

Do You Use Multiple Choice Questions?

NEMATYC 2018: Applying Mathematics to the Future

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Overview

- University profile**
- Bloom's taxonomy and math taxonomy**
- Writing good multiple choice questions**
- Advantages & disadvantages of multiple choice tests**
- Tips for students**
- Examples of multiple choice questions**
- Conclusions**



University Profile

- Small, private university with three campuses in Boston, Worcester and Manchester**
- Only the Boston campus offers undergraduate degrees**
- Programs: Pharmacy, Nursing, Dental Hygiene, Premed & Health Sciences (Public Health, Nuclear Med, Radiography, PT, Optometry)**
- Students have math SAT scores between 400 and 800, with the majority between 500 and 650**



Multiple Choice Questions

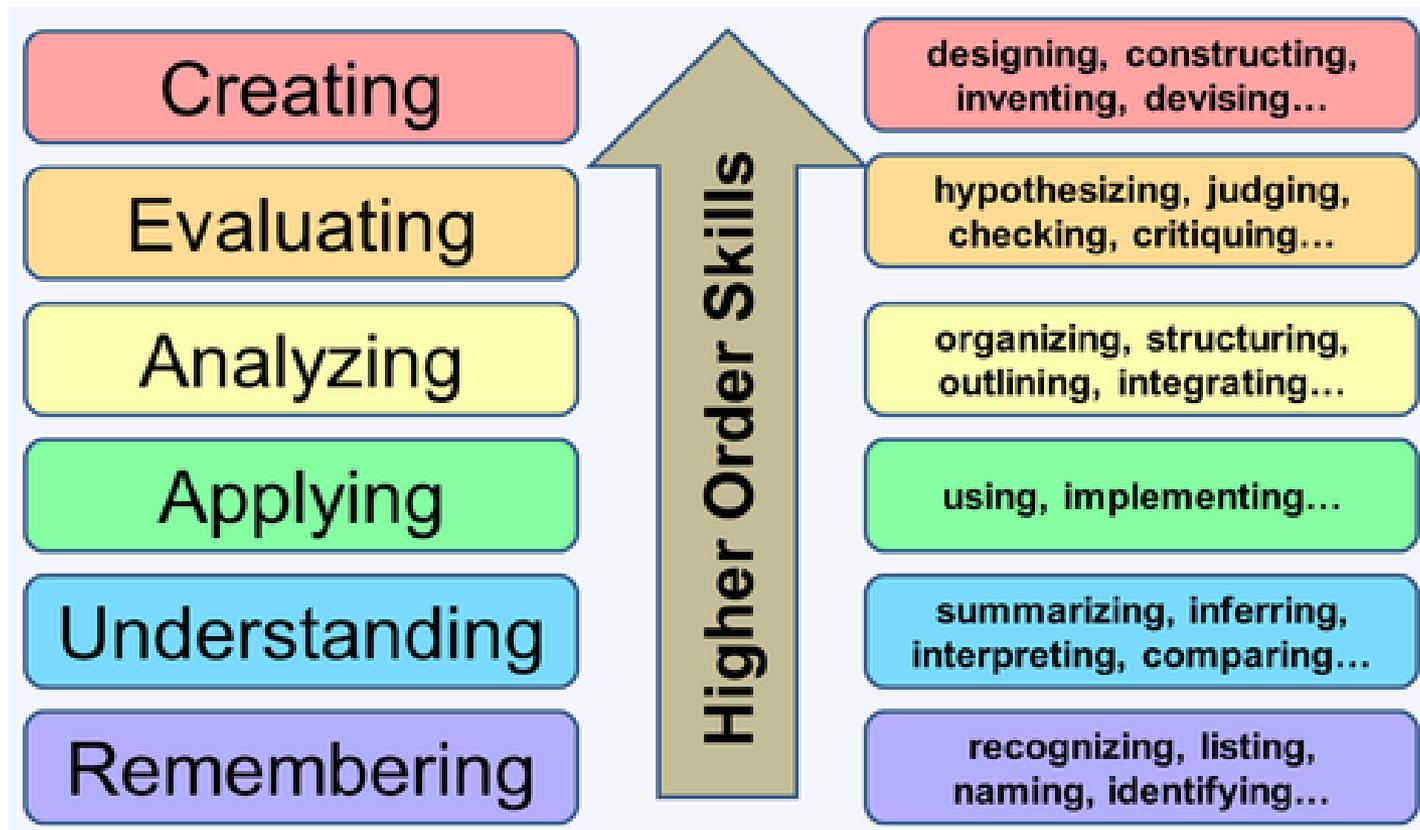


"We prefer to call this test 'multiple choice,' not 'multiple guess.'"

