Building Assessment Into Mathematics Instruction

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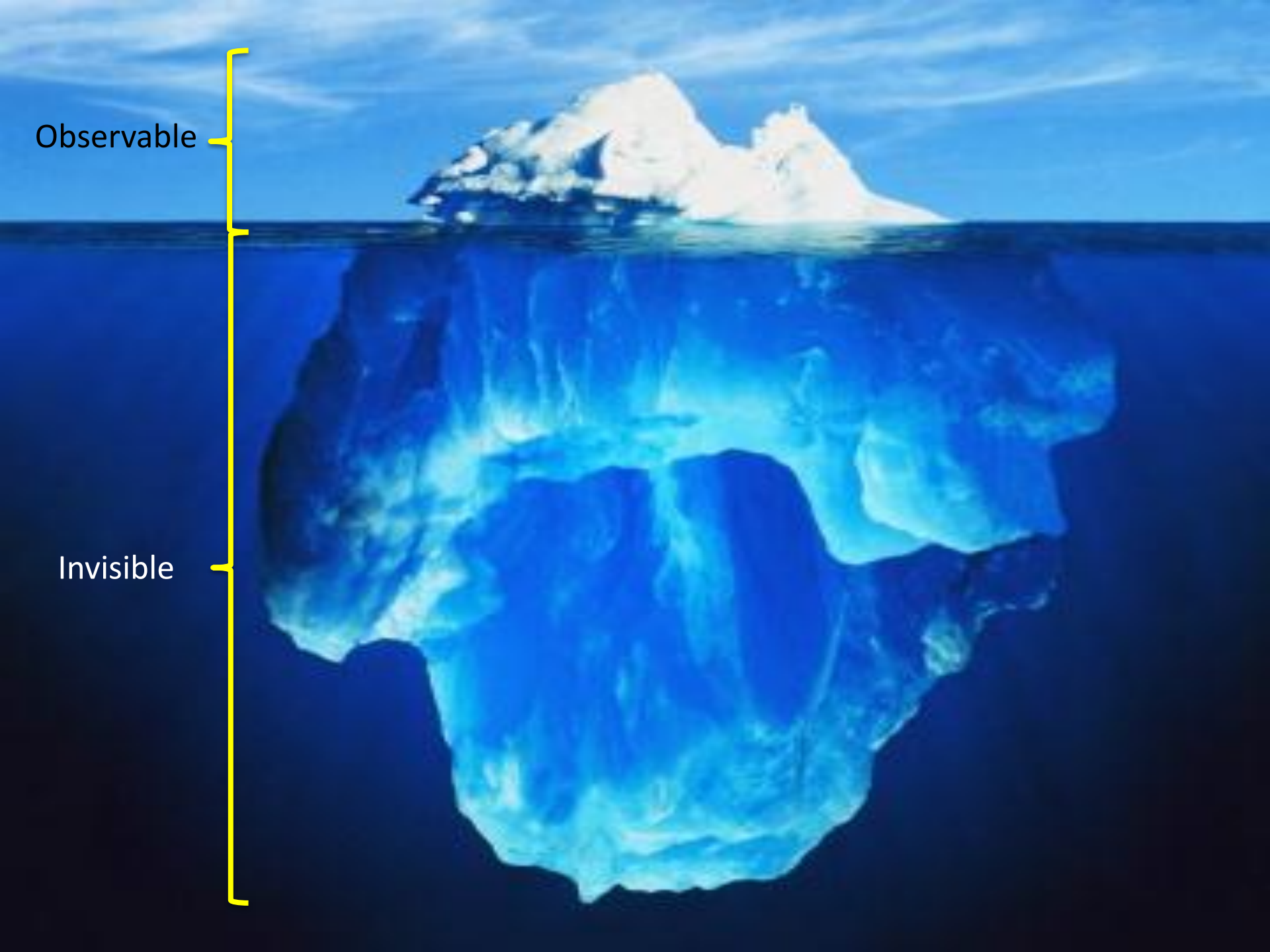
Bureau of Learning Delivery

Department of Education

Observable

Invisible

DepEd Order No. 8, s. 2015

Classroom Assessment in the K to 12 Basic Education Program

https://www.youtube.com/watch?v=Eje4bAcpoJM

K to 12 Classroom Assessment

- A joint process that involves both teachers and learners

- An integral part of teaching and learning

- Facilitates the development of learners' higher-order thinking and 21st-century skills

