

OFFICE OF CHIEF ACADEMIC OFFICER
Summary of State Board of Education Agenda Items
January 19, 2016

OFFICE OF PROFESSIONAL DEVELOPMENT

05. Information: Publication of the Mississippi English / Language Arts and Mathematics Exemplar Units for Grades PK-10 [Goals 1 and 4 – MBE Strategic Plan]

The Mississippi Department of Education received a \$500,000 grant from the W.K. Kellogg Foundation in May 2016 to support the implementation of Mississippi's College- and Career-Readiness Standards. Grant funds were used to secure a cadre of effective teachers from across the state to develop instructional resources for teachers and parents. Approximately 60 educators created English Language Arts and Mathematics lesson plans for the following grade bands: prekindergarten-K, 1-2, 3-4, 5-6, 7-8, Foundations to Algebra, Algebra I, English I and English II. All units have been reviewed for consistency and aligned with the Mississippi College- and Career-Readiness Standards for English Language Arts and Mathematics. Training to support the effective implementation of these resources will begin in January 2017.

This item references Goals 1 and 4 of the *Mississippi Board of Education 2016-2020 Strategic Plan*.

Information Only

Back-up material attached



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EXEMPLAR

Units *&* Lessons

MATHEMATICS

Grade 7

Grant funded by:



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Grade Level	Unit Title	Duration
7	Ratios & Proportions	8 days
Mississippi College- and Career-Readiness Standards for Mathematics		Standards for Mathematical Practice
<p>Focus:</p> <p>7.RP.2 Recognize and represent proportional relationships between quantities.</p> <ul style="list-style-type: none"> a. Decide whether two quantities are in a proportional relationship, e.g., by testing for equivalent ratios in a table or graphing on a coordinate plane and observing whether the graph is a straight line through the origin. b. Identify the constant of proportionality (unit rate) in tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships. c. Represent proportional relationships by equations. For example, if total cost, t, is proportional to the number, n, of items purchased at a constant price, p, the relationship between the total cost and the number of items can be expressed as $t = pn$. d. Explain what a point (x, y) on the graph of a proportional relationship means in terms of the situation, with special attention to the points $(0, 0)$ and $(1, r)$ where r is the unit rate. <p>Additional:</p> <p>7.RP.1 Compute unit rates associated with ratios of fractions, including ratios of lengths, areas and other quantities measured in like or different units. For example, if a person walks $\frac{1}{2}$ mile in each $\frac{1}{4}$ hour, compute the unit rate as the complex fraction $\frac{1/2}{1/4}$ miles per hour, equivalently 2 miles per hour.</p>		<p>SMP.1 Make sense of problems and persevere in solving them.</p> <p>SMP.2 Reason abstractly and quantitatively.</p> <p>SMP.3 Construct viable arguments and critique the reasoning of others.</p> <p>SMP.5 Use appropriate tools and manipulatives strategically.</p> <p>SMP.6 Attend to precision.</p> <p>SMP.7 Look for and make use of structure.</p> <p>SMP.8 Look for and express regularity in repeated reasoning.</p>

Unit Overview

In this unit, students will expand their understanding of ratios. Students will explore the characteristics of proportionality, paying special attention to the academic vocabulary and connecting terms to prior ratio understanding. Students will discover multiple methods for finding the constant of proportionality as they interpret tables, graphs, equations, diagrams, and verbal descriptions. Students will write equations and solve for unknown variables. They will develop a strong understanding of interpreting the different representations and solving problems centered around these representations.

Essential Questions:

- How are proportional relationships used to solve real-world and mathematical problems?
- How is the constant of proportionality shown in multiple representations of proportional relationships?

Lesson Tasks

Lesson 1: Tables as Tools

In this lesson, students will activate prior knowledge on ratios and proportions. Students will use tables to solve proportions and begin to build vocabulary for the unit.

Lesson 2: Proportionality in a Table

Students will determine whether two quantities are in a proportional relationship by identifying equivalent ratios in a table. Students will identify the constant of proportionality (unit rate) in tables and verbal descriptions of proportional relationships.

Lesson 3: How Do They Compare?

Students will discover what makes two quantities proportional. They will also begin to recognize proportional relationships on tables and graphs.

Lesson 4: Multiple Representations and Performance Task

Students create a proportional scenario and create different representations of the situation. Students will also complete the Performance Task.

Lesson 5: Solving Proportional Relationships

Students will work collaboratively to solve problems using equivalent ratios. Students will strengthen their understanding of multiple strategies, including using linear graphs.

Lesson 6: Final Assessment

Students will complete their Graffiti Wall and final assessment on representing proportional relationships.

