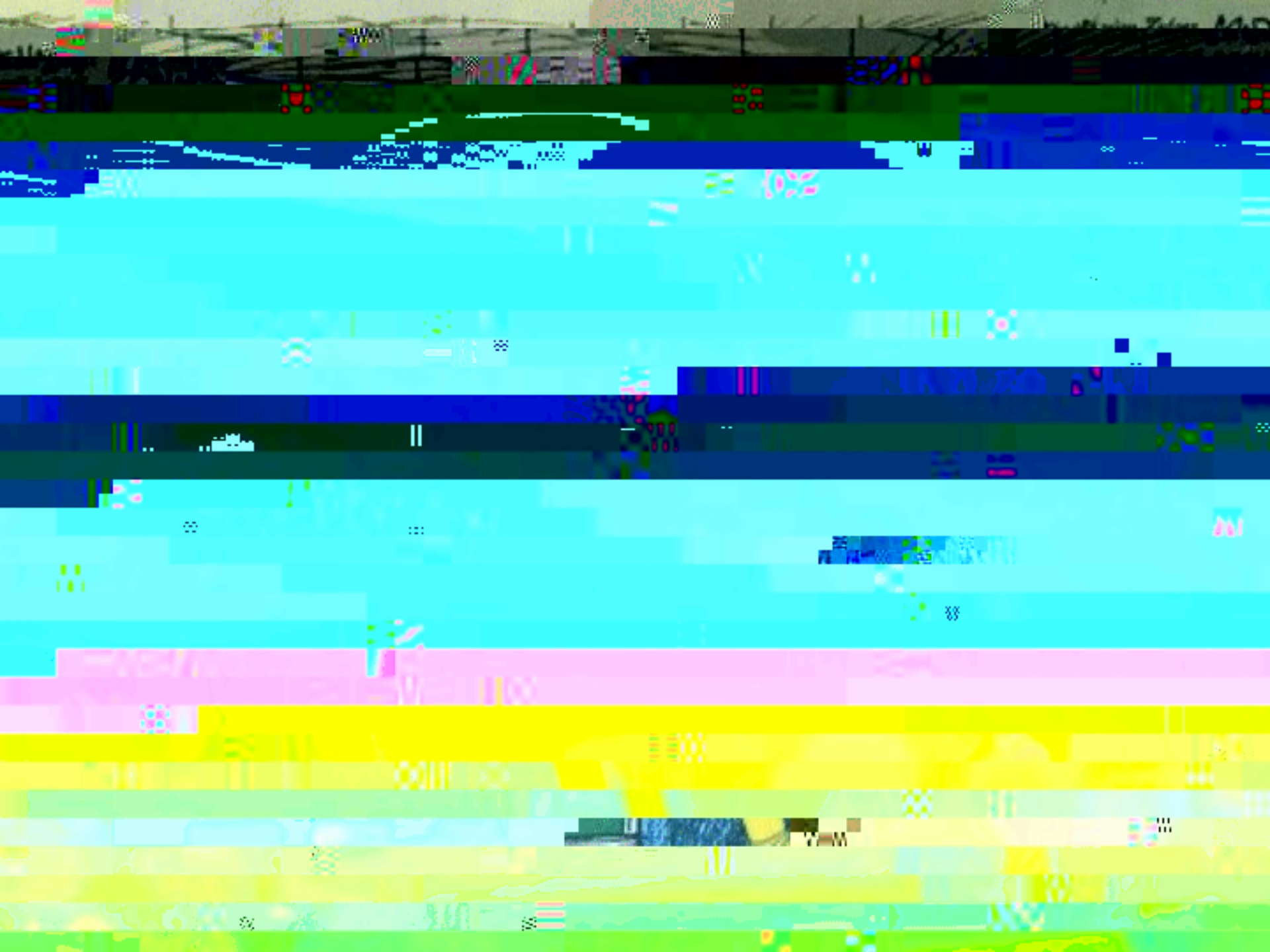
The Anatomy of High-Quality Multiple Choice Assessment Items



