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July, 2022

5E Integrated STEM Lesson Plan

Unit Title: ***Percentages, Sun, and Graphs, Who Knew?***

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Topic(s): Percentages, Calculating Percents, Representing Percentages with Graphs

Targeted Grade Level(s): ***6th/7th Grade***

Time Needed: ***6 - 10 days (45 minute class periods)***

Subject Integration: ***Math, Science, Technology***

Justification/Statement of Purpose:

- During these lessons, students will use math to demonstrate their understanding of calculating percentages and modeling the data in graph form. The data students will use is student collected and NASA data on solar fares. This will impact and enhance students' understanding of math and science.
- Based in Common Core State Standards, students in 6th and 7th grade are developing an understanding and application of percents in real life situations, which allows this unit developmentally appropriate for your students.
- These are math skills students will develop:
    - Ratio reasoning in real life situations
    - Finding a percent of a quantity
    - Use proportional relationships to solve percent problems
    - Use of math tools: compass and protractor
    - Analysis of circle graph
    - Constructing a circle graph

- Differentiation of Instruction:
    - Provide demonstrations, and complete mini lessons for those that may need a review in calculating percentages, using a compass, protractor, and the use of Google Sheets
    - For group work - students will be placed into groups of three or 4 based on Math MAP data
    - Presenting class activities auditory and visually

Standards:

NGSS Performance Expectations

MS-ETS1-3. Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.

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Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Asking Questions and Defining Problems Asking questions and defining problems in grades 6–8 builds on grades K–5 experiences and progresses to specifying relationships between variables, and clarifying arguments and models. ▪ Define a design problem that can be solved through the development of an object, tool, process or system and includes multiple criteria and constraints, including scientific knowledge that may limit possible solutions. (MS-ETS1-1) **Developing and Using Models** Modeling in 6–8 builds on K–5 experiences and progresses to developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems. ▪ Develop a model to generate data to test ideas about designed systems, including those representing inputs and outputs. (MS-ETS1-4) **Analyzing and Interpreting Data** Analyzing data in 6–8 builds on K–5 experiences and progresses to extending quantitative analysis to investigations, distinguishing between correlation and causation, and basic statistical techniques of data and error analysis. ▪ Analyze and interpret data to determine similarities and differences in findings. (MS-ETS1-3) **Engaging in Argument from Evidence** Engaging in argument from evidence in 6–8 builds on K–5 experiences and progresses to constructing a convincing argument that supports or refutes claims for either explanations or solutions about the natural and designed world. ▪ Evaluate competing design solutions based on jointly developed and agreed-upon design criteria. (MS-ETS1-2)	**ETS1.A: Defining and Delimiting Engineering Problems** ▪ The more precisely a design task's criteria and constraints can be defined, the more likely it is that the designed solution will be successful. Specification of constraints includes consideration of scientific principles and other relevant knowledge that are likely to limit possible solutions. (MS-ETS1-1) **ETS1.B: Developing Possible Solutions** ▪ A solution needs to be tested, and then modified on the basis of the test results, in order to improve it. (MS-ETS1-4) ▪ There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem. (MS-ETS1-2), (MS-ETS1-3) ▪ Sometimes parts of different solutions can be combined to create a solution that is better than any of its predecessors. (MS-ETS1-3) ▪ Models of all kinds are important for testing solutions. (MS-ETS1-4) **ETS1.C: Optimizing the Design Solution** ▪ Although one design may not perform the best across all tests, identifying the characteristics of the design that performed the best in each test can provide useful information for the redesign process—that is, some of those characteristics may be incorporated into the new design. (MS-ETS1-3) ▪ The iterative process of testing the most promising solutions and modifying what is proposed on the basis of the test results leads to greater refinement and ultimately to an optimal solution. (MS-ETS1-4)	**Influence of Science, Engineering, and Technology on Society and the Natural World** ▪ All human activity draws on natural resources and has both short and long-term consequences, positive as well as negative, for the health of people and the natural environment. (MS-ETS1-1) ▪ The uses of technologies and limitations on their use are driven by individual or societal needs, desires, and values; by the findings of scientific research; and by differences in such factors as climate, natural resources, and economic conditions. (MS-ETS1-1)

