Multiple Choice Question

Design

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Overview of Goals

• Distinguish between objectives which can be appropriately assessed by using multiple choice items and objectives which would be better assessed by some other means.

• Evaluate existing multiple-choice items by using commonly-accepted criteria to identify specific flaws in the items.

• Improve poorly-written multiple-choice items by correcting the flaws they contain.

• Construct well-written multiple-choice items that measure given objectives.

• Consider the needs of diverse/special learners when developing m/c assessment questions.
Thoughtfully written objectives are critical to the construction of appropriate test questions and in ensuring adequate assessment of intended learner competence.

- **Never** write the test in **one day**.
- Professional test designers **only write 3 or 4 questions per day**.
- Write **one or two questions after each class**, so it becomes a simple matter of assembling them into an exam.
- If students are to hand-write the letters of their chosen answers, ask them to use CAPITAL LETTERS. The handwritten, lower-case letters "a" and "d" and "c" and "e" can be difficult to distinguish when scoring.
Keys to Quality Classroom Assessments

Key 1: Clear Purpose
What's the purpose?
Who will use results?
What will they use results to do?

Key 2: Clear Targets
What are the learning targets?
Are they clear?
Are they appropriate?

Key 3: Sound Design
What method?
Quality questions?
Sampled how?
Avoid bias how?

Key 4: Effective Communication
How manage information?
How report? To whom?

Key 5: Student Involvement
Students are users, too.
Students need to understand targets, too.
Students can assess.
Students can track progress and communicate.
Advantages and Limitations of Multiple-Choice Items

• **Advantages**
  - **Versatility.**
    - Multiple-choice test items are appropriate for use in many different subject-matter areas, and can be used to measure a great variety of educational objectives.
    - They are adaptable to various levels of learning outcomes, from simple recall of knowledge to more complex levels, such as the student’s ability to:
      - Analyze phenomena
      - Apply principles to new situations
      - Comprehend concepts and principles
      - Discriminate between fact and opinion
      - Interpret cause-and-effect relationships
      - Interpret charts and graphs
      - Judge the relevance of information
      - Make inferences from given data
      - Solve problems
  - The difficulty of multiple-choice items can be controlled by changing the alternatives, since the more homogeneous the alternatives, the finer the distinction the students must make in order to identify the correct answer.
  - Multiple-choice items are amenable to item analysis, which enables the teacher to improve the item by replacing distractors that are not functioning properly.
  - In addition, the distractors chosen by the student may be used to diagnose misconceptions of the student or weaknesses in the teacher’s instruction.
  - The teacher using multiple-choice items to test enables a broader sample of course content in a given amount of testing
• **Limitations**
  
  • Versatility.
  
  • Since the student selects a response from a list of alternatives rather than supplying or constructing a response, multiple-choice test items are not adaptable to measuring certain learning outcomes, such as the student’s ability to:
    
    • Articulate explanations
    • Display thought processes
    • Furnish information
    • Organize personal thoughts
    • Perform a specific task
    • Produce original ideas
    • Provide examples
  
  • Such learning outcomes are better measured by short answer or essay questions, or by performance tests.
• **This Guessing Factor** reduces reliability of multiple-choice item scores somewhat, but increasing the number of items on the test offsets this reduction in reliability. The following table illustrates this principle:

<table>
<thead>
<tr>
<th>Number of 4-Alternative Multiple-Choice Items on Test</th>
<th>Chance of Scoring 70% or Higher by Blind Guessing Alone</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>1 out of 16</td>
</tr>
<tr>
<td>5</td>
<td>1 out of 64</td>
</tr>
<tr>
<td>10</td>
<td>1 out of 285</td>
</tr>
<tr>
<td>15</td>
<td>1 out of 8,670</td>
</tr>
<tr>
<td>20</td>
<td>1 out of 33,885</td>
</tr>
<tr>
<td>25</td>
<td>1 out of 942,651</td>
</tr>
</tbody>
</table>

For example, if your test includes a section with only two multiple-choice items of 4 alternatives each (a b c d), you can expect 1 out of 16 of your students to correctly answer both items by guessing blindly. On the other hand, if a section has 15 multiple-choice items of 4 alternatives each, you can expect only 1 out of 8,670 of your students to score 70% or more on that section by guessing blindly.
Basics of Designing Multiple Choice Questions
Why We Need to Know This