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Discussion Points	Outcome
• Knowledge Representations • Levels of Mathematics Proficiency • Appropriate Question Stems • Including Student Misconceptions in	

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- Grade level knowledge and skills
- Supports **future success in mathematics**
- Often are abstract representations of formal mathematical knowledge, but not always

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- Knowledge and skills that support the target content and are accumulated from previous learning
- **Prerequisite knowledge and skills** needed to be successful at the target knowledge and skills

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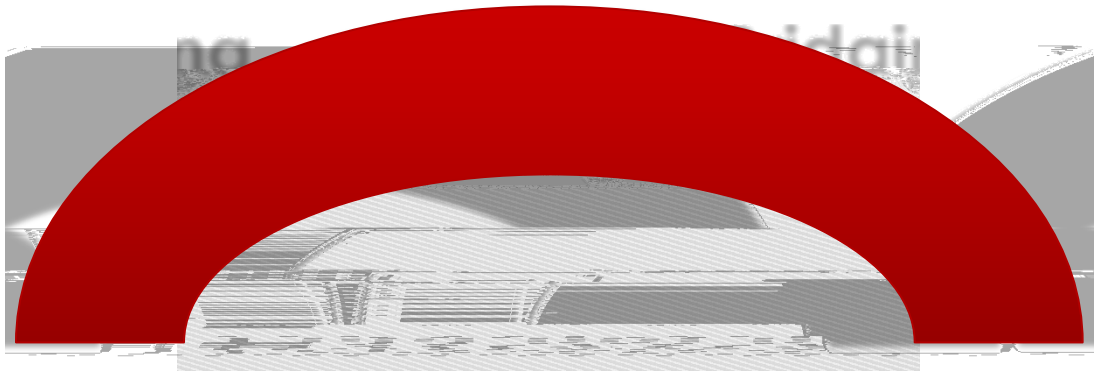
- Knowledge and skills needed to **connect or support students' learning** from the foundational knowledge to the target knowledge and skills
  - Often represents an integration of knowledge and skills (may be conceptual or model-based)
- The knowledge and skills that students learn from the teacher or instructional materials



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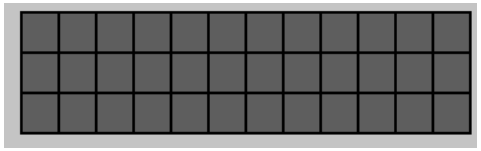
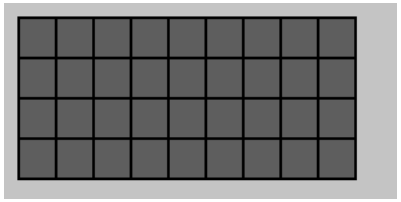
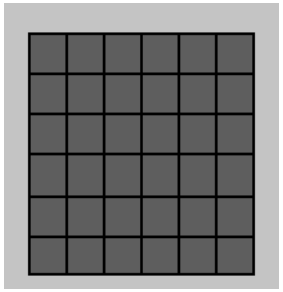
B. 

C. 

D. 

Curriculum Focal Points are:

- Framework of critical areas of mathematics instruction
- A mathematical theme, not a single TEKS statement

Before writing assessments, it is important to:

- Analyze the focal point description to identify key target skills
- Analyze related TEKS statements
- Synthesize the overlaying skills

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- Become familiar with the TEKS standard (content standard) for which you are writing a test item
- Articulate the **TARGET SKILLS**
- Articulate the **FOUNDATIONAL SKILLS**
- Articulate the **BRIDGING SKILLS**

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- Demonstrate an integrated and functional grasp of mathematical ideas
- Understand specific task as it relates to a whole concept
-

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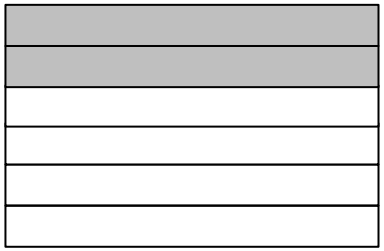
TEKS 6.4E

The student applies mathematical process standards to develop an understanding of proportional relationships in problem situations. The student is expected to:

(E) **Represent ratios and percents with concrete models, fractions, and decimals.**

Which model has an equivalent ratio of shaded parts to total parts as this rectangle?