- The "*ongoing process of identifying, gathering, organizing, and interpreting quantitative and qualitative information about what learners know and can do*" (DO #8, s. 2015, p. 1)
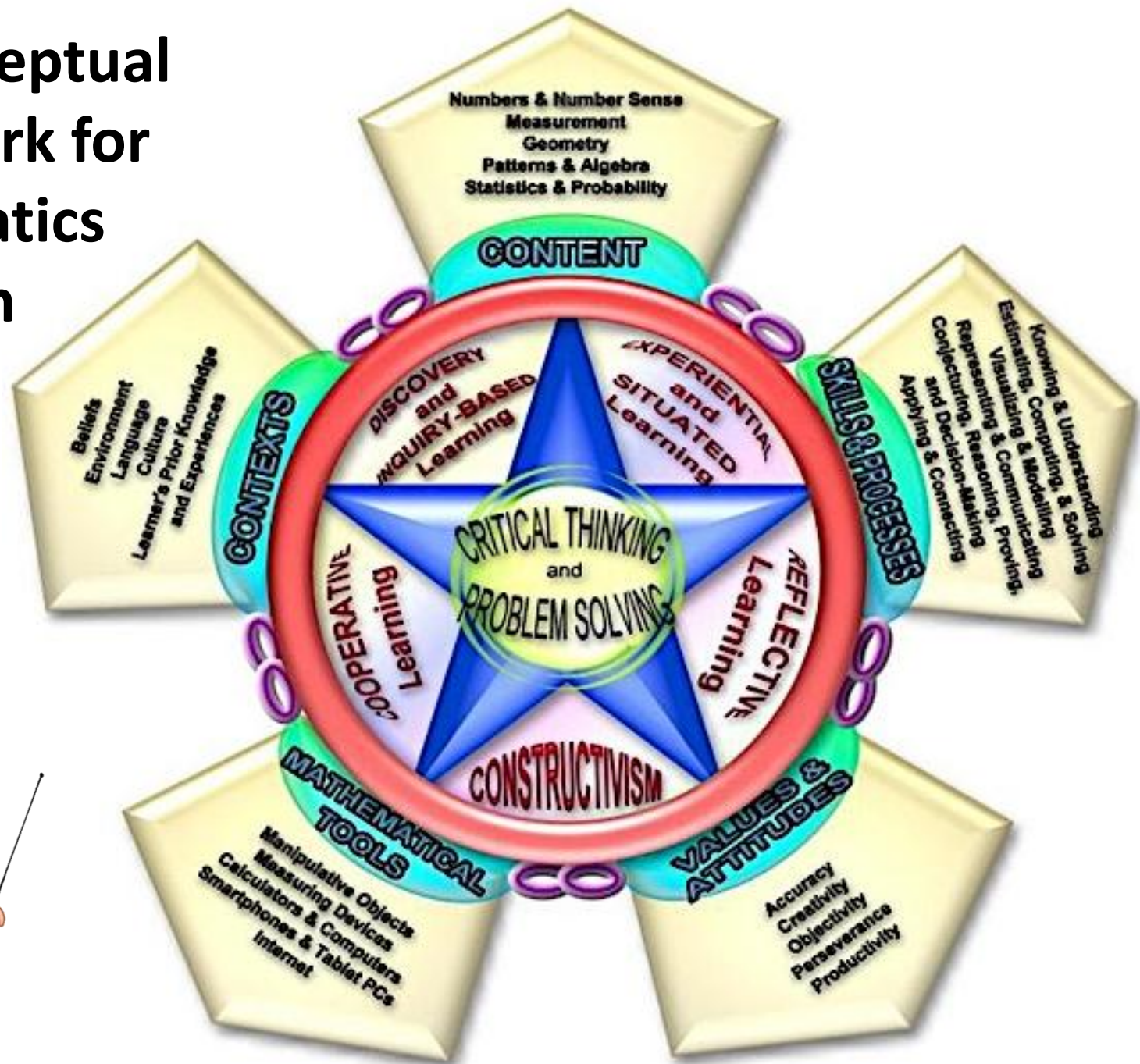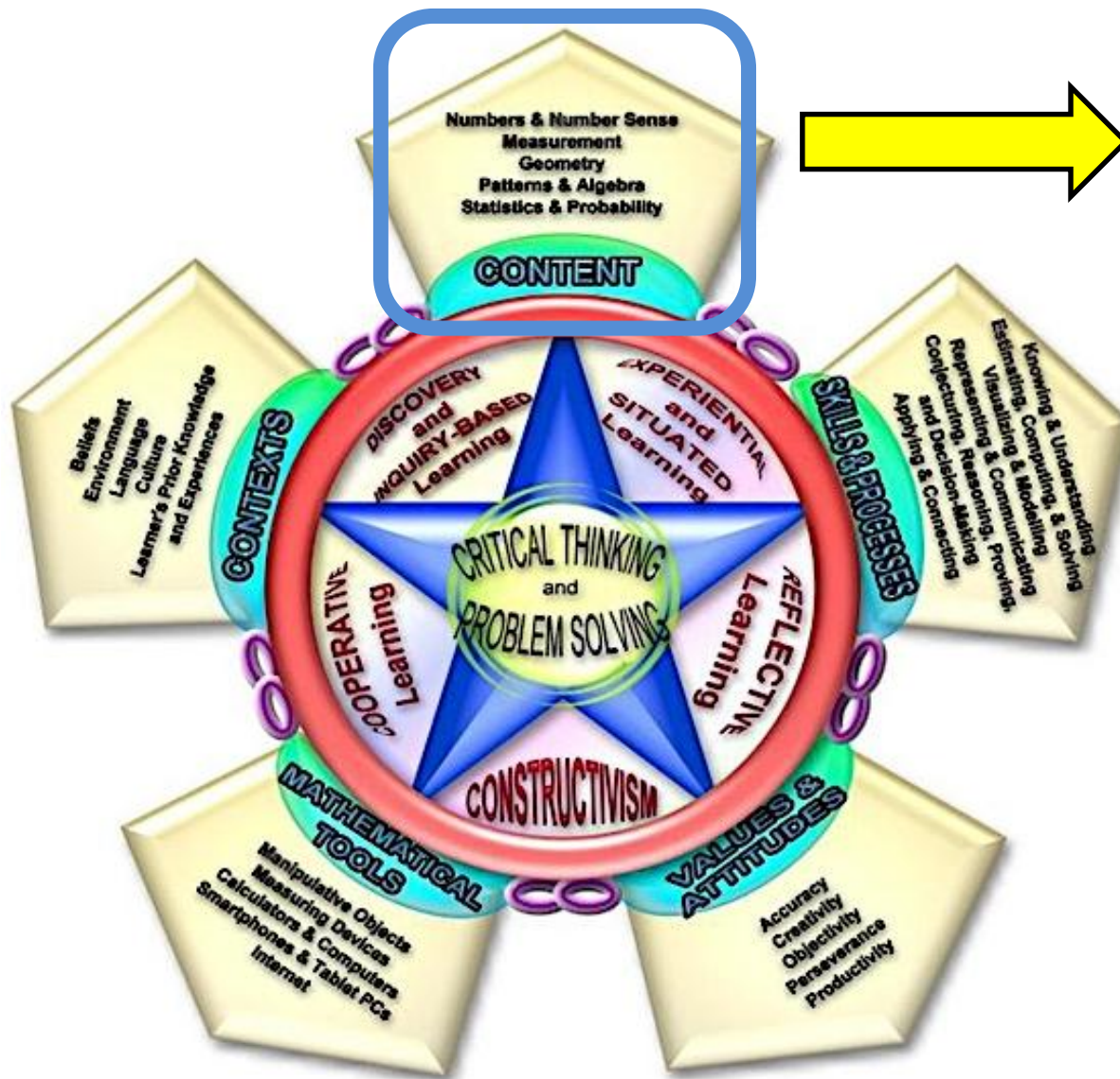
Assessing is part of [mathematics] teaching!

- Using *formative assessments* to gather cross-sectional views of students' work, progress and performance to adjust and improve instruction

- Using appropriate and useful *summative assessments* to determine the impact of mathematical learning activities on students' learning

- Using *authentic assessments* and constructing *rubrics* that reflect knowledge of students' thinking processes and errors

SEI-DOST & MATHTED, 2011

Assessment Methods

- What are you assessing – knowledge, skills or both?

- Which method would best allow your learners to demonstrate what they have learned?

- Which method would make it easy and manageable for you to gather evidence of your learners' progress over time?
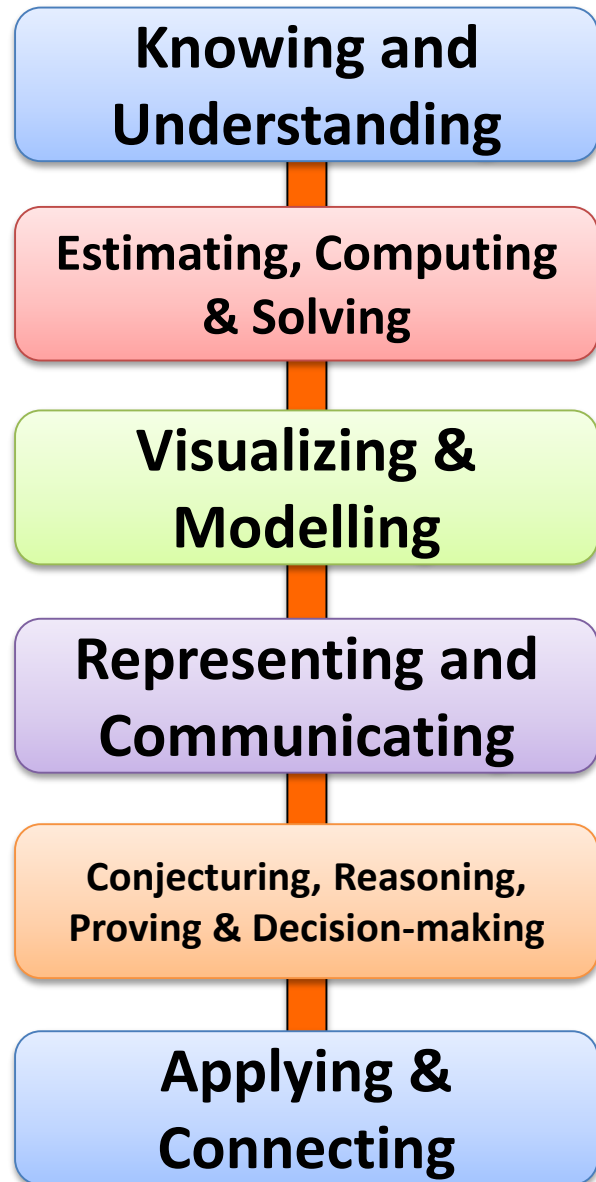
DepEd, 2016