• Reduce the errors that occur from poorly written items.
• Make test results more accurate, so the questions are interpreted by students as intended.
• The answer options are clear and without hints.
• Understanding the Anatomy of a multiple choice questions.
• Knowing the 10 rules to developing multiple choice questions
Anatomy of Multiple Choice Questions

1. The acronym “ISD” represents __________:
   a. Irrational Systems Design
   b. Instructor’s Silly Design
   c. Imagine Something Different
   d. Instructional Systems Design

Correct: d. Instructional Systems Design
Anatomy of Multiple Choice Questions

Deb has a board that measures 5 feet in length. How many $\frac{1}{4}$-foot-long pieces can Deb cut from the board?

- A 1
- B 9
- C 10
- D 20

Measured CCLS: 5.NF.7c
Example

### Example and Parts of a Multiple-Choice Item

<table>
<thead>
<tr>
<th>3. What is chiefly responsible for the increase in the average length of life in the USA during the last fifty years?</th>
<th>=STEM</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>distractor---</strong></td>
<td>a. Compulsory health and physical education courses in public schools.</td>
</tr>
<tr>
<td><strong>answer---</strong></td>
<td>*b. The reduced death rate among infants and young children</td>
</tr>
<tr>
<td><strong>distractor---</strong></td>
<td>c. The safety movement, which has greatly reduced the number of deaths from accidents</td>
</tr>
<tr>
<td><strong>distractor---</strong></td>
<td>d. The substitution of machines for human labor.</td>
</tr>
</tbody>
</table>

Ideally, the item should be answerable without all of the options being read.
10 Rules of Developing Multiple Choice Questions
Rule #1: Test comprehension and critical thinking, not just recall.

Go beyond recall by asking learners to:

- interpret facts,
- evaluate situations,
- explain cause and effect,
- make inferences, and
- predict results.

**Comprehension**

Objective: Identifies the effect of changing a parameter (rule using).

A pendulum consists of a sphere hanging from a string. What will happen to the period of the pendulum if the mass of the sphere is doubled? (Assume that the effects of air friction and the mass of the string are negligible, and that the sphere traces an arc of 20° in a plane as it swings.)

a. It will increase.
b. It will decrease.
c. It will remain unchanged.
d. More information is needed to determine what will happen.
Application

Objective: Identifies the correct application of principle (problem solving).

In the diagram above, parallel light rays pass through a convex lens and converge to a focus. They can be made parallel again by placing a:

a. Concave lens at point B.
b. Concave lens at point C.
c. Second convex lens at point A.
d. Second convex lens at point B.
e. Second convex lens at point C.
• Rule #2: Use simple sentence structure and precise wording
  • Write test questions in a simple structure that is easy to understand.
  • And try to be as accurate as possible in your word choices.
  • Words can have many meanings depending on colloquial usage and context.
We must create the correct perception or mental image in the question design students will read.
• Rule #3: Place most of the words in the question stem
  • A stem is the section of a multiple-choice item that poses the problem that the students must answer.
  • Stems can be in the form of a question or an incomplete sentence.
  • If you’re using a question stem, rather than an entire question, ensure that most of the words are in the stem.
  • The answer options can be short, making them less confusing and more legible.

There were 54 apples set aside as a snack for 3 classes of students. The teachers divided up the apples and placed equal amounts on 9 separate trays. If each of the 3 classes received the same number of trays, how many apples did each class get?

A 2
B 6
C 18
D 27

Key: C

Aligned CCLS: 3.OA.2, 3.OA.3
a. Avoid vague stems by stating the problem in the stem:

Poor Example

California:
  a. Contains the tallest mountain in the United States.
  b. Has an eagle on its state flag.
  c. Is the second largest state in terms of area.
  *d. Was the location of the Gold Rush of 1849.

Good Example

What is the main reason so many people moved to California in 1849?
  a. California land was fertile, plentiful, and inexpensive.
  *b. Gold was discovered in central California.
  c. The east was preparing for a civil war.
  d. They wanted to establish religious settlements.
b. Avoid wordy stems by removing irrelevant data:

Poor Example

Suppose you are a mathematics professor who wants to determine whether or not your teaching of a unit on probability has had a significant effect on your students. You decide to analyze their scores from a test they took before the instruction and their scores from another exam taken after the instruction. Which of the following t-tests is appropriate to use in this situation?