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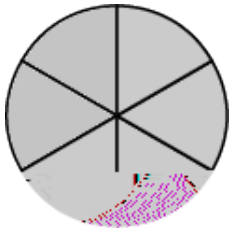

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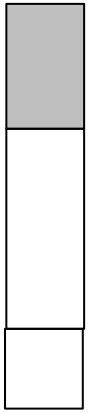

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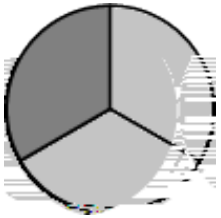

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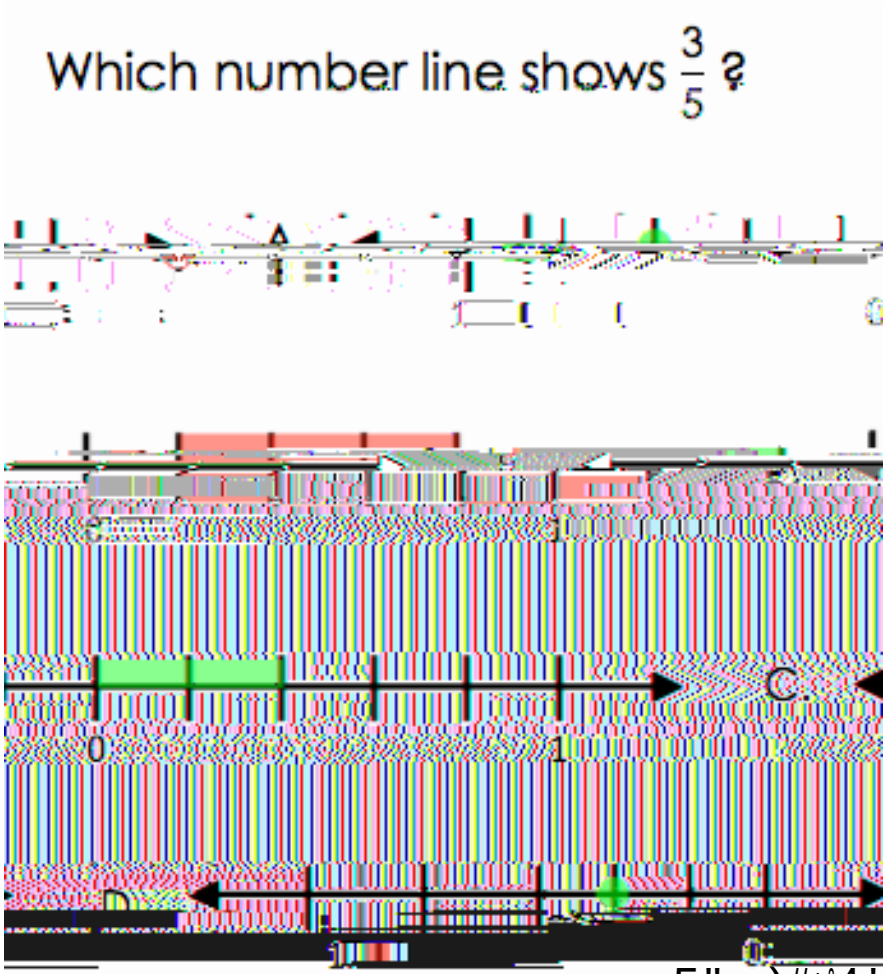
TEKS 3.3D

The student applies mathematical process standards to represent and explain fractional units. The student is expected to:

(D) **Compose and decompose a fraction with a numerator greater than zero and less than or equal to as a sum of parts 1/ .**



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- Use formal language or symbolic representations
- Carry out accurate computations
- Follow multiple steps sequentially
- Make proper use of algorithm and properties

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TEKS 7.11A

The stub8.#)6$.43&!3$)#:&

Solve for w:

$$\frac{w + 12}{3} = 20$$

A. 72

[redacted]

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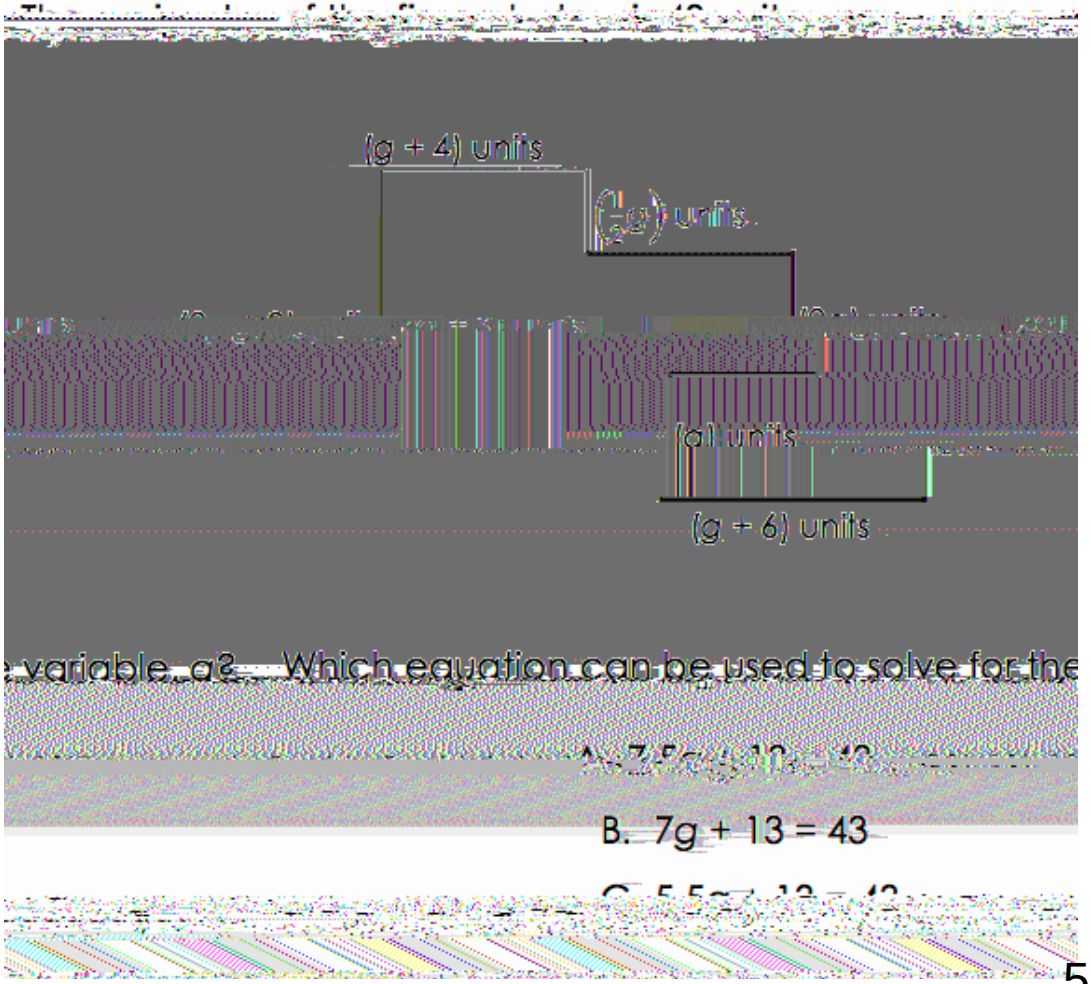
(g + 4) units
(g) units
(g) units
(g + 6) units
variable, g?
Which equation can be used to solve for the
B. 7g + 13 = 43