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Bloom's Taxonomy



(illustration by Scott Brande)



Math Taxonomy



Group A	Group B	Group C
Factual knowledge	Information transfer	Justifying and interpreting
Comprehension	Application in new situations	Implications, conjectures and comparisons
Routine use of procedures		Evaluation



Description of Multiple Choice Elements

All multiple choice questions have two parts:

- A problem (*stem*)
- A list of options (*alternatives*)
 - ✚ One correct option (the actual answer)
 - ✚ Several incorrect options (distractors)



Writing Good Multiple Choice Questions

How to write good stems:

- Identify and include the main idea to be tested
- Avoid irrelevant hints
- Eliminate excessive verbiage
- Restrict the use of negatives
- When using a negative, underline or italicize it, or use caps



Writing Good Multiple Choice Questions

How to write good alternatives:

- They have to be mutually exclusive
- The grammar has to be consistent with the stem
- Ideally, there should be only one correct option
- Use plausible alternatives
- Incorporate students' common errors in the distractors



Writing Good Multiple Choice Questions

How to write good alternatives:

- Keep the alternatives parallel in form
- Keep the alternatives similar in length
- In general, avoid “all of the above” and “none of the above”
- In general, avoid negatives, “never”, “always”
- The correct answer should be randomly placed among the alternatives



Writing Good Multiple Choice Questions

How to write good alternatives:

- Use letters in front of the alternatives rather than numbers
- When rewriting a multiple choice test, replace distractors not chosen by any students
- Avoid the use of humor in alternatives
- Always create the final answer key to ensure accuracy of the test



Advantages of Multiple Choice Questions

- Quick and easy to grade, by hand or electronically
- Can be graded objectively and are less disputed
- Can cover a broad range of topics and problem solving skills
- Students are very familiar with multiple choice questions





Advantages of Multiple Choice Questions

- Many questions in math have a single, objective answer
- Easy to create multiple versions, especially if using a software and/or Blackboard
- If using a software or Blackboard, simple statistics allow item analysis that indicate which topics are not understood by students





Disadvantages of Multiple Choice Questions

- Clarity of multiple-choice questions is frequently compromised
 - + Questions often assess memorization of facts and details
 - + Extreme care must be utilized to write them well
- With lucky guesses students get credit for correct answers
- Zero-tolerance approach to mistakes





Disadvantages of Multiple Choice Questions

- Wrong answer options expose students to misinformation
- Inferior to other examination options for most upper-level math courses
- Multiple choice questions promote the idea that the answer to a mathematical question is more important than the step-by-step process





Tips for Students

General Suggestions:

- Multiple choice questions are NOT easier than free response ones
- Read the instructions BEFORE you begin answering the questions
- Write down rules & formulas on a corner of your paper
- Scan the test and look for the problems you most expected; do the easiest problems first





Tips for Students

General Suggestions:

- Look out for the word **“not”** to make sure you understand the question
- Work out the problems **BEFORE** checking the given answers
- If unsure about an answer, eliminate as many alternatives as possible to increase your correct guessing
- If your answer doesn't match any of the choices, read and redo the question





Tips for Students

General Suggestions:

- Try not to keep changing your answer once you've worked out a question
- Don't spend too much time on a problem; if stuck, move on to the next question
- Double check your answers; just because your answer happens to be a choice it does not mean that you are correct
- Do not randomly guess; try to take an educated guess





Tips for Students

Suggestions for Math:

- ❑ Make estimates for your answers and see if they are reasonable
- ✚ Really work out the question before checking the answers
- ✚ Solving for the correct variable (x versus y)
- ✚ Magnitude: can't be 215 years old
- ✚ Measurements can't be negative (length, age, area ...)





Examples of Multiple Choice Algebra

If $x = 5$ and $y = -1$, what is the value of $(x - y)^2$?

- A. 4
- B. 16
- C. 24
- D. 36**



Examples of Multiple Choice Algebra

A Fahrenheit temperature F can be approximated by doubling the Celsius temperature C and adding 32. Which of the following expresses this approximation method?

A. $F = \frac{1}{2}C + 32$

B. $F = 2C + 32$

C. $F = 2(C + 32)$

D. $F = C^2 + 32$



Examples of Multiple Choice Statistics

A subset of the population selected to help make inferences about the population is called

- A. a sample**
- B. a census
- C. a population
- D. inferential statistics



Examples of Multiple Choice Statistics

Which of the following statements is correct (please justify your answer)?

A. $P(z > 2) = P(z > -2)$

B. $P(z > 2) = P(z < -2)$

C. $P(z > 2) = P(-2 < z < 2)$

D. $P(z > 2) = P(z < 2)$



Examples of Multiple Choice Statistics

Which of the following is NOT a possible value of the linear correlation coefficient?

A. +1.00

B. -1.00

C. 0.05

D. +1.01



Examples of Multiple Choice Statistics

If the 90% CI limits for the population mean μ are 70 and 80, which of the following could be the 95% CI limits?

- A. 72 and 78
- B. 65 and 75
- C. 65 and 85**
- D. 72 and 85



Conclusion

- Writing good multiple choice questions is time consuming
- Using multiple choice questions could be very useful in many math courses
- Some courses are better suited to use multiple choice questions on tests



What Do YOU Think?

THANK YOU!

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References

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