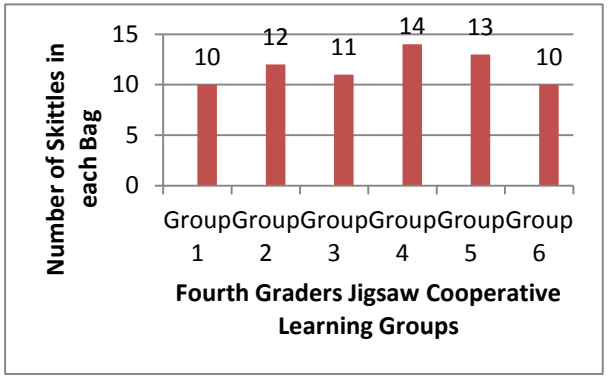
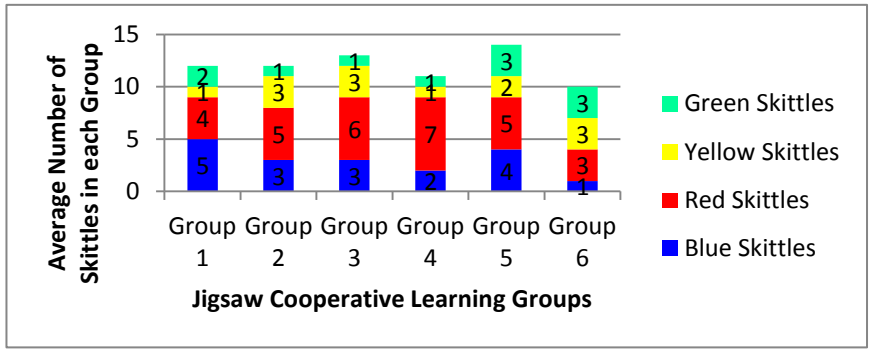
Grade Level	**4th Grade**	**Content Area**	**Science**
Course Title (grades 9-12 Only)			
Length of Unit	**4 days**	**Time of Year**	**3rd Quarter**
Expected Prior Knowledge *The knowledge/skills mastered earlier in the year foundational to the mastery of the required Standard in the current sample.*	Students will have mastered the following knowledge/skills earlier in 4th grade: S1C1PO 1-4, S1C2PO 1-5.		
Alignment to Program of Instruction *Briefly outline methods of instruction found in this sequence of lessons that align to the Program of Instruction described in A.3.*	The following methods of instruction are aligned to the Program of Instruction: (1) Common Core State Standard: instruction aligned to 4.1.3.1. (2) Direct Instruction: instruction is teacher-led and driven. (3) Understanding by Design (UbD): UbD lesson plan template used; title/objective identified for every lesson. (4) RTI tier grouping. (5) Cooperative Learning: students are organized in a Jigsaw Cooperative Learning Classroom.		
Standard Number and Description *List the Number* and full description for the required Standard.*	**4.1.3.1.** Analyze data obtained in a scientific investigation to identify trends		
Summative Assessment *Describe a cumulative and comprehensive activity, clearly separate from instruction and guided or independent practice, which allows each student to individually demonstrate mastery of the required Standard. A copy of the summative assessment must be attached to the curriculum sample.*	Students will successfully analyze the results of scientific investigation and identify trends in the collected data. Students will be able to earn a total of 10 points in this assessment.		
Scoring Scale and Mastery Level *Explain how the assessment is scored, to include points per question, how points are awarded, total points possible, criteria necessary to demonstrate mastery, and grading scale. A copy of the answer key and scoring rubric (whichever applicable) must be attached to the curriculum sample.*	The summative assessment will be scored using an answer key. Mastery will be demonstrated with a minimum score of 80% or at least 8 points out of a total of 10. A score of 10 points / 10 points = 100%. A score of 9 points / 10 points = 90%. A score of 8 points / 10 points = 80%. A score of 7 points / 10 points = 70%. A score of 6 = 60%.		
Materials/Resources Needed	A data chart for the American Kennel Club (http://www.akc.org/breeds/index.cfm), several small bags of Skittles candy, measuring tapes, and science notebooks.		

