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THE 2015 ROSENTHAL PRIZE

for Innovation in Math Teaching

Do you have a classroom activity that is: Innovative? Engaging? Hands-on? Original? Replicable? Designed for students in grades 4–8?

If you answered "yes" to all of the above, the National Museum of Mathematics wants to hear from you!

The Rosenthal Prize for Innovation in Math Teaching, a **$25,000** prize awarded annually to a classroom teacher in the United States, celebrates innovation in the middle school math classroom by rewarding a teacher who creates an exceptional, hands-on, engaging math activity. The winning teacher will not only achieve national recognition, but will have the opportunity to influence classrooms across the country through dissemination of his or her activity.

New this year! Additional **$1,000** prizes for noteworthy activities.

Preliminary applications are due on May 19, 2015. Finalists will be notified in July 2015, and the prize will be awarded in December 2015. Find out more by visiting **rosenthalprize.momath.org** or by emailing **rosenthalprize@momath.org**. Nominate an educator at **nominate.momath.org**.

The Rosenthal Prize and MoMath: Improving math education across the United States.

The Rosenthal Prize for Innovation in Math Teaching is administered by the National Museum of Mathematics (momath.org), North America's only museum devoted to math and its many connections. MoMath uses innovative and engaging exhibits and programs to stimulate inquiry, spark curiosity, and highlight the wonders of mathematics.

rosenthalprize.momath.org

How to Apply for the 2015 Rosenthal Prize for Innovation in Math Teaching

1. Go to **in.momath.org/rosenthalprize**.

2. Click on the **Create new account** link in the **User login** area on the left side of the page.

3. To create your account, enter the requested information:
   - Personal contact information
   - School information (contact information plus grade levels)
   - What percentage of your daily schedule is dedicated to teaching?
   - What percentage of your daily teaching schedule is dedicated to teaching math?
   - A professional reference

Then press the **Create new account** button at the bottom of the page to submit the form.

4. You will receive an email from rosenthalprize@momath.org. Follow the instructions in the email (click on the second link) to finish setting up your account. You will be directed to a one-time login page that will allow you to set your password.

5. At the one-time login screen, click on the **Log in** button. On the next screen, you will be able to create a password and edit the information you submitted when creating your account. Click on the **Save** button to save the password and/or any updated information.

6. In the list of options at the top left area of the page, click on **Create a New Application**.

7. You can then view and respond to the six questions in the preliminary application.
   - Describe an innovative activity you implemented with your students in which the activity itself illustrates a relevant mathematical concept. (Please answer in 200 words or less.)
   - What was the grade level of the students who participated in your activity?
   - Please write a brief essay explaining how this activity represents your teaching philosophy. (Please answer in 200 words or less.)
   - Is this activity original to you? If so, please comment on when and how you developed it. If this activity is one you have borrowed from another source, please provide an attribution and explain how you have adapted or changed the activity.
   - Imagine that another teacher were trying to implement your activity in their classroom. If they had to start from scratch, what materials would they need? How much time would it take to prepare? What would be the cost (at market value) of all materials involved?
   - When did you start using this innovative practice in your classroom?

8. To submit or save your work, click on the **Save** button at the bottom of the screen. This submits your application; however, you will still be able to revise your answers (prior to the application deadline) after clicking on **Save**. If you wish, you can work on your application offline and then copy and paste your answers into the application.

Questions? Contact MoMath at rosenthalprize@momath.org or (212) 542-0566.

Rubric for Judging Preliminary Application

Please check if you agree: “Based on the information provided and at least a brief Internet search, this application appears to be the submitter's original work or contain an important component that is the submitter's original work.”

