ARMT+

Alabama Department of Education
Presenters: Miriam Byers
Judy Pugh
Kanetra Germany
Students need to be taught to be mathematical thinkers.

Think left and think right
and think low and think high
Oh! the Thinks you can think up
if only you try!
~dr. seuss
- Students need to be taught to be mathematical thinkers who feel confident to attack different problems that cover different topics on all standards.

- Even though a large portion of the ARMT consists of multiple-choice items, simply relying on drilling skills and ARMT coach books is not the answer.

- Using these tools effectively in your classroom is a step towards the answer.
Talking Points

Content Standards
Blueprints
Item Specifications
Calculator Usage
Format
Rubrics
Do and Don’t
Must Have
Tips
Myth busters
Content Standards

Based on 2003 Alabama Course of Study
No questions addressing 2009 COS
No questions addressing 2010 COS
No questions from Stanford 10
Science – no change

Stand alone, criterion-referenced assessment
Types of Questions

3$^{rd}$ grade: 50 items – 46 MC, 4 OE
4$^{th}$ grade: 64 items – 56 MC, 4 OE, 4 GR
5$^{th}$ grade: 55 items – 45 MC, 4 OE, 6 GR
6$^{th}$ grade: 55 items – 44 MC, 4 OE, 7 GR
7$^{th}$ grade: 58 items – 46 MC, 4 OE, 8 GR
8$^{th}$ grade: 60 items – 45 MC, 5 OE, 10 GR
Item Specifications

- Current item specifications are applicable.
- Revisions will be posted as soon as possible.
- Revisions will reflect:
  - increased rigor
  - new formats
  - sample questions
Item Specifications

Use as a tool to work toward proficiency

Give students specific details of the different expectations for the different performance levels
Item Specifications

How to locate:
www.alsde.edu

Sections
Assessment and Accountability
Publications
ARMT Resources
Item Specifications
**Calculator Usage**

- Calculators are not needed
- 3\textsuperscript{rd} grade students are not permitted to use a calculator
- Basic 4-function calculators are allowed for grades 4 – 8
- Calculators are not allowed on selected subtests – please refer to your TAM
- Students need to be proficient with using the specific calculator they will use on the test before the test!
Format – ways standards are addressed

Item Types:
- Multiple Choice
- Gridded Response
- Open-ended Response
Multiple-Choice Items

How are multiple-choice items addressed on the ARMT\textsuperscript{+}?
ARMT: Which of the following is equivalent to the fraction below?

\[
\frac{4}{10}
\]

A) \(\frac{4}{8}\)  
B) \(\frac{1}{4}\)  
C) \(\frac{3}{5}\)  
D) \(\frac{2}{5}\)
ARMT+: Which of the following is equivalent to the fraction below?

\[ \frac{4}{10} \]
ARMT: Sam bought a candy bar for 39 cents, including tax. He gave the salesperson 3 quarters for the bar. Which shows the amount of change Sam should receive?

ARMT+: George has 39 cents. Which group of coins shows how much more money George would need to have exactly $1?
ARMT: Which figure below is a quadrilateral?
4th Grade

ARMT+: Margarita sorted her stickers by shape. Which shows the shapes sorted in order from greatest number of sides to least number of sides?

A. Triangle, Quadrilateral, Hexagon
B. Pentagon, Triangle, Quadrilateral
C. Hexagon, Octagon, Pentagon
D. Octagon, Hexagon, Pentagon
Instead of being given the word problem and asked to write a number sentence, students may be given the number sentence and asked to pick the appropriate word problem.

Example: Which word problem can be solved using this number sentence? $5 \times 3 = ?$

a. Jeremiah made 5 lemon tarts. His family ate 3 of the tarts. How many tarts remain?
b. Jeremiah made 5 lemon tarts. He made 3 more later that day. How many total tarts did he make?
c. Jeremiah made 5 tarts. He used 3 lemons in each tart. How many lemons did he use in all?
d. Jeremiah made 5 tarts. He gave the same number of tarts to 3 different friends. How many tarts did he give to each friend?
ARMT: What number is 6 spaces to the left of 0 on the number line?

