

# **Writing High Quality Multiple-Choice Questions**

**Alexey Leontyev**

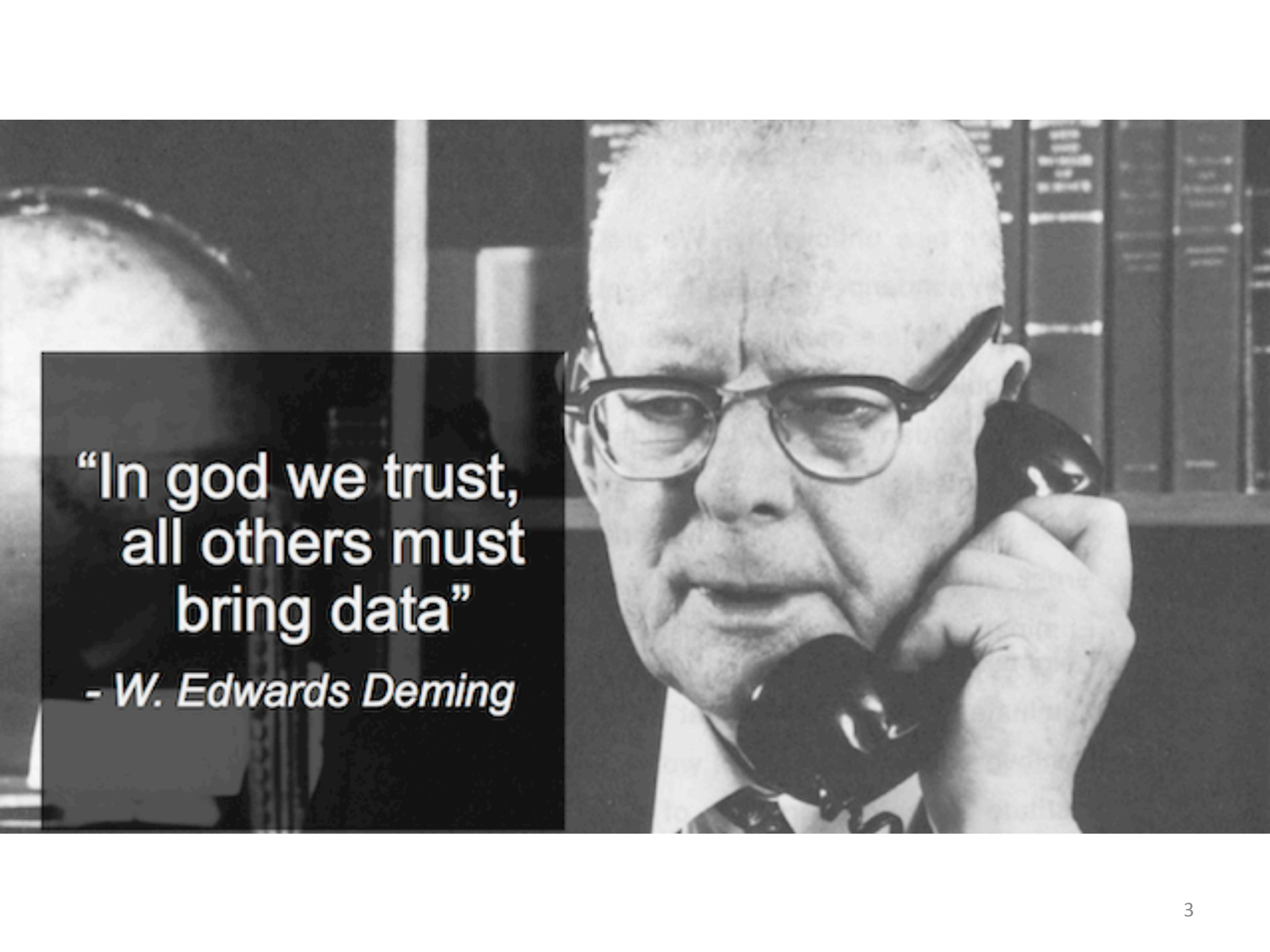
Adams State University

Alamosa, CO

Active Learning in Organic Chemistry cCWCS Workshop, Atlanta  
3:15 – 4:45 PM, Wednesday, June 14, 2017.