*a. Dependent samples.
b. Heterogenous samples.
c. Homogenous samples.
d. Independent samples.

Good Example

When analyzing your students’ pretest and posttest scores to determine if your teaching has had a significant effect, an appropriate statistic to use is the t-test for:

*a. Dependent samples.
b. Heterogenous samples.
c. Homogenous samples.
d. Independent samples.
If you feel you must use a negative and there is NO other wording option, then the following must apply:

• The negative word should be placed in the stem, not in the alternatives
• The negative word should be emphasized by using underlining, italics, bold face, or CAPITALS.
• In addition, each of the alternatives should be phrased positively to avoid forming a confusing double negative with the stem.

NOTE: In a survey of 46 authoritative references in the field of educational measurement, 31 of the 35 authors that discussed the negative variety recommend that they be avoided (Haladyna & Downing, 1989a).
• Rule #4: Make all distractors plausible
  • All of the wrong answer choices should be completely reasonable and based on state standards.
  • Avoid throwing in those give-away distractors as it detracts from the test’s validity.
  • Avoid answer choices “I do not know” or “I was never taught this material”. It distracts from the analysis of the assessment and the measure of knowledge to the standards.
Poorly Written Distractors

• Common mistakes in writing exam alternatives have to do with how the various alternatives relate. They should be mutually exclusive, homogenous, plausible and consistently phrased.

  a. Avoid Overlapping Alternatives
  Poor Example
  What is the average effective radiation dose from chest CT?
  a. 1-8 mSv
  b. 8-16 mSv
  c. 16-24 mSv
  d. 24-32 mSv
  
  Good Example
  What is the average effective radiation dose from chest CT?
  a. 1-7 mSv
  b. 8-15 mSv
  c. 16-24 mSv
  d. 24-32 mSv
b. Avoid Dissimilar Alternatives

Poor Example

Idaho is widely known as:
*a. The largest producer of potatoes in the United States.
b. The location of the tallest mountain in the United States.
c. The state with a beaver on its flag.
d. The “Treasure State.”

Good Example

Idaho is widely known for its:
a. Apples.
b. Corn.
c. Potatoes.
d. Wheat

Note: The good example tests students’ knowledge of Idaho’s agriculture. The poor example is confusing because students are unsure if they are answering a question on Idaho’s agriculture, geography, flag or nickname.
c. Avoid implausible alternatives:

**Poor Example**

Which of the following artists is known for painting the ceiling of the Sistine Chapel?

- a. Warhol.
- b. Flinstone.
- *c. Michelangelo.
- d. Santa Claus.

**Good Example**

Which of the following artists is known for painting the ceiling of the Sistine Chapel?

- a. Botticelli.
- b. da Vinci.
- *c. Michelangelo.
- d. Raphael.
d. Avoid inconsistent phrasing of alternatives:

Poor Example

The term operant conditioning refers to the learning situation in which:

a. A familiar response is associated with a new stimulus.
b. Individual associations are linked together in sequence.
*c. A response of the learner is instrumental in leading to a subsequent reinforcing event.
d. Verbal responses are made to verbal stimuli.

Good Example

The term operant conditioning refers to the learning situation in which:

a. A familiar response is associated with a new stimulus.
b. Individual associations are linked together in sequence.
*c. The learner’s response leads to reinforcement.
d. Verbal responses are made to verbal stimuli.

Note: The length of answer in the poor example is longer than the distractors. Some students are keen at spotting these changes. Also, the language in the poor example is from the textbook, but the distractors are in the instructor’s own words. The good example makes the phrasing consistent in length and uses the instructor’s language.
• Rule #5: Keep all answer choices the same length
  • This can be difficult to achieve, but expert test-takers can use answer length as a hint to the correct answer.
  • Often the longest answer is the correct one.
  • If getting all four answers to the same length is difficult, then try using two short and two long sentence.
• **Rule #6: Avoid double negatives**
  
  • Don’t use combinations of these words in the same question:
    
    • not, no, nor, the -un prefix, etc.
    
    • For example, this type of question could confuse test-takers: ‘Which of the following comments would NOT be unwelcome in a work situation?’
    