ARMT+: On the number line, how many spaces apart are 4 and -3?
What is the closest to the area of the shaded figure below?

A. 77 square units  
B. 71 square units  
C. 36 square units  
D. 80 square units
ARMT+: What is the closest to the area of the shaded figure below?

A. 77 square units  
B. 71 square units  
C. 36 square units  
D. 80 square units
5th Grade

ARMT: Which property of whole numbers is demonstrated by the number sentence below?

\[ 7 \times 6 = 6 \times 7 \]

ARMT+: Which picture should go in the box to demonstrate the commutative property of multiplication?

A \quad B \quad C \quad D
5th Grade

ARMT: Which of the following represents a pair of congruent polygons?

ARMT+: Which two figures are congruent?

A. M and N  
B. N and O  
C. M and P  
D. O and P
ARMT: In items dealing with maps and scale drawings, the scale has been given.

ARMT+: The actual distance from Erin’s home to Birmingham is 135 miles. The distance on the map is 4.5 inches. What scale could have been used for the map?

A. 1 inch = 130.5 miles  
B. 1 inch = 30 miles  
C. 1 inch = 3 miles  
D. 1 inch = 607.5 miles
6th Grade

ARMT: What is the probability of selecting the number 5 out of the set of cards below?

ARMT+: The probability of selecting a card with the number 5 is 2/7. Which could be the numbers on the set of 7 cards?
ARMT: The table shows the amount of money Sara deposited in her account each month.

<table>
<thead>
<tr>
<th>Month</th>
<th>Amount of Deposit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>$5</td>
</tr>
<tr>
<td>2</td>
<td>$12</td>
</tr>
<tr>
<td>3</td>
<td>$19</td>
</tr>
<tr>
<td>4</td>
<td>$26</td>
</tr>
</tbody>
</table>

If the pattern shown in the table continues to increase by the same amount each month, how much should Sara have deposited in the seventh month?

A. $33  B. $40  C. $54  D. $47
ARMT+: The table shows the amount of money Sara has in her account at the end of each month.

<table>
<thead>
<tr>
<th>Month</th>
<th>Amount of Deposit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>$8.00</td>
</tr>
<tr>
<td>3</td>
<td>$15.00</td>
</tr>
<tr>
<td>4</td>
<td>$18.50</td>
</tr>
<tr>
<td>7</td>
<td>$29.00</td>
</tr>
</tbody>
</table>

If the pattern shown in the table continues, how much should Sara have saved each month?

A. $7.00  B. $3.50  C. $10.50  D. $3.00
ARMT: A circle has a diameter of 6 inches. What is the area in square inches, of the circle?

ARMT+: Janna drew a rectangle around two circles as shown in the figure below. Which is closest to the total area, in square feet, of the two circles?

A. 72 sq. ft.
B. 28.26 sq. ft.
C. 108 sq. ft.
D. 56.52 sq. ft.
7th Grade

ARMT: Which of the following is a quadrilateral?

ARMT+: Which is true of the following two quadrilaterals?

A. Both are isosceles trapezoids.
B. Both have a side that is 8 cm.
C. Both have a pair of perpendicular sides.
D. Both have a height of 8 cm.
ARMT: The student was given radius or diameter and asked to find circumference or area.

ARMT\+: The student is given circumference or area and asked to find radius or diameter.
ARMT: What is the probability of the spinner landing on a 3?

ARMT+: What is one way the numbers on the spinner above could be changed making the probability of stopping on a 6 on the first spin and a 3 on the second spin 1/8?
ARMT: Which of the following is a characteristic of a regular pentagon?

A. Has six sides  
B. Has no obtuse angles  
C. Has five sides  
D. Has a right angle
ARMT+: Which special polygon could be constructed using the side lengths shown below?