Lesson (add as needed)	Instruction	Student Activities
	Day 1: Objective – Run an experiment with the scientific method, in a jigsaw cooperative learning classroom. Determine trends in the experimental data collected. • Inform students that they will run a scientific investigation in the cooperative learning jigsaw classroom using the scientific method; and they will analyze the data collected to find pattern or trends. • Explain the benefits of using cooperative learning in a diverse classroom where students are at different levels of academic readiness. • Explain that in the jigsaw classroom, they will be organized in groups of six students and all jigsaw groups will be equal to each other in terms of academic strength. • To make sure that the five jigsaw groups are equal to each other in terms of academic strength, use the DORA/DOMA curriculum-based platforms and/or formative assessments to identify RTI tier-1, 2 and 3 students. Assign the same number of tier-1, 2 and 3 students to each one of the jigsaw groups. Also, assign the same number of boys/girls to each team. The jigsaw cooperative learning groups will be heterogeneous in student composition but homogenous in academic strength. • Write the six steps of the scientific method on the board and explain the importance of this procedure in scientific inquiry. Instruct students that they will use the scientific method to run a scientific experiment in a jigsaw cooperative learning classroom. • In each jigsaw cooperative learning group, assign a specific step of the scientific method to a specific student within the jigsaw group; and explain to this student that he/she will be the expert in that specific step for his/her group . He/she will be required to know everything about this step, specifically how to implement it. • Instruct students that they will use the scientific method to find out if all same size Skittles bags contain the exact same number of candies. Give a bag of Skittles to each jigsaw cooperative learning group, and help them start their experiment with the scientific method. • Help Student #1 in each group start Step 1 of the scientific method by	Students learn the benefits of cooperative learning in general and jigsaw cooperative learning in particular. Students learn how jigsaw cooperative learning groups are organized. In each jigsaw cooperative learning team, every student is assigned a specific task in the project. Specifically each student is responsible for mastering one of the six steps of the scientific method; the student will become the expert in that specific task for his/her team and will teach/inform the team about his/her specific task. Students learn about the following six steps of the scientific method and write them in their science notebooks: Step 1: Ask a Question Step 2: Do Background Research Step 3: Formulate/Construct a Hypothesis Step 4: Test Your Hypothesis by Doing an Experiment Step 5: Analyze Your Data and Draw a Conclusion Step 6: Communicate Your Results Each student learns how to implement the specific step of the scientific method assigned to him/her. In each group, students use the scientific method to count the number

1	asking the question: Do all bags contain the same number of Skittles? Have the student write down this question in his/her science notebook. • Help Student # 2 in each jigsaw cooperative group proceed with Step 2 of the scientific method that deals with doing some background research that will help Student # 3 formulate the hypothesis that will attempt to answer the question asked in Step 1. Have Student #3 in each jigsaw cooperative learning group answer the question: Do all bags contain the same number of Skittles? For instance, in Group A, Student # 3 will formulate the hypothesis by saying: "I think that all Skittles bags have the same number of candies". • To verify if the formulated hypothesis is true or false, Student #4 in each cooperative group will run the experiment by counting the number of candies contained in the bag of Skittles that the teacher gave to his/her group. Instruct Student #5 to analyze the data provided by the experiment run by Student #4 and draw some conclusion. • Ask Student # 6 in each group to report the number of candies found in their bag in the data table. Draw a bar graph (ex. Graph 1) to represent the experimental data collected by the students in the six jigsaw groups. ***Trend Analysis of Data Collected in the Scientific Investigation*** • Instruct Student #5 and 6 who are responsible for Step 5 and 6 of the scientific method to work together in the analysis and communication of the data generated by the experiment conducted by their group. However, in the trend analysis, all students within a jigsaw group are involved. • Show students how to study trends in experimental data by first, asking all students to look at Graph 1 and visually identify any trend. For example, you may help them notice that all bags have at least 10 Skittles and no more than 14. Then ask students in each group to visually study Graph 1 and answer the question asked in Step 1 of the scientific method (Do all bags contain the same number of Skittles)? • Second, define and show students how to calculate the mean/average number of Skittles and the range of Skittles in this experiment; these two statistics can be used to express trends in data analysis. • Third, ask students to use the calculated statistics to confirm (or not	of Skittles contained in their bag. They report the number of Skittles in data table and copy the bar graph (Graph 1) that the teacher drew on the board.  **Graph 1. Number of Skittles in Bags.** All students are involved in the data analysis designed to identify trends in their samples. Student #5 and 6 calculate the mean and range of the number of Skittles in this experiment. They also discuss the results of their scientific