    • Flip it around and write it in the positive form: ‘Which of the following comments are acceptable in a work situation?’
• Rule #7: Mix up the order of the correct answers
  • Make sure that most of your correct answers aren’t in the “b” and “c” positions, which can often happen.
  • Most test designers have a favorite letter and it is usually B or C.
  • Keep correct answers in random positions and don’t let them fall into a pattern that can be detected.
  • When your test is written, go through and reorder where the correct answers are placed, if necessary.
• Rule #8: Keep the number of options consistent
  • Making the number of options consistent from question to question helps learners know what to expect.
  • Research doesn’t seem to agree on whether 3 or 4 or 5 options is best.
Rule #9: Avoid tricking test-takers

- Tests exist to measure knowledge.
- Never use questions or answer options that could trick a learner.
- If a question or its options can be interpreted in two ways or if the difference between options is too subtle, then find a way to rewrite it.
• Rule #10: Use ‘All of the Above’ and ‘None of the Above’ with caution
  • They may not promote good instruction.
  • *All of the Above* can be an obvious give-away answer when it’s not used consistently.
  • The *All of the Above* option can encourage guessing if the learner thinks *one or two answers* are correct.
  • The downside to *None of the Above* is that you can’t tell if the learner really knew the correct answer.
  • These distractors also emphasize quantity of distractors over quality of distractor.
**Test Items**
- Relate directly to instructional objectives
- Test at the same level of learning as the objectives are designed to assess
- Reflect different levels of learning (recall, comprehension and application, problem solving)

**Stems**
- Provide a complete statement
- Include only relevant information
- Contain as much of the test item as possible
- Have a length as short as possible, commensurate with the level of learning being tested
- Ask for the correct, not the “wrong” answer
- Avoid absolute terms, such as always, never, all, or none
- Avoid imprecise terms, such as seldom, rarely, occasionally, sometimes, few, or many
- Avoid cues, such as may, could, or can
- Define eponyms, acronyms, or abbreviations when used

**Options**
- Follow grammatically from the stem
- Relate to each other in kind
- Are similar in grammar, length, and complexity, with distractors being plausible but clearly incorrect
- Avoid none of the above and all of the above
- Follow a logical order (eg, numeric, chronologic)
- Are independent and do not overlap
- Vary position of the correct answer
### Differentiated Instruction vs. Specially Designed Instruction

<table>
<thead>
<tr>
<th>DI (Instructional Strategies)</th>
<th>SDI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heterogeneous Grouping</td>
<td>Extraneous information is removed</td>
</tr>
<tr>
<td>Movement</td>
<td>Simplified numbers</td>
</tr>
<tr>
<td>Manipulatives</td>
<td>Three answer choice options on MC tests</td>
</tr>
<tr>
<td>Cues, questions, and advance organizers</td>
<td>Instruction is direct, small group or individualized, and intensive, meaning emphasized over time</td>
</tr>
<tr>
<td>Nonlinguistic representations</td>
<td>Simplified graphics</td>
</tr>
<tr>
<td>Cooperative learning</td>
<td>Simplified vocabulary</td>
</tr>
<tr>
<td>Graphic Organizers</td>
<td>Complex tasks are broken down into component parts and each part is completed before trying to combine the components</td>
</tr>
<tr>
<td>Technology-Speech-to-text software</td>
<td>Important tasks require frequent repetitions</td>
</tr>
<tr>
<td>Student Choice on Assessment Options/Home Assignment</td>
<td>Assignments are shortened and/or divided into parts</td>
</tr>
<tr>
<td>Text Selection</td>
<td>Accommodations that allow access to general ed curriculum; i.e., calculator, graphic organizer, oral administration, speech-to-text software</td>
</tr>
<tr>
<td>Small Group Instruction</td>
<td></td>
</tr>
<tr>
<td>Pre-Teach Opportunities</td>
<td></td>
</tr>
</tbody>
</table>
Types of Question Types *NOT* Recommended by Research
Combined Response

In items of the combined-response variety, one or more of the alternatives are correct answers; the remaining alternatives serve as distractors. The student is directed to identify the correct answer or answers by selecting one of a set of letters, each of which represent a combination of alternatives.

Example

The fluid imbalance known as edema is commonly associated with:
1. Allergic reactions.
2. Congestive heart failure.
3. Extensive burns.
4. Protein deficiency.

