
 - Essay Questions: 87 (3%)



Multiple-choice Question

All of the following features are more likely with feline hepatic lipidosis than with feline cholangitis **EXCEPT?**

STEM

ANSWER

DISTRACTORS

A
L
T
E
R
N
A
T
I
V
E
S

- a) Fever
- b) History of prolonged anorexia and marked weight loss
- c) Obesity is a risk factor
- d) Normal serum GGT activity
- e) Hepatic tissue hyperechoic compared to the faciform fat on abdominal ultrasonography



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Value of MC Questions

- Versatility
- Reliability
- Validity



Constructing the Stem

Make the stem meaningful and clear. Get rid of irrelevant and distracting material.

By which of the following mechanisms do nonsteroidal anti-inflammatory agents (NSAIDs) NOT inhibit platelet function mechanisms?

Which nerve provides motor innervation to the sartorius?

Which structure(s) contributes to the formation of the corpora quadrigemina?

- a) Lateral geniculate body
- b) Medial geniculate body
- c) *Caudal colliculus
- d) Both a and b



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Middle example from:
<http://www.duq.edu/about/centers-and-institutes/center-for-teaching-excellence/teaching-and-learning/multiple-choice-exam-construction>

Constructing the Stem

Make the stem a question or a partial sentence.

Cranial Drawer
and Cranial
Tibia Thrust
test for what?

The acquired
phenotypic feature of
malignant neoplastic
cells which **most
directly** accounts for
the propensity of them
to move into
surrounding tissue is:

In addition to the
nucleus, _____
are organelles that
contain DNA.

A chest radiographic
finding of the left
upper lobe collapse is

_____.



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Examples from CVM,
<http://cft.vanderbilt.edu/guides-sub-pages/writing-good-multiple-choice-test-questions/>, and Collins (2006).

Summarizing Stems

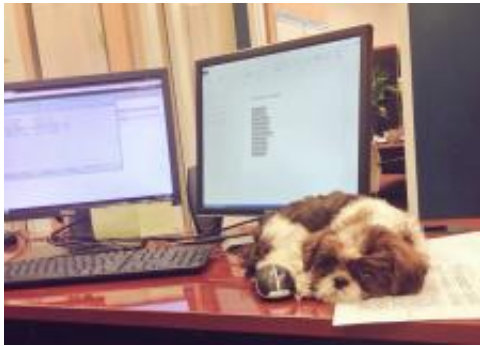
- Provide a complete statement.
- Include only relevant information.
- Contain as much of the test item as possible.
- Go short and be commensurate with the level of learning being tested.
- Ask for the correct, not the wrong answer.
- Avoid absolute terms – always, never, all, none.
- Avoid imprecise terms, seldom, rarely, few, many.
- Avoid cues -- may, could, or can.
- Define eponyms, acronyms, or abbreviations when used.



Constructing Effective Alternatives

Which canine is the cutest?

A.



C.



B.



D.



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On Alternatives (Distractors)

- Clear and concise.
- Mutually exclusive.
- Homogeneous in content.
- Free from inadvertent cues.
- Not include all of the above or none of the above.



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More on Alternatives

- They should be presented in alpha or numerical order.
- They should not be overly confusing (A & D, A & C, C & D)
- They should be independent of one another regarding content.

Logical order	Example
Numerical	a. 1939 b. 1940 c. 1941
Alphabetical	a. Changing a from 0.01 to 0.05 b. Increasing the spread of the exam scores. c. Reducing the size of the treatment effect.
Sequential	a. Heating ice from -100°C to 0°C. b. Melting ice at 0°C c. Heating water from 0°C to 100°C



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Reliability and Validity

And ... Item Analysis



Exam Takers = 160 KR20 = 0.77 Stdev = 4.09 Mean = 44.81 (89.63%) Median = 46.00 Min = 23.00 Max = 50.00 Total Pts = 50.00

Question #	Correct Responses			Disc. Index	Point Biserial	Correct Answer	Response Frequencies (*indicates correct answer)											At Ans Time
	Diff(p)	Upper	Lower				A	B	C	D	E	F	G	H	I	J	Unanswered	
1	0.96	100.00%	84.78%	0.15	0.21	C	4	2	*153	1	-	-	-	-	-	-	0	N/A
Question ID / Rev: 140 / 3							% Selected	2.50	1.25	95.63	0.63	-	-	-	-	-	0.00	-
							Point Biserial (rpb)	-0.19	-0.08	0.21	-0.05	-	-	-	-	-	-	-
							Disc. Index	-0.09	-0.04	0.15	-0.02	-	-	-	-	-	-	-
							Upper 27%	1.00	0.00	1.00	0.00	-	-	-	-	-	-	-
							Lower 27%	0.00	0.04	0.85	0.02	-	-	-	-	-	-	-