	confirm) their answer to question 1 obtained from the visual observation of Graph 1. • Call on students to summarize the results of their investigation. • Collect the bags of Skittles to use for the next lesson. • To study trends in data, ask students to look at a data chart of dog owners to identify trends.	experiment and answer the question: Do all bags contain the same number of Skittles? Students record the summary of their findings in their individual science notebooks. Students identify trends in a data chart of dog owners.
2	**Day 2: Objective – Using the scientific method in a jigsaw cooperative classroom to study the number of colored Skittles in same size bags, with a focus on trend analysis.** • Review the information presented in Day 1 on the scientific method, the jigsaw cooperative learning classroom and the analysis of data to identify trends. • Explain that today students will conduct another investigation to determine whether a bag of Skittles has the same number of Skittles in different colors. Hand out three bags of Skittles to each jigsaw cooperative learning group and help Student #1 in each group initiate the scientific study by asking the question: Does a Skittles bag has the same number of Skittles in different colors? Write this question on the board and help students in each group answer the question by going through the steps of the scientific method. • To answer the question in Step 1 of the scientific method and study the trend associated with the investigation, instruct and help each group calculate the average/mean of the number of each color Skittles in the three bags received by the group. The group will also calculate the range of the number of each color Skittles that they have. • Instruct students in each group to record their results on the data table as shown in Table 1. Make a bar graph of their results as shown in Graph 2. The teacher guide the students in each group as they discuss their results and attempt to answer the question asked in Step 1 of the scientific method. ***Trend Analysis of Data Collected in the Scientific Investigation*** • Ask students to find trends in the experimental data by a visual study of bar Graph 2 first. Have them answer the question "Does a Skittles bag have the same number of Skittles in different colors?" Then help them use the average/means and ranges of Skittles of each color to confirm	The students review the information presented yesterday. Working in jigsaw cooperative learning groups, students will use the six steps of the scientific method to determine whether bags of Skittles have the same number of candies in each color. Students will separate Skittles in each bag according to their color and count them by color. They will determine the mean count by color by adding Skittles with the same color from the 3 bags given to the group by the teacher and by dividing this number by 3. Students in each group report their finding in the data table identical to Table 1; and they copy Graph 2 that the teacher drew on the board. The students analyze the data within their own group and compare their data to the data of other groups.

the results of their visual trend analysis.
• Allow students to share their conclusions with the class.



Graph 2. Mean Number of Skittles of Different Colors in Bags

Average Number of Skittles in each Group						
	Grip 1	**Grp 2**	**Grp 3**	**Grp 4**	**Grp 5**	**Grp 6**
Green	2	1	1	1	3	3
Yellow	1	3	3	1	2	3
Red	4	5	6	7	5	3
Blue	5	3	3	2	4	1

Table 1. Mean Number of Skittles of Different Colors in Bags

3

Day 3: Objective – Use the scientific method (with a focus on data collection, representation, and trend analysis) to study student height in a jigsaw cooperative classroom.
• Review the information on the scientific method and its importance and use in scientific inquiry. Review the six steps of the scientific method and have the students practice them.
• Review the information on the jigsaw cooperative learning classroom and help students form and integrate into their jigsaw groups. Help them remember their specific assignment with regard to the implementation of the scientific method in their jigsaw cooperative learning groups.
• Instruct students that today they will run an investigation in the jigsaw cooperative learning classroom to answer the following questions: (1) what is the average height of the six students in a jigsaw group. (2) Is the average height of boys bigger than the average height of all six students within the group? (3) Is the average height of girls bigger than the average height of all students? To conduct this study and answer these questions, students will use the scientific method and determine: (a) the average height of all six students within each jigsaw cooperative learning group; (b) the average height of boys; and (c) the average height of girls within each jigsaw cooperative learning group.
• They will collect and analyze the data and determine the trends within

• Student reviews the information being presented by the teacher on the scientific method, the jigsaw cooperative learning classroom and data analysis to identify trends.
• With the teacher's help Student #1 in each jigsaw group ask the following 3 questions:
(1) What is the average height of the six students within his/her group?
(2) Is the average height of boys bigger than the average height of all six students within the group?
(3) Is the average height of girls bigger than the average height of all students?
• Student #2 conducts some background research on the topic so that the questions asked can be answered.
• Student #3 uses the information provided by Student #2 research to make 3 educated guesses (formulate a hypothesis for each one of the question) with each one answering one of the three questions.
• Student #4, with the teacher's help run an experiment to see if the answers given by Student # 3 are correct. He/she measures the height of the members of his/her jigsaw group to test the hypotheses formulated by Student #3.
• Student #5 analyzes the data generated above in the experiment run by Student # 4. Then he/she calculates the average/mean height of all students in the group, the average/mean height of boys and girls within