The correct answer is:
- 1, 2, and 3.
- 1 and 3.
- 2 and 4.
- 4 only.
- *e. 1, 2, 3, and 4.

• This variety is also known as complex multiple-choice, multiple multiple-choice, or type K.
• It shares the disadvantage of all-or-none scoring with the multiple-response variety discussed previously, and has the added disadvantage of providing clues that help students with only partial knowledge detect the correct combination of alternatives.
• In the example to the left, a student can identify combination e as the correct response simply by knowing that alternatives 1 and 4 are both correct.
• Because of these disadvantages, items of combined-response variety are not recommended.
• An item of the combined-response variety is often simply a series of related true-false questions presented together as a group.

NOTE: Numerous studies indicate that items of the combined-response variety are lower in reliability, lower in discrimination, higher in difficulty, and equal in validity when compared with similar items of the single-correct-answer and best-answer varieties (Albanese, 1990; Haladyna & Downing, 1989b). They have also been found to be lower in reliability, higher in difficulty, and equal in validity when compared with similar multiple true-false items (Frisbie, 1990).
Check List for Constructing Multiple-Choice Items

• Construct each item to assess a single written objective.
  • Research. Although few studies have addressed this issue, one study has found that basing items on objectives makes the items easier and more homogeneous (Baker, 1971).

• Base each item on a specific problem stated clearly in the stem.

• Include as much of the item as possible in the stem, but do not include irrelevant material.
  • Research. Several studies have indicated that including irrelevant material in the item stem decreases both the reliability and the validity of the resulting test scores (Haladyna & Downing, 1989b).

• State the stem in positive form (in general).

• Word the alternatives clearly and concisely.

• Keep the alternatives mutually exclusive.

• Keep the alternatives homogeneous in content.

• Keep the alternatives free from clues as to which response is correct.
  • Keep the grammar of each alternative consistent with the stem.
    • Research. Several studies have found that grammatical clues make items easier (Haladyna & Downing, 1989b).

• Keep the alternatives parallel in form.

• Keep the alternatives similar in length.

• Avoid textbook, verbatim phrasing.

• Avoid the use of specific determiners. (Never, Always)

• Avoid including keywords in the alternatives.
  • Research. Several studies have reported that items are easier when a keyword in the stem is also included in the answer (Haladyna & Downing, 1989b).

• Use plausible distractors.

• Avoid the alternatives “all of the above” and “none of the above” (in general).
  • Research. While research on the use of “all of the above” is not conclusive, the use of “none of the above” has been found in several studies to decrease item discrimination and test score reliability (Haladyna & Downing, 1989b).

• Lay out the items in a clear and consistent manner.
Use as Many Functional Distractors as are Feasible

- Functional distractors are those chosen by students that have not achieved the objective and are ignored by students that have achieved the objective.

**Research.** Numerous studies have reported that there is little difference in difficulty, discrimination, and test score reliability among items containing two, three, and four distractors (Haladyna & Downing, 1989b).
Randomizing Choices

- The easiest method of randomizing the answer position is to arrange the alternatives in some logical order. The following table gives examples of three logical orders. The best order to use for a particular item depends on the nature of the item’s alternatives.

<table>
<thead>
<tr>
<th>Logical order</th>
<th>Example</th>
</tr>
</thead>
</table>
| Numerical     | a. 1939
               | b. 1940
               | c. 1941
               | d. 1942 |
| Alphabetical  | a. Changing $a$ from .01 to .05.
               | b. Decreasing the degrees of freedom.
               | c. Increasing the spread of the exam scores.
               | d. Reducing the size of the treatment effect. |
| Sequential    | a. Heating ice from $-100^\circ$C to $0^\circ$C.
               | b. Melting ice at $0^\circ$C.
               | c. Heating water from $0^\circ$C to $100^\circ$C.
               | d. Evaporating water at $100^\circ$C.
               | e. Heating steam from $100^\circ$C to $200^\circ$C. |

Research. Numerous studies indicate that items are easier when this guideline is violated (Haladyna & Downing, 1989b).
Checklist for Reviewing Multiple-Choice Items

☐ Has the item been constructed to assess a single written objective?

☐ Is the item based on a specific problem stated clearly in the stem?

☐ Does the stem include as much of the item as possible, without including irrelevant material?