A. Regular rhombus
B. Parallelogram
C. Isosceles Trapezoid
D. Rectangle
8th Grade

ARMT+: Explain why the figure below cannot represent a right triangle.

- Change one side to make it a right triangle.
- Explain which side you should change and show why the change will make the drawing correct.

![Triangle diagram with sides 16 cm, 24 cm, and 12 cm]
Grids

3rd grade – no change (no grids)
4th grade – no change
8th grade – no change
6th grade

ARMT

ARMT+
7th grade

ARMT

ARMT+

3

1

7

1

/ 2

$
What Is an Open-Ended Item?

An open-ended math item asks students to solve a multi-step problem. They must show all their work **or** explain **HOW** they got the answer.
Open-Ended Items

• Analyze past results for open-ended items

• Teach tips on solving open-ended items

• Use open-ended items in your classroom/curriculum on a regular basis
Open-ended

How are open-ended items addressed on the ARMT+?
ARMT: A three-shaped repeating pattern is shown below.

A. What shapes should be in the 2 blank spaces?
B. Explain how you decided on the two missing shapes in the pattern.
ARMT+: Sara made the pattern shown above.

A. What is the next shape in the geometric pattern?

B. What shape in the pattern will have the number 28 in it?

C. Explain how you know the shape in part b is correct.
ARMT+: Gracie made the chart shown below.

<table>
<thead>
<tr>
<th>Number of Books</th>
<th>Total Cost (in dollars)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>9</td>
</tr>
<tr>
<td>6</td>
<td>18</td>
</tr>
<tr>
<td>9</td>
<td>27</td>
</tr>
<tr>
<td>12</td>
<td>36</td>
</tr>
</tbody>
</table>

A. What should the output be when the input is 21?

B. What should the input be when the output is 45?

C. What rule did Gracie use with the input number to get the output number?
4th Grade

ARMT: Which bar graph/line graph below represents the data found in the table?

ARMT+: Make a table from data found in a bar graph/line graph.
ARMT: The table below shows the number of candy bars sold at Baker High School during a basketball game.

### Candy Bars

<table>
<thead>
<tr>
<th>Name</th>
<th>Number Sold</th>
</tr>
</thead>
<tbody>
<tr>
<td>Milky Way</td>
<td>25</td>
</tr>
<tr>
<td>Butterfinger</td>
<td>36</td>
</tr>
<tr>
<td>Snickers</td>
<td>22</td>
</tr>
<tr>
<td>Hershey</td>
<td>8</td>
</tr>
</tbody>
</table>

Choose the answer below that represents the number sold in order from least to greatest.

A. 8, 22, 25, 36  
B. 36, 25, 22, 8  
C. 8, 36, 22, 25  
D. 25, 22, 36, 8
ARMT+: The table below shows the number of candy bars sold at Baker High School during a basketball game.

<table>
<thead>
<tr>
<th>Name</th>
<th>Number Sold</th>
</tr>
</thead>
<tbody>
<tr>
<td>Milky Way</td>
<td>25</td>
</tr>
<tr>
<td>Butterfinger</td>
<td>36</td>
</tr>
<tr>
<td>Snickers</td>
<td>22</td>
</tr>
<tr>
<td>Hershey</td>
<td>8</td>
</tr>
</tbody>
</table>

Which inequality about the number sold is true?
A. 25 < 8  C. 36 > 25
B. 22 > 25  D. 36 < 22
A. What is 1 possible list of items you could buy that costs at least $20.00 but not more than $25.00?

B. What is a different list of items you could buy that costs at least $20.00 but not more than $25.00?

<table>
<thead>
<tr>
<th>Item</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Books about computers</td>
<td>$7.99</td>
</tr>
<tr>
<td>Hair ribbons</td>
<td>$4.74</td>
</tr>
<tr>
<td>Purse</td>
<td>$15.45</td>
</tr>
<tr>
<td>Stereo headphones</td>
<td>$9.83</td>
</tr>
</tbody>
</table>
The table below shows the number of people who attended 3 different outdoor concerts.