<table>
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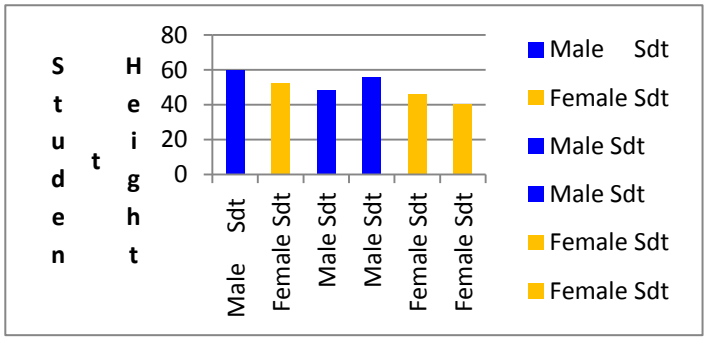
<td></td>
<td>the collected data.
• Guide students in each group start the study in Step 1 of the scientific method with Student #1 of each jigsaw cooperative learning group asking the questions listed above.
• Help students in each group run Step 2 to 6 of the scientific method. Afterward, instruct and help students in each group build and report their results in a data table like Table 2. Help them draw their results in a graph like Graph 3 given underneath.
Trend Analysis of Data Collected in the Scientific Investigation
• In the data analysis, ask students in each group to first use a visual estimation of the bar graph to answer the 3 questions given above and detect trends within the data collected. Then, instruct them to use the calculated statistics (average/mean heights, ranges) to support the observations made visually.
• Students meet with their counterparts from other jigsaw cooperative groups to learn and exchange information about their specific assignment in the experiment.

<table>
<tr><th></th><th>Sdt #1</th><th>Sdt #2</th><th>Sdt #3</th><th>Sdt #4</th><th>Sdt #5</th><th>Sdt 6</th></tr>
<tr><td>Gender</td><td>Boy</td><td>Girl</td><td>Boy</td><td>Boy</td><td>Girl</td><td>Girl</td></tr>
<tr><td>Height</td><td>60”</td><td>52”</td><td>48”</td><td>56”</td><td>46”</td><td>40”</td></tr>
<tr><td colspan="7">Boy average height: 54.7”
Girl average height: 46.0”
Group average height: 50.3”</td></tr>
</table>

Table 2. Data Table of Student Height in a Jigsaw Cooperative Group.
Sdt = Student.</td>
<td>his/her group. Student # 5 works with Student #6 to find trends in the data collected and conclude if the answers (or hypotheses) formulated by Student #3 are correct or not.
• Student # 5 and #6 are responsible for communicating the results of the study conducted by their jigsaw cooperative group.
• Students in each jigsaw cooperative learning group report their results in a table like Table #2 and Graph 3. They then identify trends in their results by a visual analysis of their tables and graphs, and they answer the 3 questions just by their visual analysis.
• They confirm their visual analysis by using the calculated averages/means and ranges.
• They meet with their counterparts from other groups to learn more about their specific assignment.