Performance History: # Correct: 153 # Incorrect: 7 # Not Attempted: 0 Difficulty: 0.96



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Analyzing Distractors/Choice Frequency

A is a poor distractor since no one selected that answer.
In item 3, 2 of 4 distractors are implausible.

Distractors should be “distracting.” *

Item	A	B	C	D
1	0	4	15*	4
2	10	14*	3	1
3	2	23*	0	0

*Correct Answer



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Difficulty Index (P-value)

- The number of students who answered correctly divided by the total number of students.
- Item difficulty more than .75 is an easy item; below .25 is a difficult item.

Item	# Correct Upper	# Correct Lower	Difficulty Index (p)
1	4	4	.80
2	0	3	.30
3	5	1	.60



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Exam Takers = 160 KR20 = 0.77 Stdev = 4.09 Mean = 44.81 (89.63%) Median = 46.00 Min =

Question #	Correct Responses			Disc. Index	Point Biserial	Correct Answer	Response Frequencies (*Indicates						
	Diff(p)	Upper	Lower				A	B	C	D	E	F	G
1	0.96	100.00%	84.78%	0.15	0.21	C	4	2	*153	1	-	-	-
Question ID / Rev: 140 / 3							% Selected	2.50	1.25	95.63	0.63	-	-
-	-	-	-	-	-	Point Biserial (rpb)	-0.19	-0.08	0.21	-0.05	-	-	-
-	-	-	-	-	-	Disc. Index	-0.09	-0.04	0.15	-0.02	-	-	-
-	-	-	-	-	-	Upper 27%	0.00	0.00	1.00	0.00	-	-	-
-	-	-	-	-	-	Lower 27%	0.09	0.04	0.85	0.02	-	-	-

Performance History: # Correct: 153 # Incorrect: 7 # Not Attempted: 0 Difficulty: 0.96



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Point Biserial

- Exam takers who performed well on exam also selected the correct response.
- Discriminates between high- and low-scoring students.

Item	Upper27%	Lower27%	Point Biserial
5	66.7%	33.3%	.42

General Interpretation

Very Good Item:	.30 and above
Reasonably Good:	.20 - .29
Marginal Item:	.09 - .19
Poor Item:	below .09



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Exam Takers = 160 KR20 = 0.77 Stdev = 4.09 Mean = 44.81 (89.63%) Median = 46.00 Min = 23.00 Max = 50.00

Question #	Correct Responses			Disc. Index	Point Biserial	Correct Answer	Response Frequencies (*indicates correct answer)								
	Diff(p)	Upper	Lower				A	B	C	D	E	F	G	H	I
1	0.96	100.00%	84.78%	0.15	0.21	C	4	2	*153	1	-	-	-	-	-
Question ID / Rev: 140 / 3				-	-	% Selected	2.50	1.25	95.63	0.63	-	-	-	-	-
-	-	-	-	-	-	Point Biserial (rpb)	-0.19	-0.08	0.21	-0.05	-	-	-	-	-
-	-	-	-	-	-	Disc. Index	-0.09	-0.04	0.15	-0.02	-	-	-	-	-
-	-	-	-	-	-	Upper 27%	0.00	0.00	1.00	0.00	-	-	-	-	-
-	-	-	-	-	-	Lower 27%	0.09	0.04	0.85	0.02	-	-	-	-	-

Performance History: # Correct: 153 # Incorrect: 7 # Not Attempted: 0 Difficulty: 0.96



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Standard Deviation

- Low standard deviation = most of the test takers are close to average.
- High standard deviation = wide variation of scores.
- You define the limits: What % of students fall within the limits and how many failed.
- If failure rate is higher than the limit, rate the exam “not good.”



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Exam Takers = 163

KR20 = 0.77

Stdev = 5.04

Mean = 41.31 (82.63%)

Median = 42.