<table>
<thead>
<tr>
<th>Concert</th>
<th>Number of People</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>20,785</td>
</tr>
<tr>
<td>2</td>
<td>46,915</td>
</tr>
<tr>
<td>3</td>
<td>82,460</td>
</tr>
</tbody>
</table>

A. What was the total number of people that attended the 3 concerts?
B. How many more people attended concert 2 than concert 1?
C. A fourth concert set a record for the number of people attending. The number was two times the number attending concert 2 but less than 100,000. How many people could have attended the fourth concert?
An athletic store purchased 1,428 new water bottles.

A. Of the 1,428 new water bottles, 1/6 of the bottles had the University of Troy logo on them. How many had the University of Troy logo on them?

B. Of the bottles with the Troy logo on them, ½ of them were solid red. How many of the Troy bottles were solid red?

C. Of the 1,428 new water bottles, ¼ had the Alabama State logo on them and 1/6 of the bottles had the Troy logo on them. The rest had West Alabama’s logo on them. What fraction of the bottles had West Alabama’s logo on them?
ARMT: Which of the following points appears to be located on the y-axis?

A. S  B. T  C. W  D. U
ARMT+: Jacobi is going on a treasure hunt. He is making a map on a Cartesian Plane.

A. Label the Cartesian Plane located on your answer document.

B. He is starting at the origin. Mark the origin and label it J.

C. The treasure can be found in Quadrant III. Put a point in Quadrant III and label it “treasure.” Explain how you know this is quadrant III.
ARMT: In 1990, car sales in Alabama during the month of June were an estimated 2000. In July, sales increased by 30%.

A. What was the amount of increase?
B. In November, estimated automobile sales were 2510. In December, sales decreased by 40%. What was the amount of decrease?

ARMT+: In 1990, car sales in Alabama during the month of June were an estimated 2000. In July, sales increased by 30%. In November, estimated automobile sales were 2510. In December, sales decreased by 30%. Explain why a 30% decrease in December sales is greater than the 30% increase in June sales.
6th Grade

ARMT: Jordan took a test. There were 60 questions on the test.
A. If Jordan worked 80% of the test, how many problems did he work?
B. What percent of the test did Jordan work if he worked 36 questions?

ARMT+: Jordan took a test. There were 60 questions on the test.
A. and B. same as above.
C. Is it possible to answer 97% of the questions on the test? Explain your reasoning.
ARMT: The 4 walls of a bedroom have dimensions of 16 feet high by 11 feet wide.

A. What is the area of the walls of the bedroom in square feet?

B. If someone wanted to put up a wallpaper border in the bedroom, how many feet would they need?
ARMT+: The 4 walls of a bedroom have dimensions of 16 feet high by 11 feet wide.

A. What is the area of the walls of the bedroom in square feet?

B. Another bedroom has 4 walls that are all 12 feet high. The walls are all the same width. The total area of all 4 walls of this bedroom is the same as the total area of all 4 walls of the first bedroom. What is the width, in feet, of each of the walls?
ARMT: Given the set of data below,

2, 8, 2, 1, 0, 0, 3, 5, 1, 8, 6, 5, 5

A. What is the median of the set of data?

B. What is the mode of the set of data?

C. What is the mean of the set of data?
ARMT+: Given the set of runs scored in 13 softball games, 
2, 8, 2, 1, 0, 0, 3, 5, 1, 8, 6, 5, 5

A. What is the median number?

B. After recording the number of runs scored in two more games, the median increased by two. What could be one possible pair of runs scored in these two games?