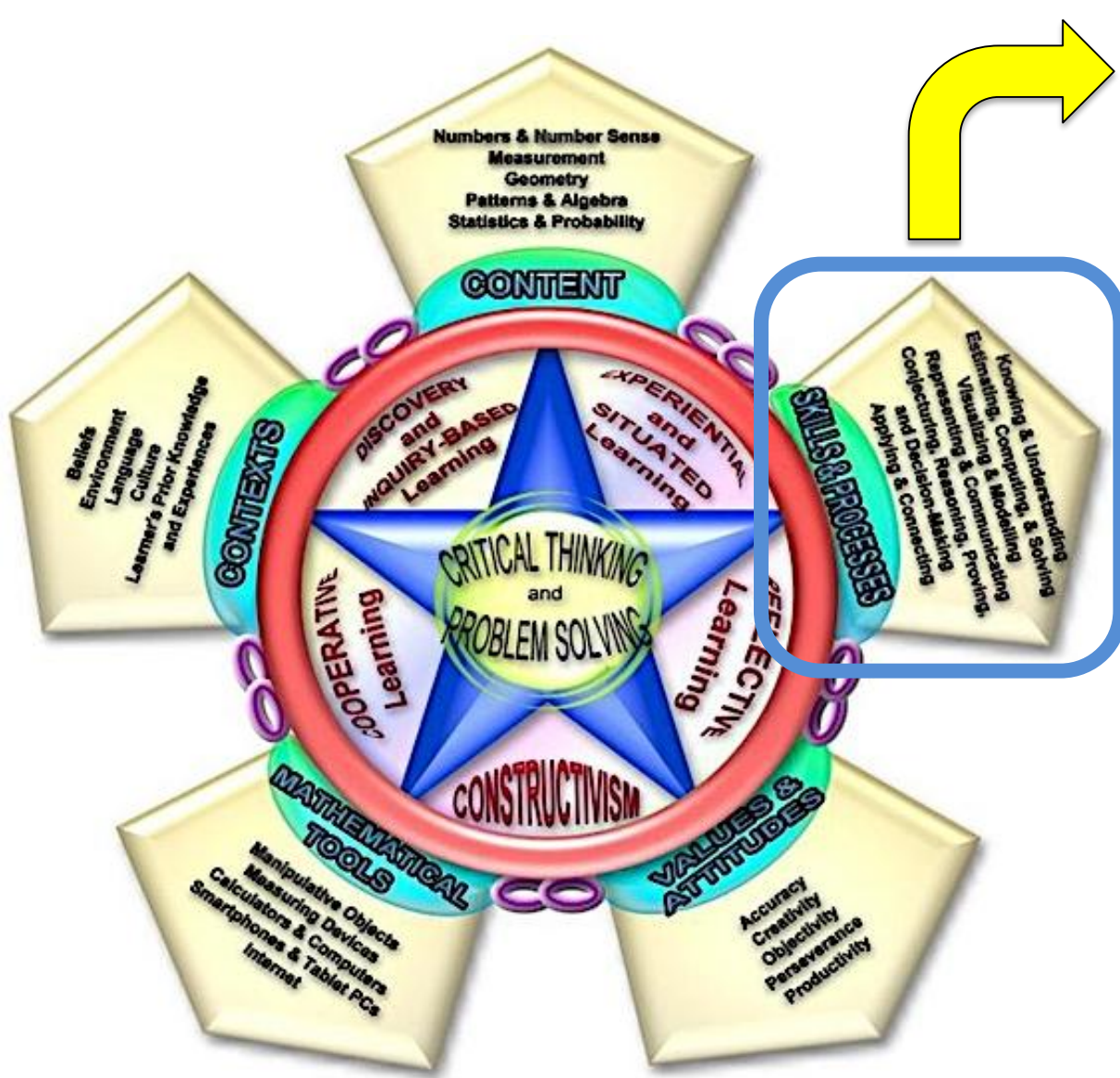# The Conceptual Framework for Mathematics Education
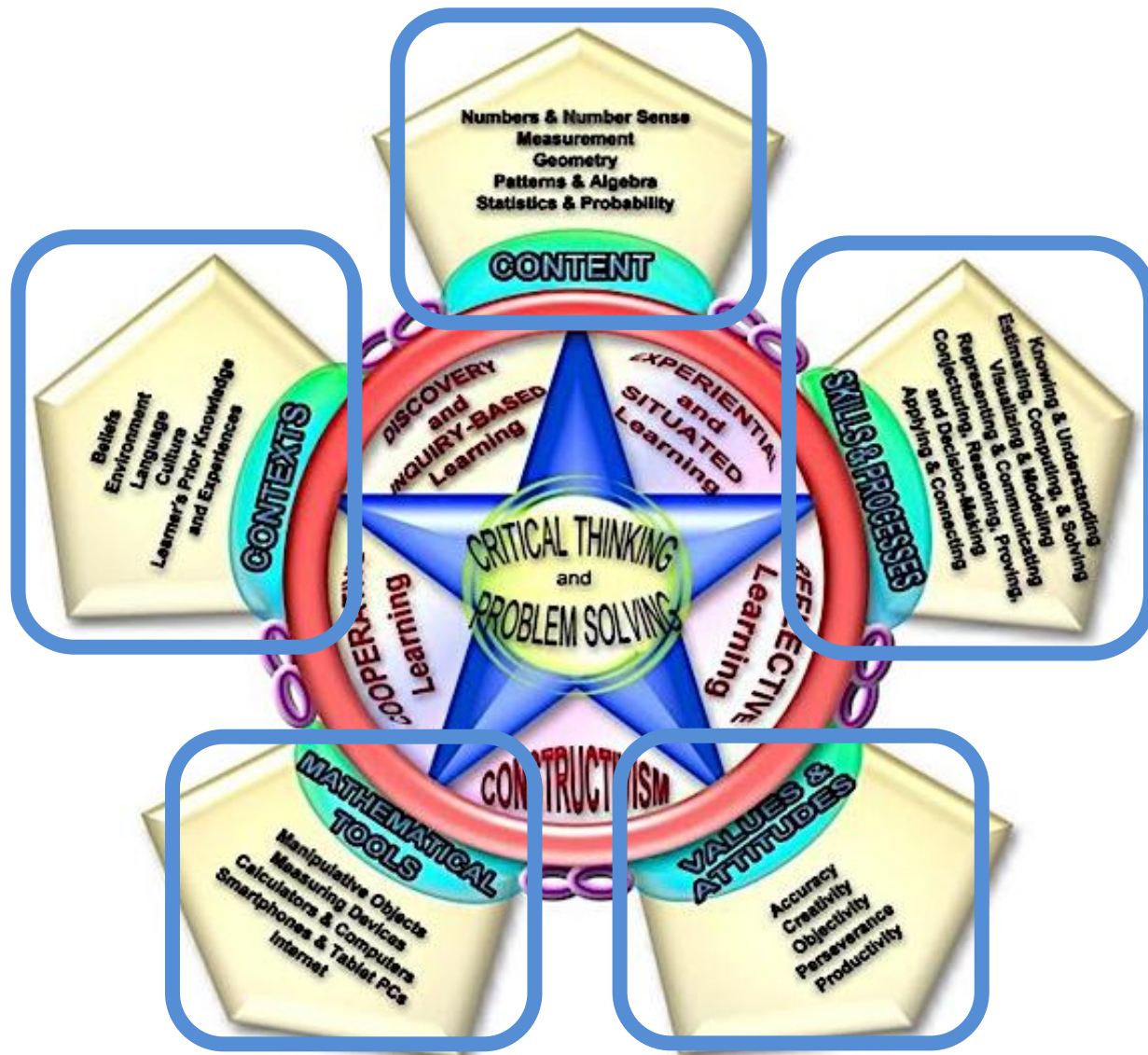
CONTENT

Numbers & Number Sense
Measurement
Geometry
Patterns & Algebra
Statistics & Probability

Numbers and Number Sense

Measurement

Geometry

Patterns and Algebra

Statistics and Probability

CONTENT

Numbers & Number Sense
Measurement
Geometry
Patterns & Algebra
Statistics & Probability

CONTEXTS

Beliefs
Environment
Language
Culture
Learner's Prior Knowledge
and Experiences

SKILLS & PROCESSES

Knowing & Understanding
Estimating, Computing, & Solving
Visualizing & Modelling
Representing, Reasoning, Proving,
and Decision-Making
Applying & Connecting

DISCOVERY and INQUIRY-BASED Learning

EXPERIENTIAL and SITUATED Learning

COOPERATIVE Learning

REFLECTIVE Learning

CRITICAL THINKING and PROBLEM SOLVING

CONSTRUCTIVISM

MATHEMATICAL TOOLS

Manipulative Objects
Measuring Devices
Calculators & Computers
Smartphones & Tablet PCs
Internet

VALUES & ATTITUDES

Accuracy
Creativity
Objectivity
Perseverance
Productivity

Knowing and Understanding

Estimating, Computing & Solving

Visualizing & Modelling

Representing and Communicating

Conjecturing, Reasoning, Proving & Decision-making

Applying & Connecting

Assessment Methods

- What are you assessing – knowledge, skills or both?