Question #	Correct Responses			Disc. Index	Point Biserial	Correct Answer	Response Frequencies				
	Diff(p)	Upper	Lower				A	B	C	D	E
1	0.56	70.59%	34.78%	0.36	0.24	E	16	46	4	5	*92
Question ID / Rev: 2059 / 2				-	-	% Selected	9.82	28.22	2.45	3.07	56.44
-	-	-	-	-	-	Point Biserial (rpb)	-0.08	-0.14	-0.06	-0.13	0.24
-	-	-	-	-	-	Disc. Index	-0.07	-0.18	-0.04	-0.07	0.36
-	-	-	-	-	-	Upper 27%	0.08	0.22	0.00	0.00	0.71
-	-	-	-	-	-	Lower 27%	0.15	0.39	0.04	0.07	0.35

Performance History: # Correct: 92 # Incorrect: 71 # Not Attempted: 0 Difficulty: 0.56



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About Short Answer/FITB Questions

- Good for application, synthesis, analysis, and evaluation levels.
- Easy to construct.
- Good for who, what, where, when content.
- Minimizes guessing.



About Short Answer/FITB Questions

- Encourages more intensive study; the student must know the answer vs. recognizing the answer.
- May overemphasize memorization of facts.
- Questions may have more than one correct answer.
- Scoring is tedious.



Essay Questions

- Evaluate information
- Analyze evidence
- Articulate explanations
- Provide examples
- Display thought processes
- Furnish information
- Perform a specific task



Western U's CVM Veterinary Issues course

Name Analyzing an Ethical Dilemma - Rubric

Description This is the grading rubric that will be used to grade the group wiki Analyzing an Ethical Dilemma (Block 2 Assignment). The group will be given one grade based on their collective performance.

Rubric Detail

Criteria	Levels of Achievement			
	Poor	Marginal	Good	Excellent
Organization and Mechanics (5 points)	0 to 1 points Choppy and confusing; format was difficult to follow; transitions of ideas were abrupt and made product difficult to assess; unacceptable number of spelling and/or grammatical errors	2 to 3 points Somewhat organized; ideas were not presented coherently and transitions were not always smooth; spelling and/or grammatical errors	4 to 4 points Presented in a thoughtful manner; organized and most transitions were easy to follow, but at times ideas were unclear; minimal spelling and/or grammatical errors	5 to 5 points Extremely well organized; logical format that was easy to follow; flowed smoothly from one idea to another and cleverly conveyed; no spelling or grammatical errors
Content (20 points)	0 to 10 points Poor understanding of the "Kidder Process"; many inaccuracies and inconsistencies in logic; assignment instructions were not followed	11 to 14 points Gaps in the understanding of the "Kidder Process"; more than a few inconsistencies or errors in logic; some assignment instructions were not followed	15 to 17 points Good understanding of the "Kidder Process"; mostly accurate with a few inconsistencies or errors in logic; most assignment instructions were followed	18 to 20 points Excellent understanding of the "Kidder Process"; logic was consistent and clear; assignment instructions were closely followed
Group Effort (5 points)	0 to 0 points One or more group members did not contribute	1 to 2 points Group contribution was very imbalanced	3 to 4 points Contribution was made by each group member though not equally	5 to 5 points Evidence of almost equal contribution among all group members



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About True/False Questions

- Good for knowledge-level testing.
- Use to evaluate student understanding of misconceptions.
- Use to test on concepts with two logical responses.
- Quick method for testing: 3 to 4 questions per minute.
- They're easy to compose.
- Difficult to discriminate between students who know/don't know the material.
- 50-50 chance.
- Need large number of items for high reliability.



Issues/Challenges at CVM



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?s or
comments



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T/F Quiz

Is it recommended to take statements directly from the text to make good true-false questions?

A. Yes

B. No ✓

Two ideas can be included in a true-false statement if the purpose is to show cause and effect.

A. Yes ✓

B. No



T/F Quiz

When a true-false statement is an opinion, it should be attributed to someone in the statement?

A. Yes ✓

B. No

Underlining or circling answers is preferable to having the student write them down.

A. Yes ✓

B. No



T/F Quiz

Complex statements are used to measure higher order thinking.

Good Practice

Poor Practice ✓

If negatives, such as “not,” are used, they should be highlighted in some way.

✓ Good Practice

Poor Practice



T/F Quiz

True and false statements should be approximately the same length.

✓ Good Practice Poor Practice

The following are examples of words that should be avoided: all, none, never, sometimes, generally, often.

✓ Good Practice Poor Practice