☐ Is the stem stated in positive form?

☐ Are the alternatives worded clearly and concisely?

☐ Are the alternatives mutually exclusive?

☐ Are the alternatives homogeneous in content?

☐ Are the alternatives free from clues as to which response is correct?

☐ Have the alternatives “all of the above” and “none of the above” been avoided?

☐ Does the item include as many functional distractors as are feasible?

☐ Does the item include one and only one correct or clearly best answer?

☐ Has the answer been randomly assigned to one of the alternative positions?

☐ Is the item laid out in a clear and consistent manner?

☐ Are the grammar, punctuation, and spelling correct?

☐ Has unnecessarily difficult vocabulary been avoided?

☐ If the item has been administered before, has its effectiveness been analyzed?
Let’s Practice
Question 5. Which of the following techniques would you feel to be a good first step towards finding an antiderivative \( \int x^2 \log(1+x) \, dx \) of the function \( x^2 \log(1+x) \)?

1. Integration by parts, differentiating \( x^2 \) and integrating \( \log(1+x) \).
2. Integration by parts, differentiating \( \log(1+x) \) and integrating \( x^2 \).
3. Substitution, setting \( y = x^2 \).
4. Substitution, setting \( y = 1+x \).
5. Substitution, setting \( y = \log(1+x) \).
6. Trial differentiation, using functions such as \( x^3 \log(1+x) \).
7. Sketching a graph of \( x^2 \log(1+x) \).
8. Taylor series expansion of \( \log(1+x) \).
9. Start up Maple, Mathematica, or SAGE. :-)}
Which of the following is NOT one of the reasons Dr. Leakey chose Jane to work with him?

A. She knew a lot about Africa.
B. She knew a lot about African wildlife.
C. She earned the money to travel to Africa on her own.
D. She was interested in studying animals in the wild.
Lines $l$ and $m$ intersect line $k$. Assume angles 4 and 7 are supplementary.

Then we can conclude that

a. lines $l$ and $m$ are perpendicular.

b. angle 8 and angle 1 are congruent.

c. lines $l$ and $m$ are parallel.

d. angles 1 and 2 are complementary.

e. angles 1 and 5 are supplementary.
“You are late, Goodman Brown,” said he. “The clock of the Old South was striking as I came through Boston, and that is full fifteen minutes ago.”

“Faith kept me back a while,” replied the young man, with a tremor in his voice, caused by the sudden appearance of his companion, though not wholly unexpected.

4Goodman: title of respect for farmer or householder.

In the final paragraph, Goodman Brown tells the man he meets in the woods that “Faith kept me back a while.” Literally, he means that his wife made him late. What other meaning could this remark have had?

A. ? The remark could have no meaning beyond the literal one.

B. ? His religious faith almost kept him from the journey.

C. ? Faith is necessary to complete the things one is required to do.

D. ? His faith in his marriage was more important than the journey.
The pie chart above shows the portion of time Pat spent on homework in each subject last week. If Pat spent 2 hours on mathematics, about how many hours did Pat spend on homework altogether?

A. 4  
B. 8  
C. 12  
D. 16
6. Which of the following is best supported by evidence from the text?
   a) Gutenberg’s idea was a tremendous success that made him incredibly wealthy.
   b) Gutenberg’s idea didn’t catch on in his lifetime, but grew very popular after his death.
   c) Gutenberg’s idea did not make him rich but spread very quickly.
   d) Gutenberg’s idea did not catch on right away but made him incredibly rich over time.

7. Which best explains why most people were illiterate during Gutenberg’s time?
   a) Books were rare and very expensive.
   b) The public school system had not yet been created.
   c) Writing had not yet been invented.
   d) Emperor Charlemagne made reading and writing illegal for common people.

8. Which best expresses the author’s purpose in writing this text?
   a) To describe what life was like during the Middle Ages
   b) To persuade people to read and write more
   c) To chart the spread of printing technologies across Europe
   d) To provide biographical information about Johannes Gutenberg

9. Which best explains why so few of Gutenberg’s bibles were sold to private individuals?
   a) Gutenberg wanted to use his talents to help churches and universities.
   b) Gutenberg’s Bible was pretty expensive and most people couldn’t read.
   c) Most Europeans were not religious and did not care about the bible.
   d) Gutenberg’s investors forbade him from selling the bibles to private individuals.
In the figure above, a shaded polygon which has equal sides and equal angles is partially covered with a sheet of blank paper. If $x + y = 80$, how many sides does the polygon have?