Graph 3. Height of Students in a Jigsaw Cooperative Learning Group
Sdt = Student.</td>
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<td>4</td>
<td>Day 4: Objective - Students will analyze the results of scientific investigation and identify trends in the collected data. Summative Assessment: The teacher distributes the assessment for student to complete independently.</td>
<td>Summative Assessment: Students complete the summative assessment and present it to the teacher for scoring.</td>
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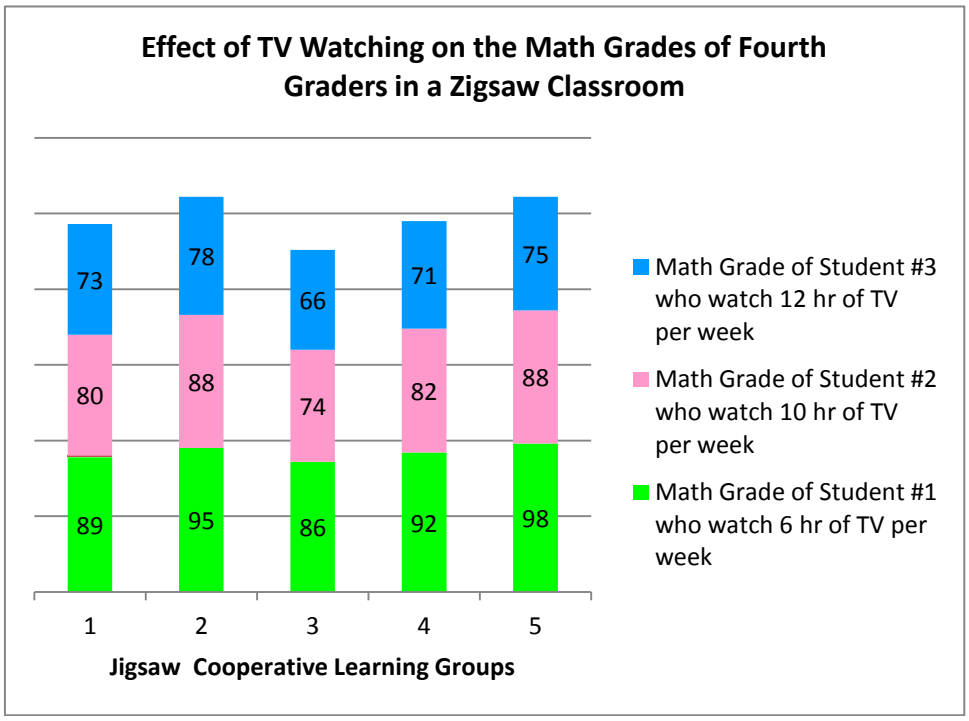
Summative Assessment

What Effect Does Watching Television Have On the Math Grades of Fourth Grades in a Jigsaw Cooperative Learning Classroom?

4.1.3.1. Analyze data obtained in a scientific investigation designed to identify trends

In this study, the fourth graders are pooled into five jigsaw cooperative learning groups. Each group has three students identified as Student #1, 2 and 3. Student #1 watches 6 hours of TV per week after school. Student #2 and 3 respectively watch 10 and 12 hours of TV per week after school. After, two quarters, the students' math grades are collected and displayed in the bar graph listed below. The students' job is to analyze the graph and identify trend(s) in the data collected. To conduct this analysis, students will answer the following questions:



1. Look at the graph, identify and describe 2 trends in the data between hours of television viewing and math grades (2 pts).

_____

_____

2. Calculate the average math score for the five Students #1, then for the five Students #2 followed by the five Students#3. Also, calculate the range of math grades for these three groups of students. Use these statistics to support the trend(s) visually identified in question 2 (8 pts).

Use the following examples to calculate the averages and ranges:
Students#1 average grade = (Std 1 grade + Std 2 grade + Std 3 grade + Std 4 grade + Std 5 grade) /5
Students#1 grade range of grades = biggest grade – smallest grade.

Answer Key

1. Look at the graph, identify and describe 2 trends in the data between hours of television viewing and math grades (2 pts).

A visual study of the bar graph shows that Student #1 grades are in the 90s; Student #2 grades are in the 80s; and Student #3 grades are in the 70s.

A visual study of the bar graph shows that the number of hours of television watching does appear to affect math grades. As students spend more time watching television, their math grades seem to decrease.

2. Calculate the average math score for the five Students #1, then for the five Students #2 followed by the five Students#3 (3 pts).

- Average math score of the six Students #1 (1 pt):

92% = (89% + 95% + 86% + 92% + 98%) / 5

- Average math score of the six Students #2 (1 pt):

82% = (80% + 88% + 74% + 82% + 88%) / 5

- Average math score of the six Students #3 (1 pt):

73% = (73% + 78% + 66% + 71% + 75%) / 5

Also, calculate the range of math grades for these three types of students (3 pts).

- Range of math grades for Student #1 (1 pt): 6%.
- Range of math grades for Student #2 (1 pt): 14%.
- Range of math grades for Student #3 (1 pt): 7%.

Use these statistics to support the trend(s) visually identified in #2 (2 pts).

The average math grades for Student #1, 2 and 3 are visually estimated in the 90s, 80s and 70s respectively. These estimates are confirmed by the calculated averages that are respectively, 92%, 82% and 73%.

The calculated averages also confirm that as students spend more time watching television, their math grades do indeed decrease.

A score of 10 pts/10 pts = 100%.
A score of 9 pts/10 pts = 90%.
A score of 8 pts/10 pts = 80%. Minimum score for mastery.
A score of 7 pts/10 pts = 70%. Minimum score for proficiency.
A score of 6 pts /10 pts = 60%