# Quality of MCQ

- Multiple-choice questions (MCQs) are frequently used to assess students in different educational streams.
- Wisely constructed and utilized, MCQ will make stronger and accurate assessments.
- Most of the Concept Inventories include multiple-choice items.
- You cannot assume the quality of items, you need to look at the data.

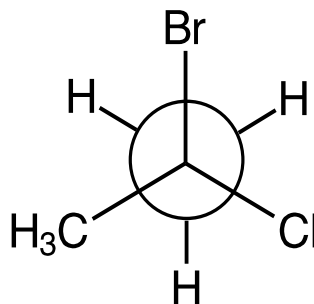
A black and white photograph of W. Edwards Deming, an older man with glasses, wearing a suit and tie, holding a rotary telephone receiver to his ear. He is looking slightly to the side with a serious expression. The background shows a bookshelf filled with books.

**“In god we trust,  
all others must  
bring data”**

**- W. Edwards Deming**

# Anatomy of Multiple-Choice Questions

18. Is the following molecule chiral?



Distractors

- A. Yes, because its mirror image cannot be overlaid on itself.
- B. Yes, because it has a carbon atom with four different substituents.
- C. No, because it is a meso compound.
- D. No, because it does not have a carbon atom with four different substituents.

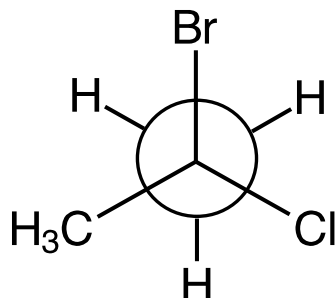
Correct  
answer

Stem

Response  
options

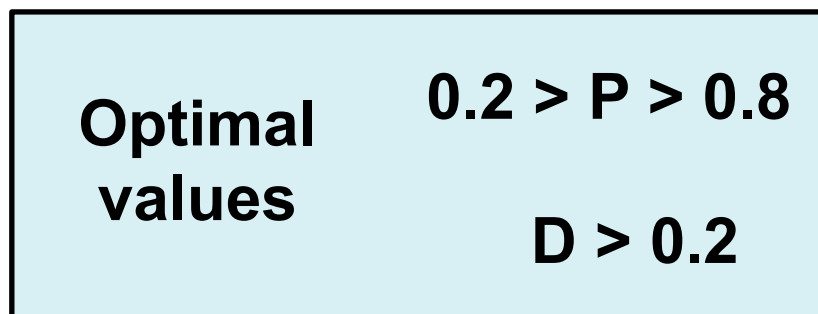
# Difficulty and Discrimination

18. Is the following molecule chiral?



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- D. No, because it does not have a carbon atom with four different substituents.

Proportion	Point-biserial correlation
0.49	0.40

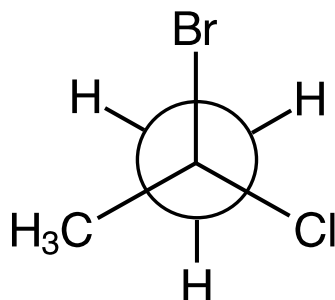


→ **Difficulty (P)**

→ **Discrimination (D)**

# Distractor Analysis

18. Is the following molecule chiral?



- A. Yes, because its mirror image cannot be overlaid on itself.
- B. Yes, because it has a carbon atom with four different substituents.
- C. No, because it is a meso compound.
- D. No, because it does not have a carbon atom with four different substituents.

Proportion	Point-biserial correlation
0.11	– 0.12
0.37	– 0.26
0.03	– 0.20
<b>0.49</b>	<b>0.40</b>