Performance/Culminating Task

Reynaldo's Trip

Students will complete Handout 4.3: Reynaldo's Trip. Students will identify and compare the unit rate of two vehicles using a table and graph. Based on the information, students will compare the different representations and explain their reasoning.

Standard(s) Assessed: 7.RP.2a, 7.RP.2b, 7.RP.2c, 7.RP.2d

Rubric for Performance/Culminating Task

	4	3	2	1
<p>Question 1</p> <p>Complete the table using the given situation and information</p>	The student filled in the table with no errors and clearly explained the usefulness of a table in finding a unit rate.	The student filled in the table with only one error and clearly explained the usefulness of a table in finding a unit rate.	The student filled in the table with multiple errors and cannot explain the usefulness of a table in finding a unit rate.	The student filled in the table incorrectly and cannot explain the usefulness of a table in finding a unit rate.
<p>Question 2</p> <p>Find the unit rate from the table</p>	The student correctly determined the unit rate, used appropriate units, and gave a clear explanation of how he/she found the answer and units.	The student correctly determined the unit rate and gave a clear explanation of how he/she found the answer, but did not label the units.	The student correctly determined the unit rate; however, he/she did not provide a clear explanation as to how he/she found the answer.	The student did not correctly identify the unit rate and/or provided a flawed explanation as to how he/she found the answer.
<p>Question 3</p> <p>Find the unit rate using coordinates on the graph</p>	The student correctly determined the unit rate, used appropriate units, and gave a clear explanation of how he/she found the answer and units.	The student correctly determined the unit rate and gave a clear explanation of how he/she found the answer, but did not label the units.	The student correctly determined the unit rate; however, he/she did not provide a clear explanation as to how he/she found the answer.	The student did not correctly identify the unit rate and/or provided a flawed explanation as to how he/she found the answer.
<p>Questions 4 & 5</p> <p>Determine proportionality from the table and graph</p>	The student correctly identified the table and graph as proportional and used explicit reasoning when explaining.	The student correctly identified the table and graph as proportional and used basic reasoning when explaining.	The student correctly identified one (or fewer) of the representations, and used basic reasoning when explaining.	The student did not correctly identify the table or graph and the explanation is not correct.

Lesson 1: Table as a Tool

Focus Standard(s): 7.RP.2a, 7.RP.2b

Additional Standard(s): 7.RP.1

Standards for Mathematical Practice: SMP.1, SMP.3, SMP.8

Estimated Time: 50 minutes

Resources and Materials:

- Butcher Paper
- Markers
- Handout 1.1: [Graffiti Wall](#)
- Handout 1.2: [Table as a Tool](#)
- Shmoop Tube Video: <http://www.shmoop.com/video/unit-rate>

Lesson Target(s):

- Students will activate prior knowledge on ratios and proportions.
- Students will use tables to solve proportions and begin to build vocabulary for the unit.

Guiding Question(s):

- What tools can be used to help find unit rate?
- How is unit rate used to determine proportionality?


Vocabulary

Academic Vocabulary:

- Unit Rate
- Constant Rate
- Proportional
- Table of Values
- Rate

Instructional Strategies for Academic Vocabulary:

- Introduce words with student-friendly definitions and pictures
- Model how to use the words in discussion
- Create pictures/symbols to represent words
- Write/discuss using the words

Symbol	Type of Text and Interpretation of Symbol
	Instructional support and/or extension suggestions for students who are EL, have disabilities, or perform well below the grade level and/or for students who perform well above grade level
✓	Assessment (Pre-assessment, Formative, Self, or Summative)

Instructional Plan

Understanding Lesson Purpose and Student Outcomes: Students will be introduced to how unit rate relates to proportionality. Students will find the unit rate from a table and complete missing table values using unit rate. Students will compare different methods and decide which method they prefer.

Anticipatory Set/Introduction to the Lesson: Graffiti Wall

Distribute Handout 1.1: Graffiti Wall. This activity will require students to recall prior knowledge about ratios and proportions. Instruct students to brainstorm and record their ideas onto the Graffiti Wall and share ideas with their team.

Prompting Questions:

- What do you know about ratios and proportions?
- Are there any situations you can think of related to these words?
- Is there anything you know of that is proportional?
- What additional words do you associate with these words?

Actively monitor students and provide scaffolding support through questioning.

Prompting Questions:

- Why do you associate that word to ratios?
- What helped you connect that example to proportions?
- Explain this word to me.
- How does the example use ratios?

Note: The teacher is responsible for encouraging participation from all team members. Some teams may find it difficult to begin, if so, the teacher can ask questions to activate prior knowledge.