C. Explain how the median could be 2.5 when it is not possible to score half a run.

D. Explain how it is possible to play 2 more games and have no change in the value of the range.
ARMT:

A. Using the spinner above, what is the probability that a player will draw 3 cards?

B. What is the probability that a player will draw 1 card on the first spin and 2 cards on a second spin?
Harry wants the probability that a player draws 3 cards and moves 2 spaces to be $\frac{3}{8}$. How can he change the spinners to result in this probability?
**ARMT:** Which box-and-whisker plot represents the following data: 3, 2, 6, 7, 10, 12, 13, 4, 8

**ARMT⁺:** Construct and label a box-and-whisker plot using the data. (Median, lower quartile, upper quartile, maximum value, and minimum value).
ARMT: Square saltine crackers come packaged in rectangular prisms. The length of one side of a cracker is 1.5 inches. The height of the package is 10 inches.

A. What is the volume of the package?

B. What is the surface area of the package?
ARMT+: Square saltine crackers come packaged in rectangular prisms. The length of one side of a cracker is 1.5 inches. The height of the package is 10 inches.

A. What is the volume of the package?

B. What is the surface area of the package?

C. The dimensions of the package were changed. The volume of the new package is the same but the side of the cracker was changed to 1 inch. What must be the new height of the package?
A. Create a table from data in circle graph. Label the table appropriately.
A. Create a table from data in circle graph. Label columns in the table, Candy Bars, and Number Sold. A total of 250 candy bars were sold.
Ways to Use Open-Ended Items in Your Classroom

- Put a problem on every test or quiz
- Homework
- Math journal
- Open-ended portfolio…..

- DO NOT use only as extra credit!
The ARMT⁺ Scoring

- To earn all 3 points, students need to show each step of their work in complete detail, or explain HOW they got their answers (all steps), even if the work was done in the student’s head or calculator.

- They can earn at least 1 point by showing a correct step toward solving the problem or by giving the answer only.
Explanation Tips from Teachers

Make sure ALL steps are explained in words.
Sample Question

Four members of the Johnson family took a trip from Pittsburgh to Harrisburg, a distance of 221 miles. It took them 4 hours and 15 minutes to make the trip. The car required 13 gallons of gasoline at $1.25 per gallon. The turnpike toll was $6.50, and they spent $12.84 for food. What was the average cost per mile based on the total expenses of gas, food, and tolls for this trip?
The Work

1) \$1.25 \times 13 \text{ gal} = \$16.25

2) \$16.25 + \$6.50 + \$12.84 = \$35.59

3) \$35.59 \div 221 \text{ mi} \approx \$0.1610407

4) \$0.16 \text{ per mile}
## The Final Product

<table>
<thead>
<tr>
<th>Work</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) $1.25 \times 13 \text{ gal} = $16.25</td>
<td>1) I multiplied the price of gas and the number of gallons TO GET the total cost of gas.</td>
</tr>
<tr>
<td>2) $16.25 + $12.84 + $6.50 = $35.59</td>
<td>2) I added the cost of gas, food and tolls together TO FIND the total cost of the trip.</td>
</tr>
<tr>
<td>3) $35.59 \div 221 \text{mi} \approx $0.161041</td>
<td>3) I divided the total cost of the trip by the number of miles and I FOUND the cost per mile.</td>
</tr>
<tr>
<td>4) $0.16 \text{ per mile}</td>
<td>4) SINCE I had many decimal places, I rounded to the hundredth BECAUSE I wanted money. My answer is 16 cents per mile.</td>
</tr>
</tbody>
</table>
More Explanation Tips from Teachers

Use “magic words” in the explanation.

“Magic words” are words that gear students to ‘explain’ their work rather than ‘describe’ it.
What are the Magic Words?

To find
To get
To figure out
To show
Because
Since
Therefore
Practice, Practice, Practice

• Practice should occur the entire year

• Open-ended questions should be addressed about once a week

• Incorporate these types of questions into ALL grade levels

• Open-ended questions are an integrated part of the math curriculum at ALL grade levels
Do

- Teach **correct** vocabulary
- Show **all** work or explain **all** steps
- Write **all** steps when using a calculator
  - Example: “I used a calculator to multiply 3 times 4 and got 12. Then I used the calculator to divide 12 by 6 and got 2.”
- Label **all** parts of a graph
Do - continued

• Teach students to use **points** on a graph, not pictures
  - Example: JJ found an ant hill in quadrant II. Show where JJ found an ant hill.