- Which method would best allow your learners to demonstrate what they have learned?

- Which method would make it easy and manageable for you to gather evidence of your learners' progress over time?

DepEd, 2016

Assessment Methods

- Performance tasks

- Writing and journals

- Self-assessment

- Tests

- Observations

- Interviews

RATIO AND PROPORTION
(Grade 5)

CODES	LEARNING COMPETENCIES
M5NS-IIh-122	Visualizes the ratio of 2 given numbers
M5NS-IIh-123	Expresses the ratio using either the colon (:) or fraction
M5NS-IIi-124	Identifies and writes equivalent ratios
M5NS-IIi-125	Expresses ratios in their simplest forms
M5NS-IIi-126	Finds the missing term in a pair of equivalent ratios
M5NS-IIj-127	Defines and describes a proportion
M5NS-IIj-128	Recognizes when two quantities are in direct proportion

RATIO AND PROPORTION
(Grade 6)

| CODES	LEARNING COMPETENCIES
M6NS-IIa-129	Expresses one value as a fraction of another given their ratio and vice versa
M6NS-IIa-130	Finds how many times one value is as large as another given their ratio and vice versa
M6NS-IIb-131	Defines and illustrates the meaning of ratio and proportion using concrete of pictorial models
M6NS-IIb-132	Sets up proportions for groups of objects or numbers and for given situations
M6NS-IIb-133	Finds a missing term in a proportion (direct, inverse, and partitive)
M6NS-IIc-134	Solves problems involving direct proportion, partitive proportion, and inverse proportion in different contexts such as distance, rate and time using appropriate strategies and tools
M6NS-IId-135	Creates problems involving ratio and proportion, with reasonable answers

Let's revisit!
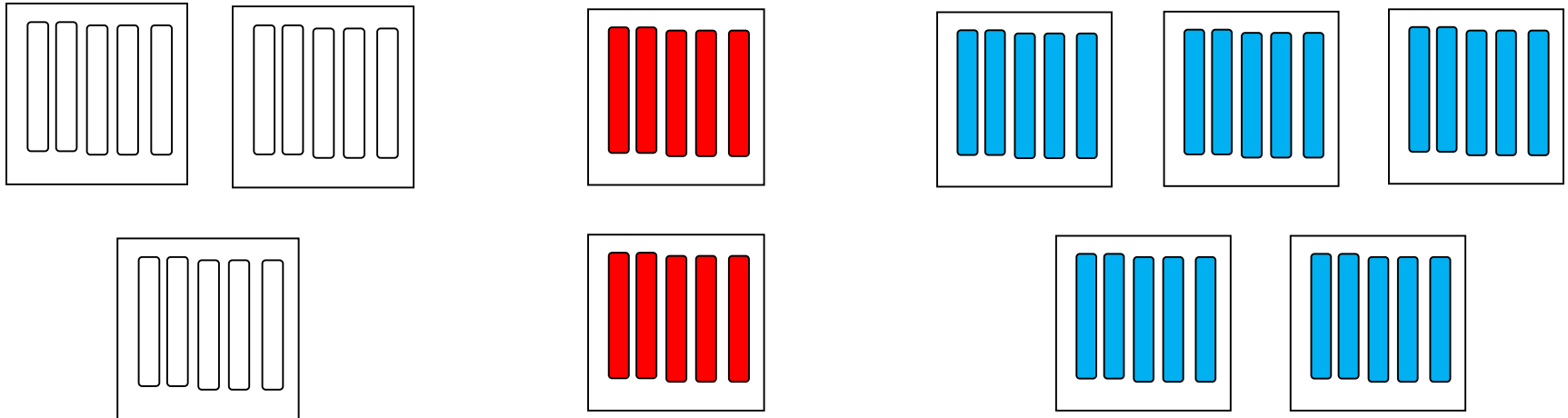
Find the ratio of:

The number of pieces of red chalk to the number of pieces of white chalk

10 : 15
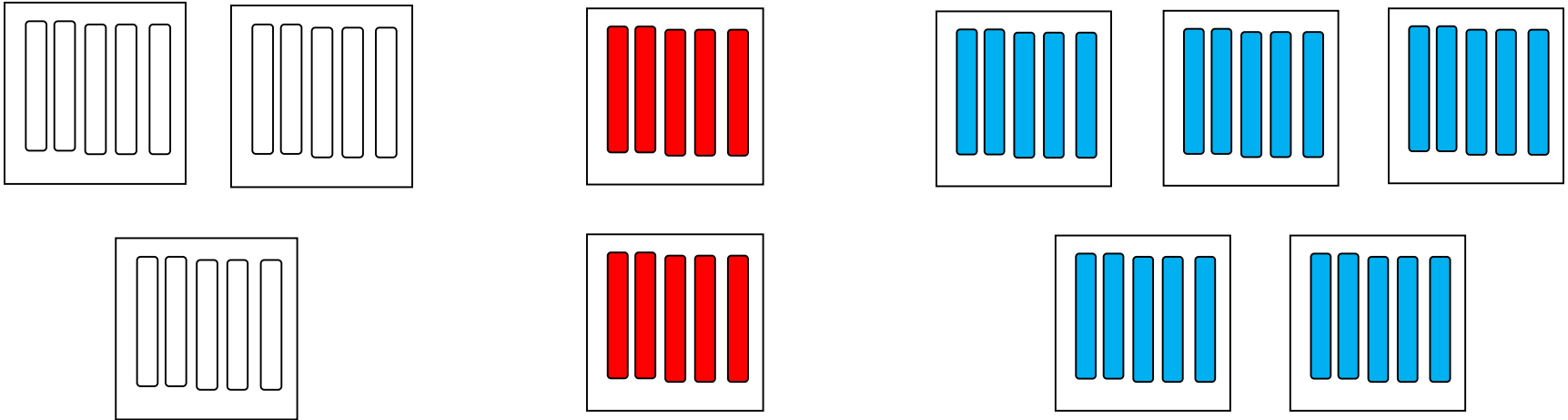
Let's revisit!
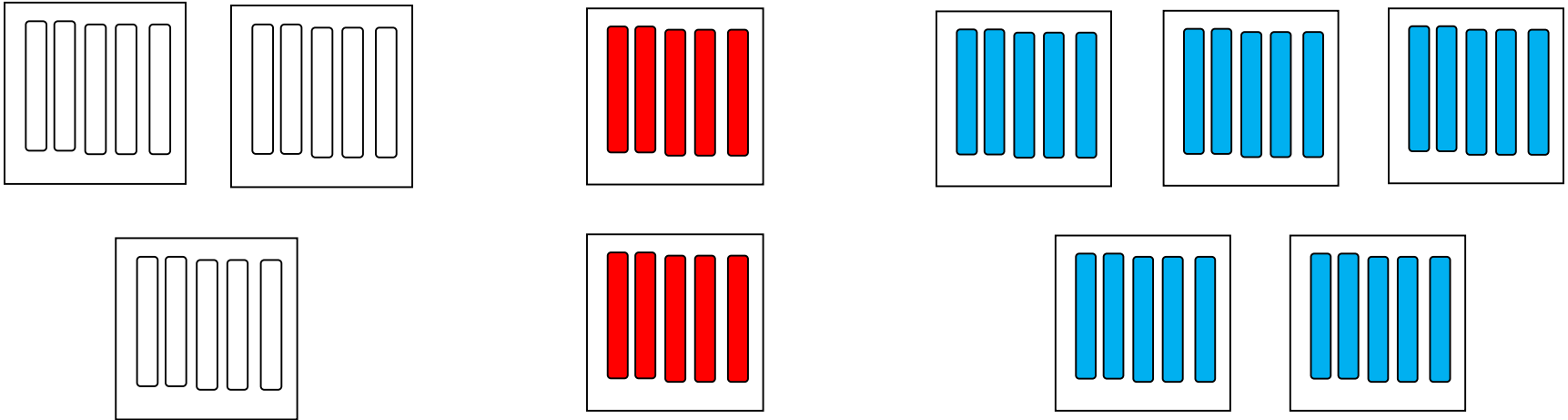
Find the ratio of:

The number of pieces of white chalk to the number of pieces of blue chalk
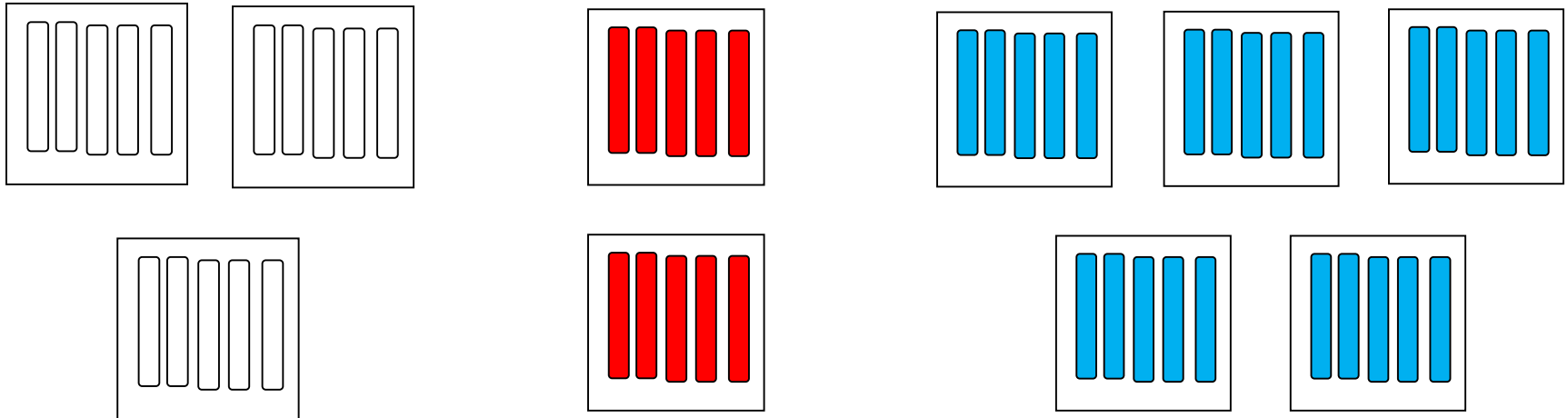
15 : 25

Find the ratio of:

The number of pieces of blue chalk to the number of pieces of red chalk
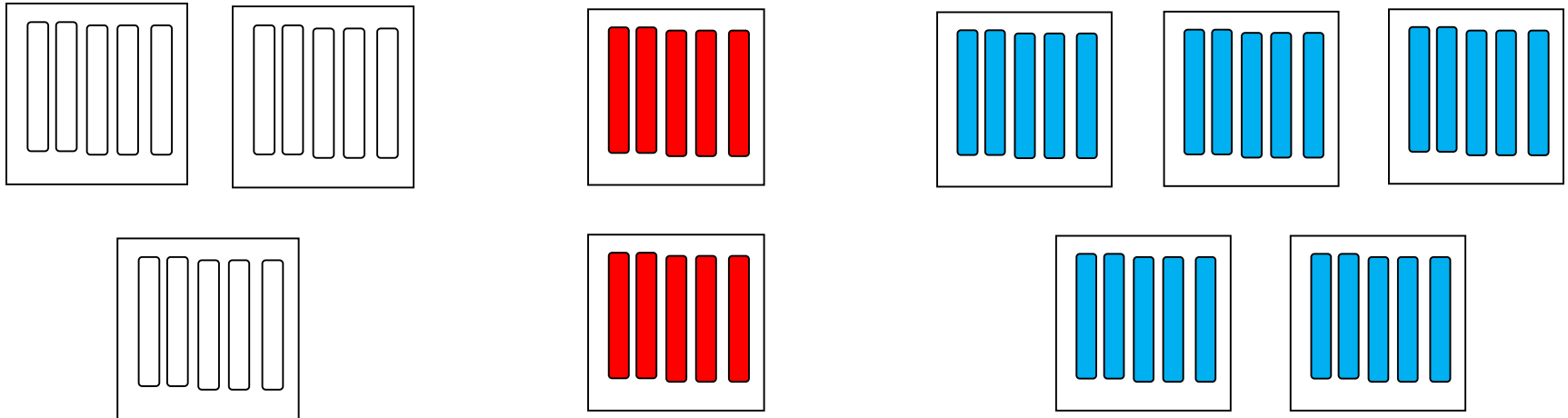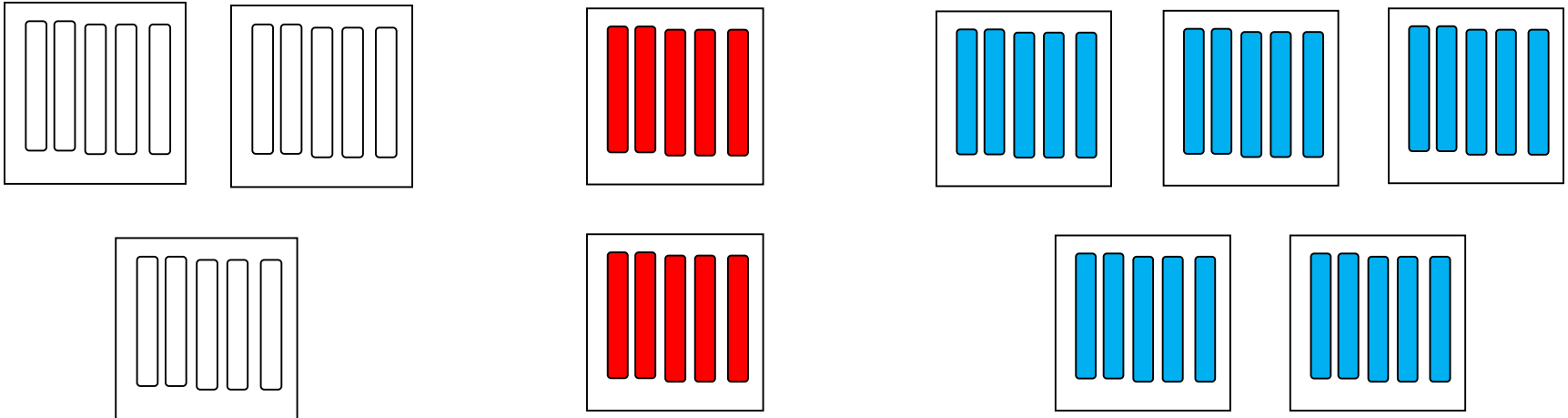
25 : 10

Let's revisit!