Common Core State Standards:

Math:

- **CCSS.MATH.CONTENT.6.RP.A.3**: Use ratio and rate reasoning to solve real-world and mathematical problems, e.g., by reasoning about tables of equivalent ratios, tape diagrams, double number line diagrams, or equations.
- **CCSS.MATH.CONTENT.6.RP.A.3.C:** Find a percent of a quantity as a rate per 100 (e.g., 30% of a quantity means 30/100 times the quantity); solve problems involving finding the whole, given a part and the percent.
- **CCSS.MATH.CONTENT.7.RP.A.3:** Use proportional relationships to solve multistep ratio and percent problems.

- **CCSS.MATH.CONTENT.7.G.A.2:** Draw(freehand, with ruler and protractor, and with technology) geometric shapes with given conditions.

Technology:

- KC1.B.1
  - Students critically curate a variety of resources using digital tools to construct knowledge.
- KC2.A.1
  - Produce creative artifacts and make meaningful learning experiences from curated knowledge for themselves and others.

ELA:

- RST.6-8.7 Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table). (MS-ETS1-3)

Measurable Student Learning Objectives:

- Students will be able to find a percent of a quantity as a rate per 100 (e.g., 30% of a quantity means 30/100 times the quantity); solve problems involving finding the whole, given a part and the percent.(DOK2)
- Students will be able to use proportional relationships to solve multistep ratio and percent problems.(DOK2)
- Students will be able to draw (freehand, with ruler and protractor, and with technology) geometric shapes with given conditions.(DOK3)

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Nature of STEM:

- Students are gathering, analyzing, and interpreting data that they have collected and the NASA data.

Engaging Context/Phenomena:

- Students will be hooked with the lesson when they are presented with “money” bags and will have to sort out the money based on the percentages.
- During the NASA activity, students will be engaged in the activity on discovering and learning about sunspots and solar flares.

Data Integration:

- Students will conduct their own surveys - analyze and model their results
- Students will use the data from the NASA site and will be focused on certain areas of the sun and during a certain period of time. With this data, students will develop a new classification of brightness.

Differentiation of Instruction:

- Provide demonstrations, and complete mini lessons for those that may need a review in calculating percentages, using a compass, protractor, and the use of Google Sheets
- For group work - students will be placed into groups of three or 4 based on Math MAP data
- Presenting class activities auditory and visually

Real-life Connection:

Percentages are used in calculating…

- *grades*
- *savings*
- *sales tax*
- *discounts*

- *interest rates*
- *most statistical information*

Possible Misconceptions:

- *Confusion between labeling the part to whole*
- *Misinterpreting the data*
- *Unable to read the NASA data accurately*
- *Reading the wrong scale on the protractor*

Lesson Procedure:

5E Model	5E Lesson Elements
Engage *Introduce the lesson with an anchoring phenomenon. Facilitate student questions, discussion, etc. as appropriate. Elicit students' ideas about the phenomenon with goal of making the lesson responsive to students lives and knowledge.*	**Procedure:** ● To introduce the percent of a number students are given a bag of 20 MathLink Colored cubes. ● In one bag there are… ○ 4 yellow cubes ○ 2 pink cubes ○ 10 purple cubes ○ 3 green cubes ○ 1 red cube ● With the teacher prompting them, students will need to find the percent of the whole number of cubes by determining the percent value of each cube. ● Students will be able to see percentages of a whole represented as a bar model. ● Then present the students with "How Much is in the Bag?" activity.