• Use **necessary symbols** ($ signs) and **units**
Do - continued

• Work on **answer document** and not on scratch paper

• Be **specific** when describing a translation or movement on a graph
  – Don’t use “over” (over where?)
  – Use north, south, east, west, or up, down, left, right
Do - continued

- Use a **straight edge** when graphing.
- Use an **appropriate** scale.
- Use intervals that are **equal** units apart.
- Use graphs **appropriately**.
- Make sure 4 function calculator has **square root** button.
- Teach students to leave answers in terms of $\pi$. 
Don’t

• Don’t take what is given in the problem and restate as the answer.
• Don’t leave out computational signs when working problems.
  – Example: $\frac{3}{10} \times \frac{5}{10} = \frac{3}{20}$
• Don’t restate question.
Don’t - continued

• Don’t use symbols incorrectly
  – Example: $0.44¢ or 2^2\text{ in}$

• Don’t give estimates when exact answers can be given

• Don’t swap axes when graphing
  – Y is dependant variable
  – X is independent variable
When you have the following open-ended question:

Use the two-dimensional and three-dimensional figures shown below to explain the geometric relationships of the figures.

a. Explain two ways the figures shown are the same.
b. Explain one way they are different.

Do not let students give as an answer – 1 figure is two-dimensional and 1 is three-dimensional. Students must be specific and detailed in answers.
Must Have

- Must have comparative statement if asked to compare
- Must have graph titles
- Must have equal bar widths on bar graphs
- Must have units labeled for 3 points
- Must be able to explain why one form of data display is better than another.
- If a student chooses to both show his/her work AND explain his/her answer, one must support the other.
## Sample Rubric

<table>
<thead>
<tr>
<th>Score Point</th>
<th>Response Attributes</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>All is correct.</td>
</tr>
</tbody>
</table>
| 2           | Two logics and explanation are correct.  
              OR  
              All of Part a and all of Part b are correct.  
              OR  
              All of Part c is correct and correct answers for Parts a and b.  
              OR  
              One correct logic for Part a or b, Part c is correct, and correct answer for either Part a or b. |
| 1           | One or more answers to problems are correct without logic.  
              OR  
              One correct logic or explanation. |
| 0           | None correct. (Also, blanks, rewrites problem, foreign language, illegible, refusals, off-task, etc., scored as invalid.) |
Introduction to Rubrics

• This introduction is a process.

• Possible activities:
  – students can rewrite a rubric in kid-friendly terms
  – students can create a rubric for a problem
  – students can score each other’s work
Tips for Teachers

• Insist that students use correct mathematical vocabulary in their explanations (when developmentally appropriate)

• Refer to the “Terms to Know” in the math textbooks (all grade levels). Use vocabulary used in standards.

• Review the formula sheet for 7th and 8th grades before taking the ARMT+
Tips for Beginners

• Provide time for students to solve problems individually

• Share answers/ideas with partners or in small groups

• Discuss as a class
Areas of Weakness

3rd grade: patterns, geometric representation, and open-ended questions

4th grade: data, analysis, and probability open-ended questions

5th grade: fractions, area, open-ended, and gridded questions
Areas of Weakness - continued

6th grade: measurement (area, scale), patterns, and percents

7th grade: area, perimeter, probability, and measures of central tendency

8th grade: volume, surface area, Pythagorean theorem, and graphing
Conclusion

Teaching the adopted curriculum as intended will not only help improve your ARMT+ scores, but will also help improve your students’ understanding and the ability to communicate that understanding.
Questions ?
Contact information: Judy Pugh Assessment and Accountability
334-242-8038
jpugh@alsde.edu