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TEKS 3.4A

The student applies mathematical process standards to develop and use strategies and methods for whole number computations in order to solve problems with efficiency and accuracy. The student is expected to:

(A) **Solve with fluency one-**

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Easy

- Basic Knowledge
- Skills that are familiar to students
- Sometimes conceptually based

Medium

Difficult

- Skills that are peripheral to curriculum
- Not all students will have mastered these

(Cheng, 2005)

,+) * &G4+#D&

- In your packet of materials is a 4 x 3 matrix with the 4 strands of mathematical proficiency along the top and 3 levels of difficulty along the left side.
- Take a blue set of cards. They should have a number in the corner, ranging from 1 to 12.
- As you read each item, determine the strand of mathematical proficiency and relative level of difficulty.
- Write the number associated with the item in the appropriate cell.

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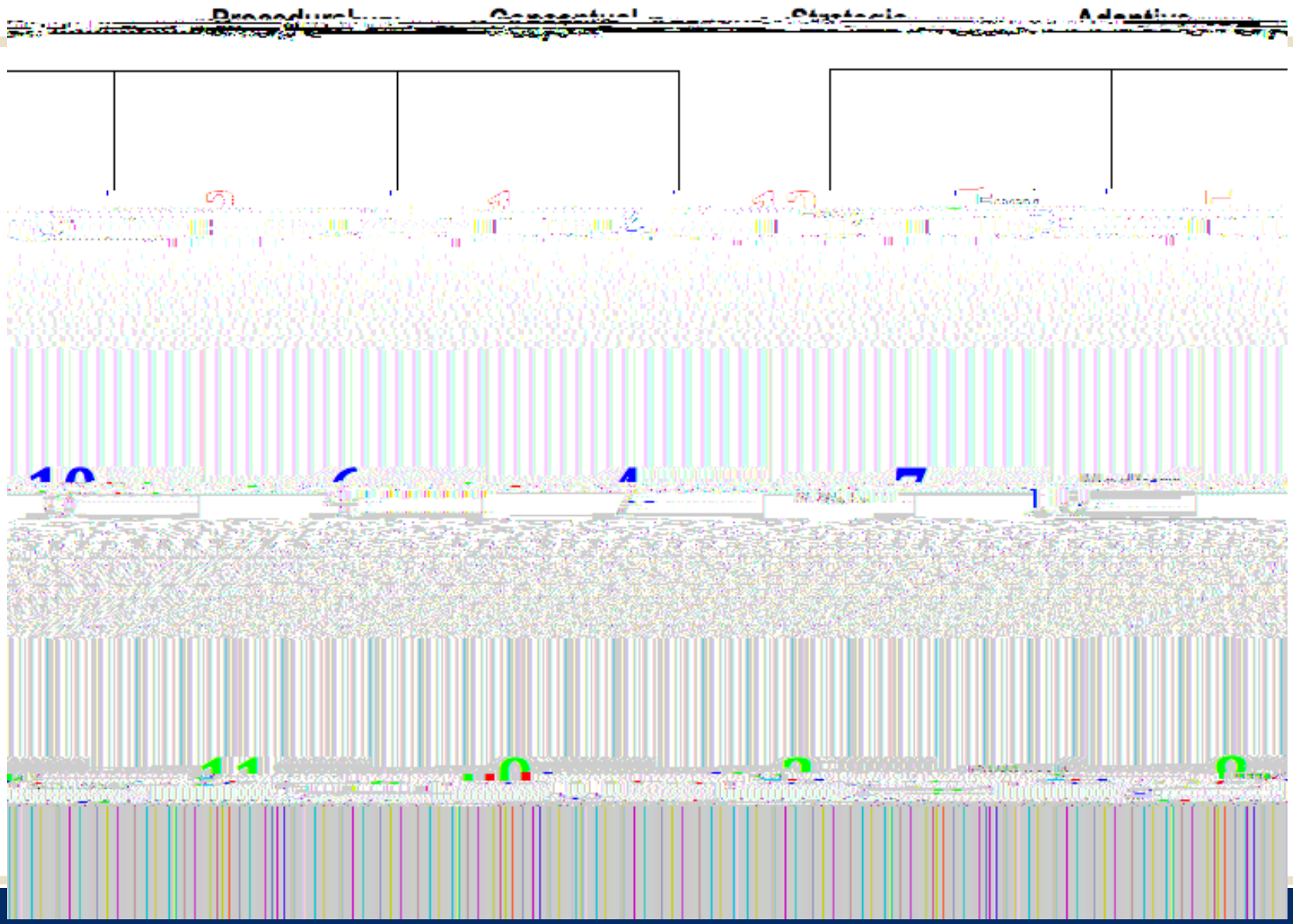