	• This activity will go deeper into the concept of finding the percent of a whole, with an emphasis of finding the 1%, etc. **Modifications** • Students may use their shoulder partners • Students are visually seeing percents in a bar model • If necessary, remind students by asking them, "A whole is what percent?" • Have instructions typed out as well as explained out loud. **Essential Questions** • Given the part, how will I be able to find a percent of a quantity as a rate per 100? **Standards Addressed** • **CCSS.MATH.CONTENT.6.RP.A.3** • **CCSS.MATH.CONTENT.6.RP.A.3.C** **Formative/Summative Assessments** • "How Much is in the Bag?" (This formative assessment is leveled to allow the teacher to see what misconceptions need to be addressed and what is mastered and what is not - based on each individual student.) **Resources** • MathLink Blocks • Bag of counter chips • How Much Is In the bag? document • Smart Board
Explore *Plan for students to engage in hands-on*	**Procedure:**

activities that are designed to facilitate conceptual change.	• Each student will be presented with the first task - FDP Review 1 (All tasks and assessments are in the **Percent Unit - FDP/Circle Graphs** • Teacher will be at the checker station, after students are finished with the task they are to be checked, if they are correct, they will be given task 2 - FDP Review 2, if they are incorrect, the teacher will give them direction on their mistakes and address misconceptions. • Students will complete all tasks, when they get to the circle graphs they will be applying what they have learned about FDP and Percent of types of problems. • After they have completed all Circle tasks, the teacher will give them the first Circle Assessment 1 (Formative Assessment) and then they will turn this one in (if the students have mistakes, guide them on their misconceptions and errors) and then complete Assessment 2 (Summative) **Modifications** • After the "How much is in the Bag?" Activity, place students is ability groups/partners • Have the questions printed out, along with printed instructions. • Rearrange the room for students to work with partners **Essential Questions** • How will I be able to use proportional relationships to solve multistep ratio and percent problems with circle graphs? **Standards Addressed** • CCSS.MATH.CONTENT.6.RP.A.3 • CCSS.MATH.CONTENT.6.RP.A.3.C **Formative/Summative Assessments** • Assessment 1 (Formative) • Assessment 2 (Summative) ○ Both Assessments are included in the Percent Unit - FDP/Circle Graphs **Resources/Materials**

	● Calculators ● Scratch Paper ● Percent Unit - FDP/Circle Graphs
Explain *Facilitate opportunities for students to explain their understanding of concepts and processes and make sense of new concepts.*	**Procedure:** ● Teacher begins the lesson by reminding students, and even revisits some of the circle graphs(pie charts) that were discussed in the previous lesson. ● Discuss with the students what they would like to conduct a survey on. ● Students then partner up and determine what survey question they will be asking their peers. ○ They may come up with their own/or research survey questions ○ All surveys must be teacher approved and different for each class period. ● After their survey is decided upon they will use Google Forms to formulate and conduct their survey. ● Students will share their school Google Form survey link - via Google Classroom or email ● Students will use their results to create their own circle graph using Google Sheets. ● Students will go to their Google Form and click on create spreadsheet. ● On the spreadsheet students will… ○ Insert Chart ○ Select the correct chart ○ Title Chart/Label sections ● Allow students to watch the Creating a Pie Chart in Google Sheets for help in creating their charts ● Teacher and Media Specialist(if available) will be circling classroom to provide assistance and feedback ● Students then turn in their Google Sheet with Data and Pie Chart in Google Classroom ● Student/Group presentations will be made to the class about their findings of the survey. ● They will address these questions… ○ What survey did they conduct? Why did they choose this survey? ○ Did you expect these results? or What was surprising about the results?

	○ Outside of school, where else would you want to conduct this survey and why? ○ If you were to do this again, what would you do differently? ● Student then completes the Peer Collaboration Evaluation **Modifications** ● Students may work with a partner ● Written and auditory instructions provided ● Media Specialist to help with posting links to Google Classroom or send email to students. **Essential Questions** ● How can I use proportional relationships to solve percent problems? ● How can I use data to determine similarities and differences? ● How can I use mathematical tools to model data? **Standards Addressed** ● CCSS.MATH.CONTENT.6.RP.A.3.C ● CCSS.MATH.CONTENT.7.RP.A.3 ● CCSS.MATH.CONTENT.7.G.A.2 ● KC1.B.1 ● KC2.A.1 **Formative/Summative Assessments** ● Partner Survey Project/Presentation Rubric ● Circle Graph Quick Check **Resources/Materials** ● Google Tools ○ Google Forms ○ Google Sheets