Find the ratio of:

The number of pieces of blue chalk to the total number of pieces of chalk

25 : 50

Let's revisit!

Find the ratio of:

The number of pieces of blue chalk to the total number of pieces of chalk

25 : 50

Let's revisit!

Find the ratio of:

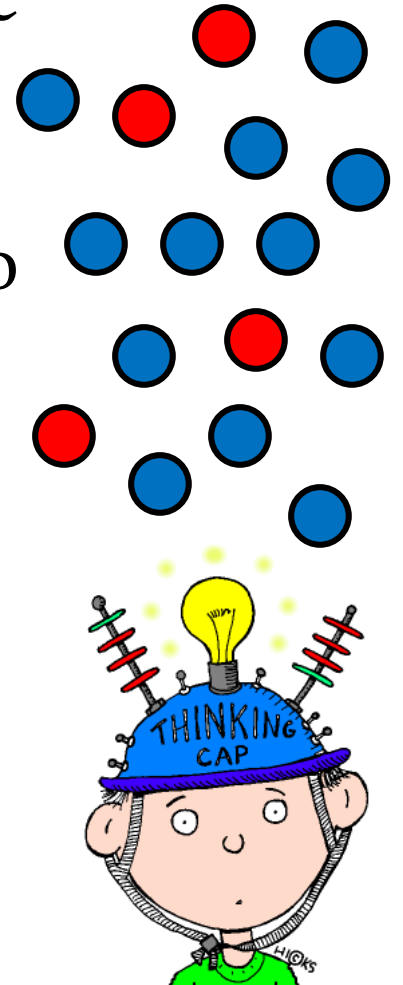The number of boxes of red chalk to the number of boxes of white chalk

2 : 3

Benjamin's Buttons

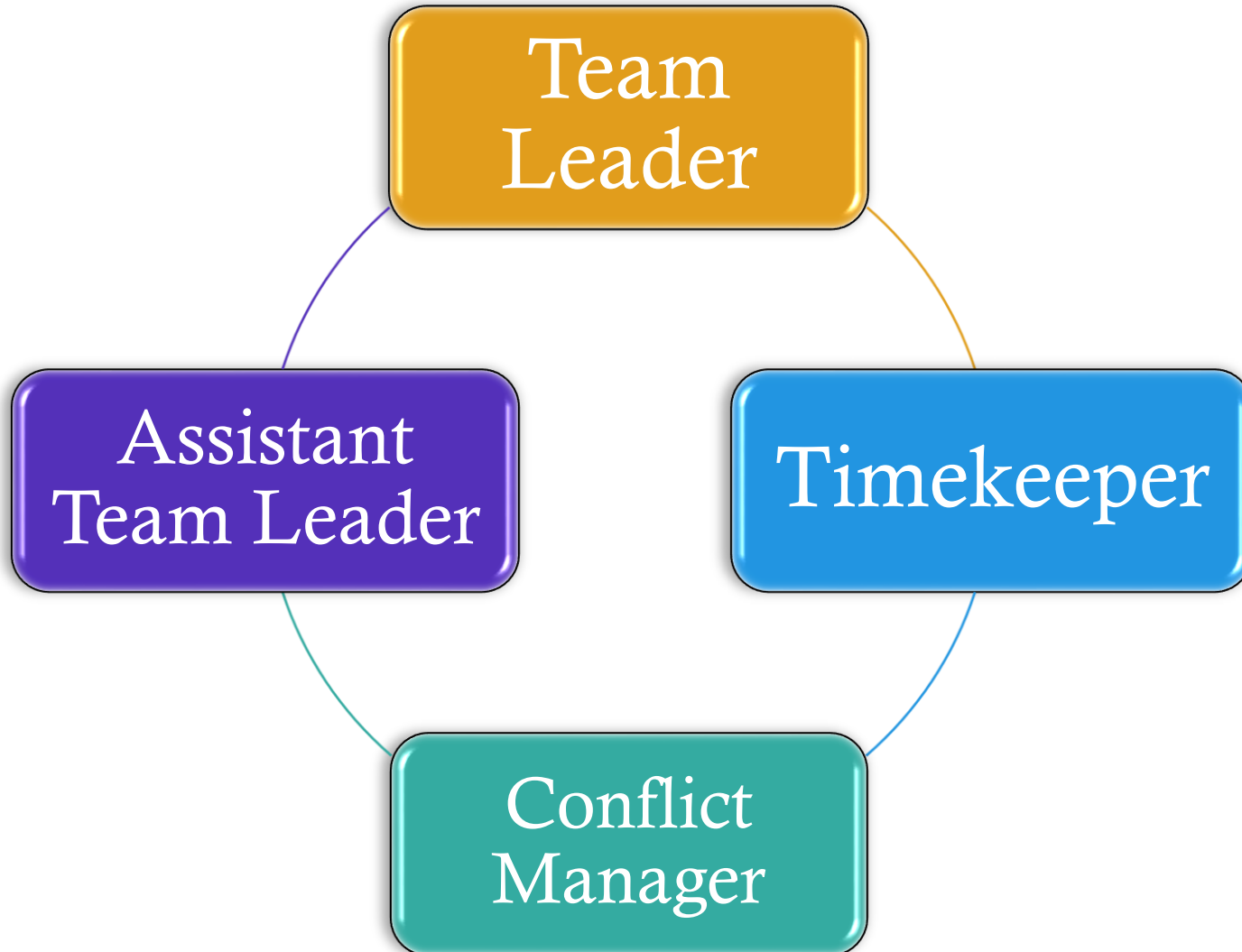Benjamin has 4 red buttons and 12 blue buttons.

He says that the ratio of the red buttons to the blue buttons is 1 : 3.

But his friend, Jack, says it is actually 2 : 6.