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- **Knowledge Representations**
  - Target knowledge and skills
  - Bridging knowledge and skills
  - Found -0.2 (e) -0.2 (e) -0.2..m /TT6 1 (u(45 (n)-0.2 (d) 0 0/) -1 (0) -1 /Cs2 cs

Assessment Item Development

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- Make all distractors plausible.
  - If you're interested in obtaining more information about students' understanding, create distractors that represent common misconceptions may have about the content being assessed
- Keep all options in an item homogenous in content and grammatical structure.
- Keep the length of options brief and fairly consistent.
- Phrase options positively, not negatively.

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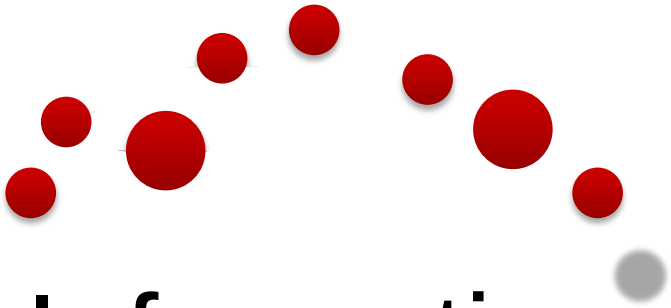

Information

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(%%)%% *)'+&9)P)3"2 *)'+&

Teachers should agree to analyze the assessments around the same set of criteria. The decisions should be directed toward:

Validation about the appropriateness of the assessment

Ensuring the assessment is congruent to the stated mastery objective and/or state or district standards