Prompting Questions:

- What is unit rate?
- How can you represent ratios?
- What do you remember about ratios?

Teams share their Graffiti Wall with the class, making connections and exploring different perspectives. Students discuss ideas they may have shared and/or unique notions presented (SMP.3). Students discuss and the teacher ensures discussions are math centered and students explain their reasoning. Collect and display Graffiti Walls as one giant wall. This will be displayed for the remainder of the unit and students may add to it as the unit progresses.

For students who are EL, have disabilities, or perform well below the grade-level:

- Use the Graffiti Wall for both visual and written representations. Encourage students to continue to add ideas to the wall throughout the unit.

Extensions for students with high interest or working above grade level:

- Encourage teams with detailed Graffiti Walls to create real-world applications and careers where unit rate would be important to understand.

Activity 1: Unit Rates Video

Prepare and display video: <http://www.shmoop.com/video/unit-rate><http://www.shmoop.com/video/unit-rate>.

Students complete a Think-Pair-Share. Students share one part of the video that caught their attention. Once partners share with one another, ask for volunteers to share similarities or differences in the responses with the whole group. Have students share additional ideas to add to the Graffiti Wall.

Activity 2: Table as a Tool

Distribute Handout 1.2: Table as a Tool. Display the first table on the board. Instruct students to independently complete the table. Once completed, students compare answers and discuss methods used to solve (SMP.3).

Note: The table values are not in any order and will require some perseverance (SMP.1). It is normal for students to use a Guess and Check method. If a student is using this method, suggest exploring by looking for a pattern (SMP.8).

Select students to come to the board and complete the table. Lead a whole group discussion on different methods and reasoning.

Actively monitor students and provide scaffolding support through questioning.

Prompting Questions:

- How did you find the missing value?
- Did you use the same method for every value?
- Can you show it another way?
- How does this relate to unit rate?
- What is the unit rate?
- Could we create a situation to represent this table?
- Is the x-axis represented on this table?
- Is the y-axis represented on the table?

Answer any additional questions students have about completing the table. Repeat this process for the remaining tables on the handout.

Note: As exposure increases, students will have more questions. Incorporate how each table could represent a real-world scenario.

Each time the class returns to whole group discussion, ask questions to help them solidify their understanding.

Prompting Questions:

- How are you finding unit rate using the table?
- Is anyone in your team using a different method?
- How could you add more values to your table?
- What makes the unit a constant rate?
- What would the y-value be if the x-value was zero?
- Is this table proportional?

For students who are EL, have disabilities, or perform well below the grade-level:

- Encourage struggling students to put the x-values in order from least to greatest to help follow the pattern.
- Provide students with a multiplication fact sheet to assist in the creation of their own table.

Extensions for students with high interest or working above grade level:

- Create more challenging tables using decimals or fractions.

Reflection and Closing:

Refer to the Graffiti Wall and review the lesson with students.

Prompting Questions:

- What words did we use the most today?
- Can we add anything to our wall?
- What one word will you remember from today?
- Is there anything that we didn't cover today that we need to look at later?
- What is another way we can define unit rate?

✓ Exit Ticket: Using Handout 1.2: Table as a Tool, have students create their own table with a unit rate of 4.

Homework

Students will not receive homework.

Ratios

&

Proportions

Handout 1.2: Table as a Tool

Name: _____

Date: _____

Directions: Fill in the missing values for each table as directed by the teacher.

Table 1:

x	10	4		9	7		18	5	
y		32	8			16		40	0

Strategy Used:

Table 2:

x		2	5		-1	1	-5	0	8
y	-27			-9	3		15		-24

Strategy Used:

Table 3:

x	-9	15		42	18	0	-6	30	-1
y	-6		8		12		-4	20	

Strategy Used:

Create Your Own!

x									
y									

Answer Key:

Table 1:

x	10	4	1	9	7	2	18	5	0
y	80	32	8	72	56	16	144	40	0

Strategy Used: Strategies will vary. Expect guess and check, rearrangement, and/or using a rule to follow the pattern.

Table 2:

x	9	2	5	3	-1	1	-5	0	8
y	-27	-6	-15	-9	3	-3	15	0	-24

Strategy Used: Strategies will vary. Expect guess and check, rearrangement, and/or using a rule to follow the pattern.

Students may struggle with the negatives if they do not have a strong sense for multiplying integers.

Table 3:

x	-9	15	12	42	18	0	-6	30	-1
y	-6	10	8	28	12	0	-4	20	$-\frac{2}{3}$

Strategy Used: Strategies will vary. Expect guess and check, rearrangement, and/or using a rule to follow the pattern.

Anticipate students who have difficulties with fractions to struggle with this problem.