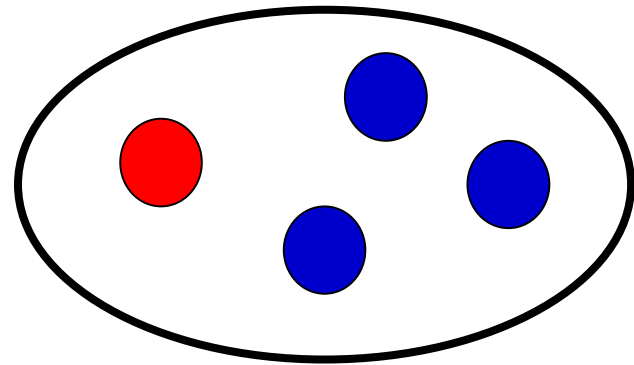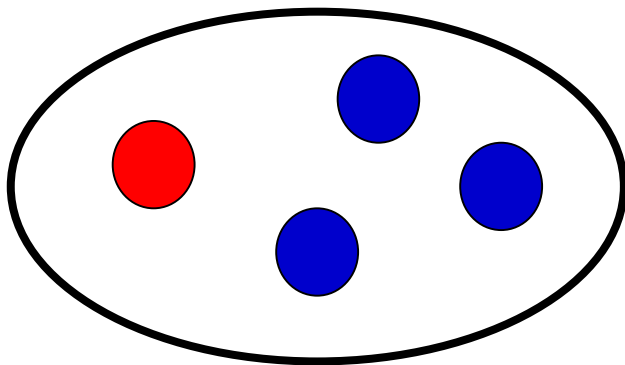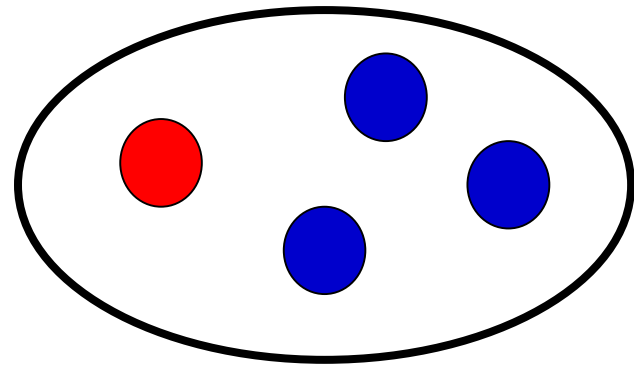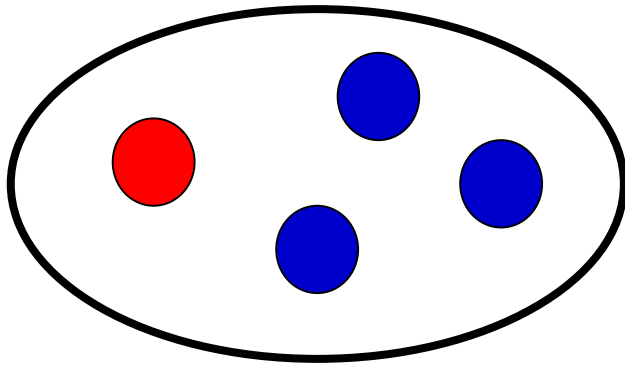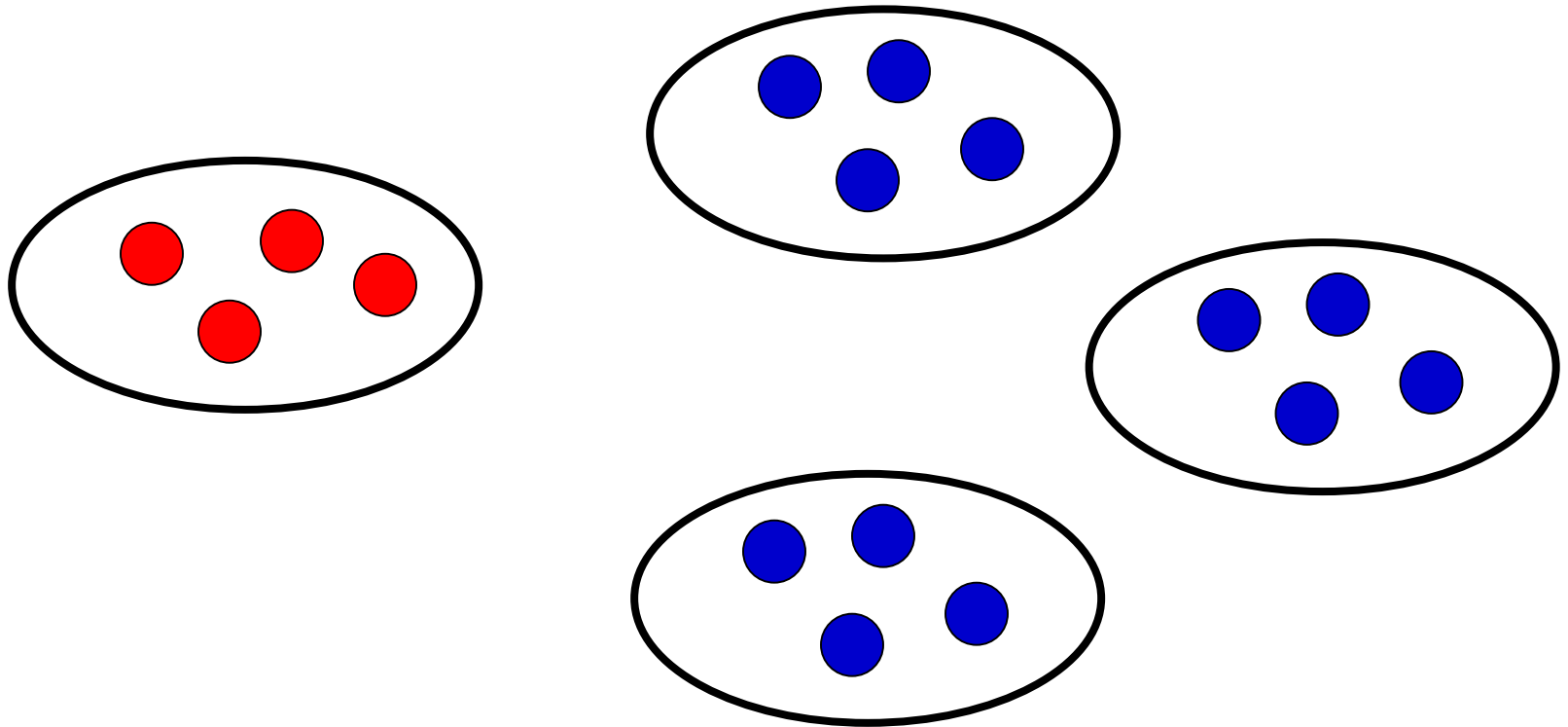Which of them is correct? Why?

Group Roles
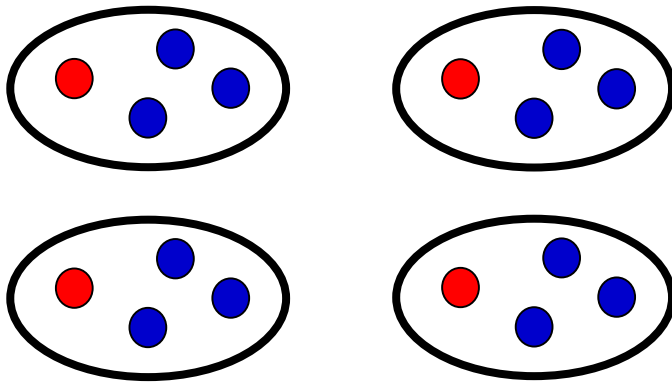
GROUP WORK

$$4 : 12 = 1 : 3$$

Method #2

$$4 : 12 = 1 : 3$$

What is similar and different between the two?

Method 1

Method 2
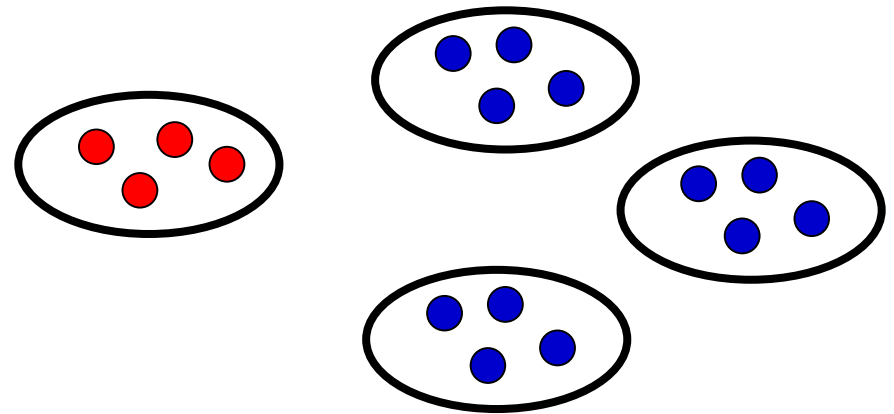
$$4 : 12 = 1 : 3$$

A Closer Look

T: You have written 8 : 2 = 4 : 1. Can you explain why 8 : 2 = 4 : 1?

L: Hmmm, the common factor is 2. So, I divide 8 : 2 by 2. And so, I get 4 : 1.

T: Can you explain why you divide by 2?

S: Well for example, there are 8 black marbles and 2 white ones. There are 2 friends, Juan and Maria. Juan gets 4 black marbles and 1 white marble. Maria gets the same. Therefore, 8 : 2 = 4 : 1.

Task: Discuss S's solution with your partner. What concept is S using to show that 8 : 2 = 4 : 1? What do you think of S's solution?