(A) Ten  
(B) Nine  
(C) Eight  
(D) Seven  
(E) Six
3. Organize the following events which led up to the result: I was kicked off the soccer team because I watched a movie.

   1) I missed the 3:55 pm bus.
   2) For the third time this week, I showed up at least thirty minutes late to soccer practice.
   3) I had to walk to soccer practice.
   4) I was watching a movie until 4:00 pm.

A. 1, 2, 3, 4
B. 2, 3, 4, 1
C. 2, 4, 1, 3
D. 4, 1, 3, 2
5. According to this selection, young boys joined the army for all of the following reasons EXCEPT:

A. adventure
B. money
C. glory
D. a desire to defend their homes
Read line 70 from the excerpt in the box below.

‘All that glisters is not gold,

Which familiar saying expresses the same idea?
A. Honesty is the best policy.
B. Quality is better than quantity.
C. Appearances are often deceiving.
D. Good things come to those who wait.
Your calculator display reads:
\[ 8.96482 \times 10^{-4} \]

This can be interpreted as:

a. \[ 8.96482 \times 10^4 \]

b. \[ 0.00896482 \]

c. \[ \frac{1}{8.96482^4} \]

d. \[ 8.96482 \times 10^{-4} \]
There were $1.5 \times 10^5$ bacteria cells in a Petri dish on day one. On day two, there were 12 times as many bacteria cells in the Petri dish. How many bacteria cells were in the Petri dish on day two?

a. $18 \times 10^5$

b. $1.8 \times 10^4$

c. $1.8 \times 10^6$

d. $18 \times 10^{60}$
This selection could effectively be adapted for presentation as a dramatic monologue because it consists of

A several suspenseful scenes.
B tales of misfortune.
C vivid descriptions by a narrator.
D exaggeration of people’s actions.
Which expression correctly expresses the following: Half of the sum of four and a number multiplied by itself three times.

a. \( \frac{1}{2} (4 + x) \)

b. \( \frac{1}{2} (4 + x^3) \)

c. \( \frac{1}{2} (4 + x)^3 \)

d. \( 3(4 + \frac{1}{2}x) \)
Steps 5 and 6 of the instructions (Document C) for installing Escape from Treasure Mountain II assume that the user

A has played Escape from Treasure Mountain I.
B owns a computer with at least 1.2 GB hard drive space.
C has some familiarity with basic computer terms.
D will want to know about new games from Madcap Studios.
9. How are the ideas in the passage mostly organized?

A. in chronological order to tell about the process of how cacao seeds grow
B. by cause and effect to show why cacao seeds grow best in rainforests
C. as a problem and solution to explain how early explorers found cacao trees
D. through comparison and contrast to explore how cacao trees are different from most trees
Which question **cannot** be answered by using the Virginia Opossum Web page?

A. How does an opossum act when it feels fear?
B. Will an opossum come near areas where humans live?
C. Where does a young opossum stay when it is first born?
D. What time of year is a person most likely to see an opossum?
If a line passes through (10,1) and (-5,-5), what is the equation of the line?

a. \(-\frac{5}{4}x - 3\)

b. \(-\frac{5}{6}x - 3\)

c. \(-1.25x - 11.5\)

d. \(0.4x - 3\)
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\[
\begin{align*}
5 \times 200,000 &= 1,000,000 \\
124,486 \times 507,012 &= 368,502 \\
25,000 \times 40 &= 1,000,000 \\
1,486,928 - 486,928 &= 1,000,000 \\
28,000,000 / 28 &= 10^6 \\
= \text{Thanks a Million!}
\end{align*}
\]
Resources

• http://theelearningcoach.com/elearning_design/rules-for-multiple-choice-questions/
• http://www.duq.edu/about/centers-and-institutes/center-for-teaching-excellence/teaching-and-learning/multiple-choice-exam-construction
• http://pubs.rsna.org/doi/pdf/10.1148/rg.262055145
• https://testing.byu.edu/handbooks/betteritems.pdf
• http://tep.uoregon.edu/resources/assessment/multiplechoicequestions/mc4critthink.html