	○ Google Classroom ● Creating a Pie Chart in Google Sheets video ● Peer Collaboration Evaluation ● Paper ● Pencil ● Calculator
Elaborate *Provide applications of concepts and opportunities to challenge and deep ideas; build on or extend understanding and skills.*	**Procedure:** ● Show a zoomed in photo of a sun spot and or solar flare and conduct with the students the "See,Think, Wonder Activity" ● After the STW, reveal the whole picture - explain that we will be looking at NASA data that was gathered on Sunspots and Solar Flares ● Allow students to research Sunspots and Solar Flares. Recommend students to go to SpacePlace website ● During their research, the students need to write down at least three facts (informative and/or interesting) that they found - Students will share with class, and the teacher will record them on the smartboard. ● Pass out the hand out - Sunspots and Solar Flare Activity ● Students will read over the activity and the data, allow time for students to ask clarifying questions ● Give students the Sunspots and Solar Flares Activity #5 - Question 2 ● Based on the results, review the assessment with the class and clear up any misconceptions ● With their partner, they will need to begin to construct their circle graph to represent the data on Post it Presentation Paper. ● After all groups have constructed their circle graphs, trade with groups to allow students to assess their graph- measuring angles and calculations. ● Close the lesson by giving students the Sunspots and Solar Flares Activity #5 - Question 3, allow students to work independently, share with a partner, and then allow for whole class discussion.

- Student then completes the Peer Collaboration Evaluation

Modifications

- Review Fraction, Decimal Percent Conversions
- Students may choose their partner, but have partners predesignated in case of misbehaviors.
- Clarify any misconceptions about the data presentation
- Anticipate misunderstandings of science vocabulary

Essential Questions

- How can I use proportional relationships to solve percent problems?
- How can I use data to determine similarities and differences?
- How can I use mathematical tools to model data?

Standards Addressed

- CCSS.MATH.CONTENT.6.RP.A.3.C
- CCSS.MATH.CONTENT.7.RP.A.3
- CCSS.MATH.CONTENT.7.G.A.2
- RST.6-8.7
- MS-ETS 1-3

Formative/Summative Assessments

- Circle Graph Construction(use rubric) -
  Partner - Circle Graph Solar Flares and Sunspots Project
- Sunspots and Solar Flares Activity #5 - Question 2
- Sunspots and Solar Flares Activity #5 - Question 3

Resources/Materials:

- See Think Wonder Activity
- See Think Wonder Images
- Sunspots and Solar Flares Activity # 5

	• Sunspots and Solar Flares - SpacePlace • Calculator • Compass • Protractor • Post it Presentation Paper • Peer Collaboration Evaluation • Partner - Circle Graph Solar Flares and Sunspots Project
Evaluate *Assess student's knowledge, skills, and abilities.*	**Procedure:** • Students will complete Circle Graph Quizziz Assessment • They must show their thinking (work) on paper - they may use calculator • Students will be asked a variety of questions about percentages along with circle graphs **Modifications** • Present questions in multiple forms for multiple learning styles **Essential Questions** • Given the part, how will I be able to find a percent of a quantity as a rate per 100? • How will I be able to use proportional relationships to solve multistep ratio and percent problems with circle graphs? • How can I use proportional relationships to solve percent problems? • How can I use data to determine similarities and differences? **Standards Addressed** • CCSS.MATH.CONTENT.6.RP.A.3 • CCSS.MATH.CONTENT.6.RP.A.3.C • CCSS.MATH.CONTENT.7.RP.A.3 **Formative/Summative Assessments** • Percentage Summative Activity - Circle Graph Quizziz

	Resources/Materials: ● Circle Graph Quizziz ● Paper ● Pencil ● Calculator

Teacher Background:

- Student need to understand that all percents are out of 100
- Fraction Decimal and Percent conversions
- Using a protractor to measure and construct angles
- Constructing circles using a compass

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