## Things to look for

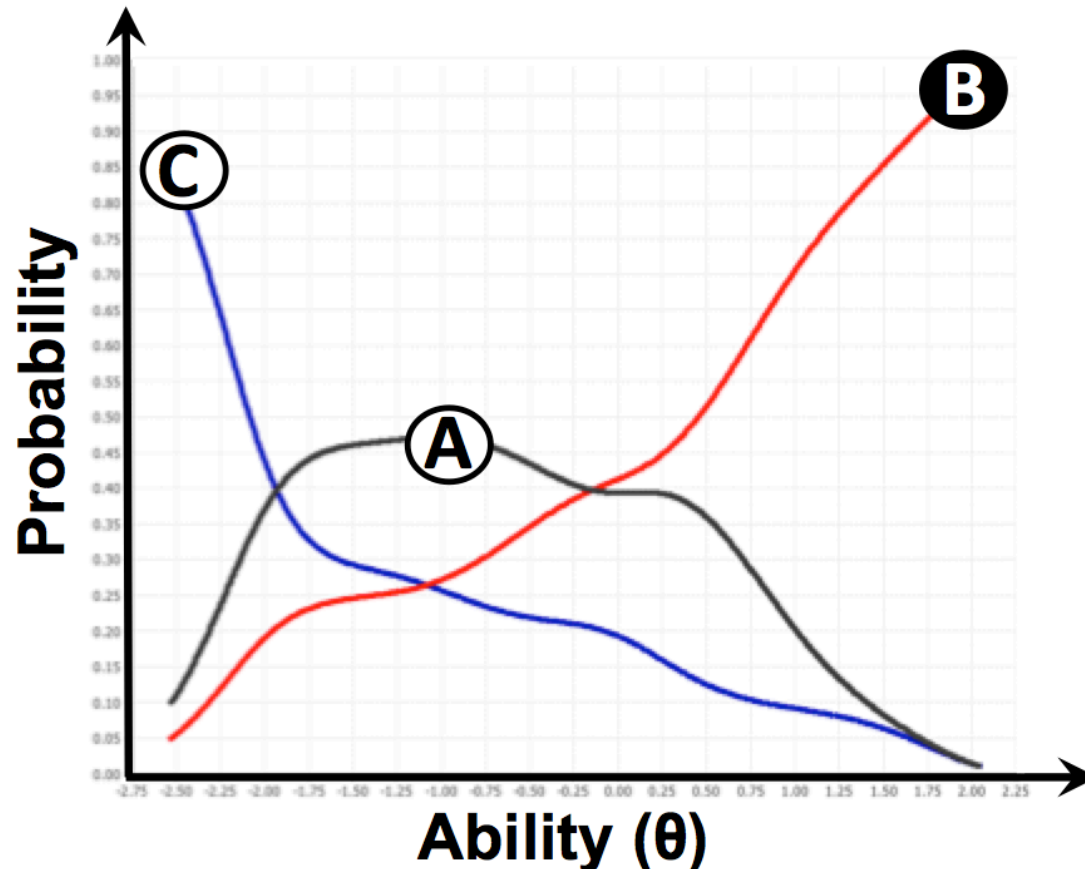
- Balance between the distractor proportions
- Negative point-biserial correlations for distractors
- Low P-values may indicate that distractor is not plausible
- Positive discrimination values for distractors



# Item Response Curve for Item 16

16. Which of the following can rotate plane-polarized light?

- A. a 50:50 mixture of enantiomers.
- B. a 50:50 mixture of diastereomers.
- C. a meso compound.



# Taxonomy of Writing MCQ

- Evidence-based approach
- 31 principles of writing MC questions
- Principles are related to
  - content
  - format
  - style
  - writing the stem
  - writing the choices

## HANDOUT 1 (Taxonomy)



# **Immediate Feedback Assessment Technique (Scratch-off Quiz)**

## **HANDOUT 2 (Quiz and Scratch-off)**

**Attempt to answer the questions on a scratch-off sheet and think about which principles of the taxonomy they violate.**

**Your Turn**

**Think-Pair-Square**

# Think – Write MCQ

1. Structure of alkenes
2. Stereospecificity of alkenes
3. Regioselectivity of alkenes
4. Oxidation/Reduction of alkenes

# Pair – Review MCQs

1. Structure of alkenes
2. Stereospecificity of alkenes
3. Regioselectivity of alkenes
4. Oxidation/Reduction of alkenes

# Square – Review MCQs

1. Structure of alkenes
2. Stereospecificity of alkenes
3. Regioselectivity of alkenes
4. Oxidation/Reduction of alkenes

**Turn in your set of questions  
(each group should have 4 MCQs)**