# Mitch's Marbles

Mitch has 12 red, 10 blue, and 8 yellow marbles. She plans to pack them into bags such that the ratio of the red to the blue to the yellow marbles is 6 : 5 : 4.

Draw a model to help Mitch how she can do this.

Scoring Guide

Points	Indicators
4	▪Has presented a strategy in solving the problem ▪Complete and correct method of solution and with correct answer
3	▪Has presented strategies in solving the problem but has not obtained the final correct answer ▪Complete and correct method of solution but wrong answer
2	▪Suggest good mathematical thinking but with incomplete solution and no answer
1	▪No solution/wrong solution but with correct answer
0	▪No attempt at all to solve the problem

The candy jar contains Durian Pops (the rectangles) and Mango Balls (the circles).
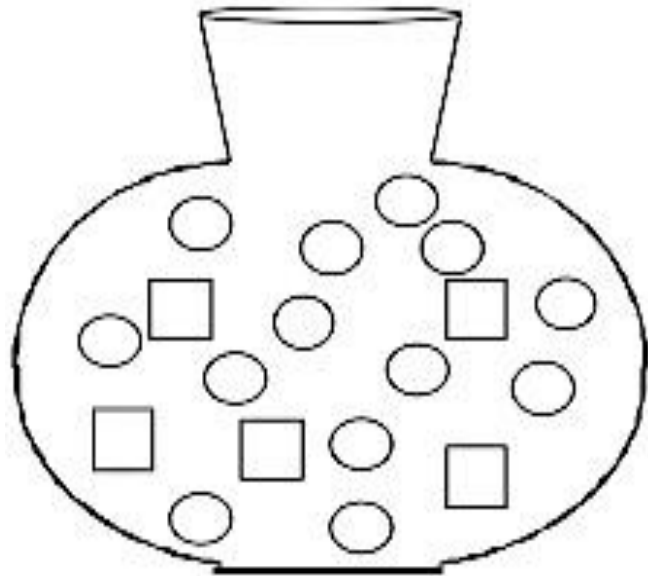
1. What is the ratio of Durian Pops to Mango Balls?

2. Suppose you have a larger jar in which the ratio of the two candies is equivalent to the ratio in this jar. How many Durian Pops and Mango Balls might be in the jar? Use mathematical reasoning to justify your response.

3. Suppose you have a new candy jar with the same ratio as shown above, but it contains 100 Durian Pops. How many Mango Balls are in the jar? Use mathematical reasoning to justify your response.

Adapted from Smith et al. (2005, p. 26)

3-Point Score

Question 1: Correctly writes the ratio 5:13.

Question 2: Correctly scales 5:13 in any of the following
ways:
  a) Scaling up 5:13 in tabular form
  b) Multiplying 5 and 13 by the same
     number
  c) Scaling up 5:13 in fraction form
  d) Using a proportion

3-Point Score

Question 3:

Correctly scales 5:13 to 100 Durian Pops in any of the following ways:

a) Multiplying 5 and 13 by 20
b) Scaling up 5:13 in fraction form until the number of Durian Pops equals 100
c) Using a proportion
d) Scaling up 5:13 in tabular form until the number of Durian Pops equals 100
e) Possibly drawing a picture of several sets of 5 rectangles and 10 circles, until switching to one of the multiplicative strategies above or until the number of rectangles equals 100

2-Point Score

Question 1: Correctly writes the ratio 5:13.

Question 2: Correctly scales 5:13 in any of the following ways, *but fails to recognize the significance of the results in the context of the problem*.
  a) Scaling up 5:13 in tabular form
  b) Multiplying 5 and 13 by the same number
  c) Scaling up 5:13 in fraction form
  d) Using a proportion

2-Point Score

Question 3:

Correctly scales 5:13 to 100 Durian Pops in any of the following ways, _but fails to recognize that the must be scaled up to 100 or fails to scale to 100 appropriately_.

a) Multiplying 5 and 13 by 20
b) Scaling up 5:13 in fraction form until the number of Durian Pops equals 100
c) Using a proportion
d) Scaling up 5:13 in tabular form until the number of Durian Pops equals 100
e) Possibly drawing a picture of several sets of 5 rectangles and 10 circles, until switching to one of the multiplicative strategies above or until the number of rectangles equals 100

1-Point Score

Question 1: Indicates *some understanding of ratio, but not the part-to-part nature of this relationship.*
      e.g. 5:18, or 13:5, or 18:5, etc.

Question 2: Attempts to reason in any of the ff. ways:
   a) Scaling up 5:13 in tabular form using addition, not multiplication
   b) Adding the same number to 5 and 13
   c) Scaling up 5:13 in fraction form using addition, not multiplication

1-Point Score

Question 3:

Attempts to reason in any of the following ways:

a) Adding 95 to 5 and 13, since 5 + 95 = 100
b) Scaling up 5:13 to 100 Durian Pops in tabular form using addition, not multiplication.
c) Scaling up 5:13 in tabular form using addition; stopping at a 'good' place to stop, possible where space runs out.
d) Possibly drawing a picture of several sets of 5 rectangles and 13 circles, until switching to one of the additive strategies above.

Homework

- Your teacher gives you 6 green marbles, 12 blue marbles, and 27 yellow marbles.

- Draw models to show two methods of regrouping to show that the ratios of green to blue to yellow counters in the two cases are the same.

- Compare and check your work with a partner.

Looking Forward

Programme for International Student Assessment (PISA)

- Conducted every three (3) years

- Aims to evaluate educational systems worldwide by testing the skills and knowledge of 15-year-old students in Reading, Mathematics and Science

- To be participated in by the Philippines in 2018 (Focus: Reading)

DM #12, s. 2016

Looking Forward

Trends in International Mathematics and Science Study (TIMSS)

- Conducted every four (4) years to Gr 4, 8 & 12

- Aims to measure the skills and knowledge of learners in reading, numeracy and science

- To be participated in by the Philippines in 2019

TIMSS 2015 Mathematics Framework

KNOWING

APPLYING

REASONING

$$\frac{4}{100} + \frac{3}{1000} =$$

A.   0.043

B.   0.1043

C.   0.403

D.   0.43

Item No. M032094, TIMSS 2011

KNOWING

APPLYING

REASONING

The fractions $\dfrac{4}{14}$ and $\dfrac{\square}{21}$ are equivalent.
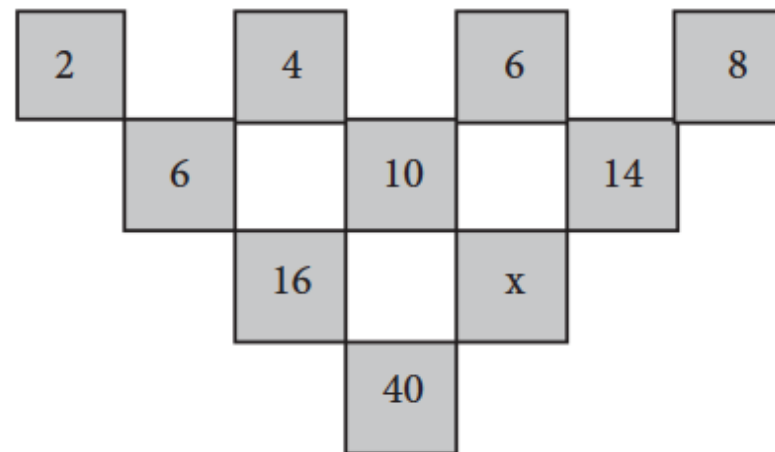
What is the value of $\square$?

A.   6

B.   7

C.   11

D.   14

Item No. M042031, TIMSS 2011

Item No. M042228, TIMSS 2011

Good teaching is inseparable from good assessing.

- Grant Wiggins -

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