Consistency of opinion about the assessment and evaluation of the work

Adjustments in teacher directions and support for all students

Data-Driven Decision Making

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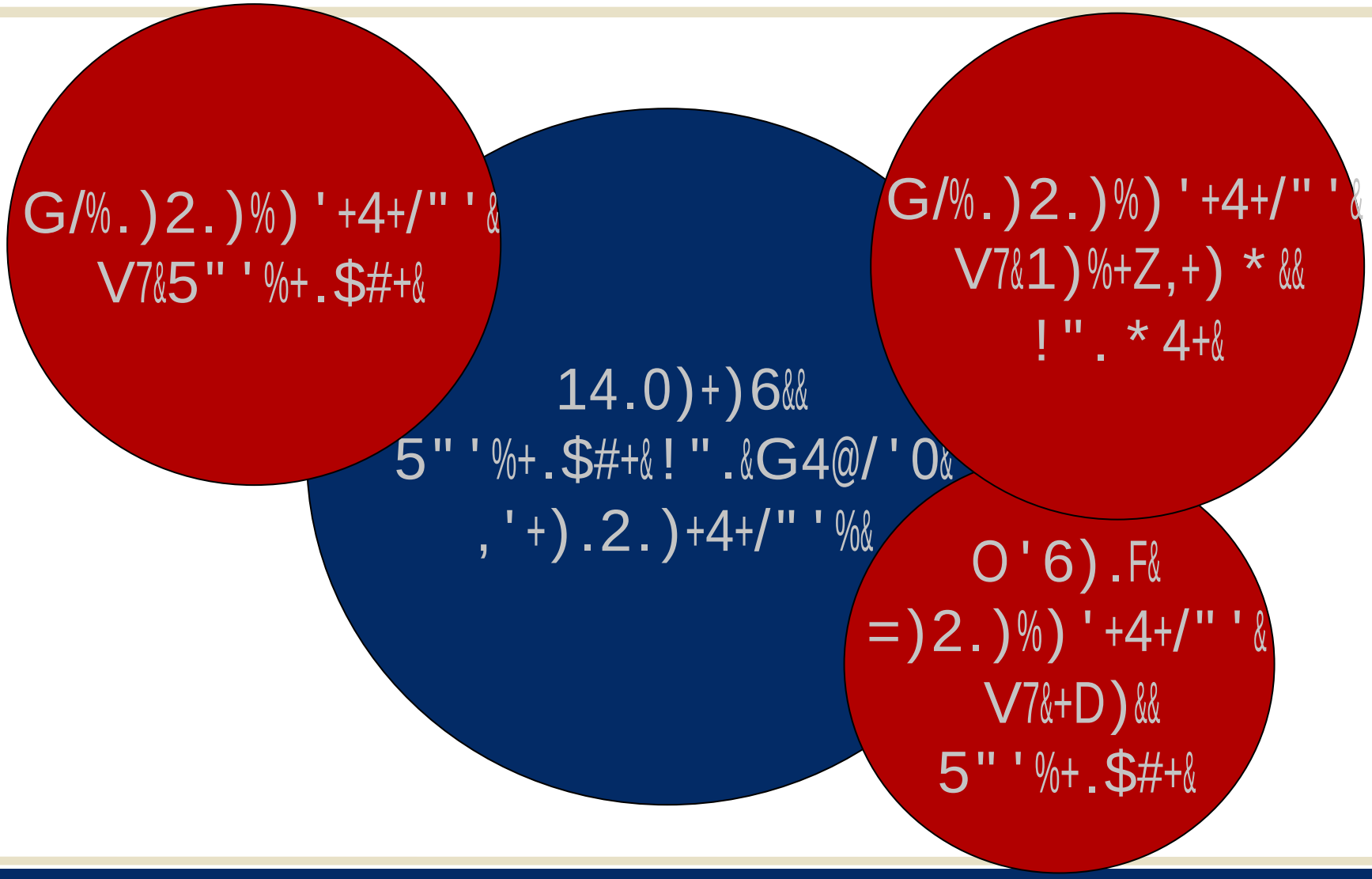

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- One of the most common ways to examine student performance data is by making normative comparisons of their **overall** performance:

Grade	Teacher	Student	Number Correct	Percent Correct

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- Similarly, even though students may have responded correctly to the same number of items within a given sub-level, again this does not necessarily mean they have mastered the same skills or have the same level of proficiency with the targeted skill

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Responses to these questions can then be used to further guide instructional planning. For example:

Target instruction to address the

Did students who got the item incorrect select the same distractor?

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Now it's time to consider the **BIG** question .

Do I need to look at the data this closely for **every** student in my classroom?

Our response .

Probably not. For students who are on track, monitoring their progress using the overall score is probably enough. For students

?" *)&!/'43&1D"$0D+%&]&14@)F (<4:%&

- **Assessment and instruction should be considered together** – performance on assessments can inform instruction and assessments can be specifically designed to provide students with opportunities to demonstrate what they've learned during instruction.
- When considering the level of knowledge represented while designing a test item, start with the outcome (target knowledge) in mind. Then consider what **foundational knowledge** the student needs and the **bridging knowledge** that will help the student acquire the **target knowledge** or skill.

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- Pooja Shivraj Ph.D.