Rubric Item	0	1	2	3
Innovation *Is it outside the box?*	The activities described are routine and/or commonplace.	The activities described represent a slight twist on well-known techniques.	The activities described contain substantial innovative elements, but are within the context of more routine techniques.	The activities described are entirely novel and groundbreaking.
Engagement *Is it fun?*	The activity is not compelling. It is unlikely to be enjoyed by students.	The activity is satisfactory. It is unlikely to convince students that math is fun, but neither would it turn them off to math.	The activity is somewhat engaging. It would likely be seen as more fun than the typical math lesson.	The activity is designed to tap into sources of inherent student interest. This activity shows math as a fun, interactive endeavor.
Content *What's the math?*	There is no clear mathematical content to this activity.	Activity reflects math content, but it is either inaccurate or developmentally inappropriate.	Activity reflects math content, presented in an accurate but incomplete way.	Activity reflects rigorous and developmentally appropriate math content.
Replicability *Is the activity easy to replicate?*	The activity requires hard-to-find or costly materials AND the activity would take significant time and/or effort to prepare.	The activity requires hard-to-find or costly materials OR the activity would take significant time and/or effort to prepare.	The activity requires moderate cost materials or those that might be found in a school setting, and would not take significant time and/or effort to prepare.	The activity is low cost and makes use of commonly available materials, and would not take significant time and/or effort to prepare.
Connectedness *Does the activity have impact?*	This activity is completely unrelated to any unit of study in the math classroom.	This activity is somewhat related to a unit of study in the math classroom.	This activity ties in with a unit of study, though it is unclear how coherent that connection is.	This activity ties in with a unit of study in a coherent, integral way.
Narrative *Is it understandable?*	Narrative is unclear. I do not understand the activity.	Narrative is somewhat clear. I understand part of the activity, but not all.	Narrative is mostly clear. I understand the activity, but would need more details before being able to implement the activity.	Narrative is clear. The information included would be essentially sufficient to implement the activity in another classroom.
Teacher's writing *Is it well-written?*	Entry displays multiple errors in grammar, spelling, or logic, or multiple typos.	Entry is generally well-written, with some grammatical, spelling, or logical errors, or some typos.	Entry is well-written, with few grammatical, spelling, or logical errors, and few typos.	Entry is well-written, with no grammatical, spelling, or logical errors, and no typos.

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Nominate a teacher for the 2015 Rosenthal Prize

Do you know a full-time fourth through twelfth grade teacher with an exceptional math activity to share? The winning activity must be designed for grades four through eight.

Please fill out the short form below, and MoMath will invite them to apply for the 2015 Rosenthal Prize for Innovation in Math Teaching. The winning educator will be awarded $25,000 – and prizes of $1,000 will also be given out for noteworthy activities — so nominate a talented teacher today! Preliminary applications are due May 19, 2015. For more information, visit rosenthalprize.momath.org.

Your name: _____

Your email: _____

Nominee's name: _____

Nominee's email: _____

May we inform the nominee of your name? YES NO

Email completed forms to rosenthalprize@momath.org, or send to:
National Museum of Mathematics
ATTN: Rosenthal Prize
134 West 26th St., Suite 4S
New York, NY 10001

To submit this form online, visit nominate.momath.org.

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THE 2012 ROSENTHAL PRIZE
for Innovation in Math Teaching

Hands-On Data Analysis

Lesson Plan
GRADE
6

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Table of Contents

Note: This lesson plan is based on a submission to the 2012 Rosenthal Prize by winner Scott Goldthorp.

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Overview

In this lesson, students will conduct an experiment that involves jumping and finger paint. They will then use the data collected to explore central tendency.

Prerequisite Knowledge

To succeed in meeting the goals of this lesson, students should have a solid foundation in performing basic mathematical computations as well as using a meter stick/ruler to measure length to the nearest centimeter. It is suggested that this lesson be taught at the beginning of a statistics unit of study. However, as the prerequisite knowledge is not prohibitive, this lesson can be adapted to suit the needs of other students in grades 4 through 8.

Lesson Goals

After participating in this lesson students will be able to:

- Collect data and draw inferences from that data
- Represent data graphically
- Demonstrate an understanding of measures of central tendency and variability
- Calculate measures of central tendency and variability

Assessment

- Throughout the lesson, students will complete the attached data analysis handout, which was designed to allow the students to demonstrate their understanding of the above goals.
- At the conclusion of the lesson, students will be given a sample set of data: {4, 6, 7, 4, 8, 2, 12} and asked to write the mean, median, mode, and range on an exit slip.

Common Core State Standards (Statistics and Probability 6.SP)

Develop understanding of statistical variability.

- Understand that a set of data collected to answer a statistical question has a distribution which can be described by its center, spread, and overall shape.
- Recognize that a measure of center for a numerical data set summarizes all of its values with a single number, while a measure of variation describes how its values vary with a single number.

Summarize numerical data sets in relation to their context, such as by:

- Reporting the number of observations.
- Describing the nature of the attribute under investigation, including how it was measured and its units of measurement.
- Giving quantitative measures of center (median and/or mean), as well as describing any overall pattern and any striking deviations from the overall pattern with reference to the context in which the data were gathered.

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Hands-On Data Collection & Analysis Activity

Length of Lesson

Two class periods (40 to 50 minutes each)

Length of Prep Time

Day One—15 minutes
Day Two—5 minutes

Materials:

- Washable finger paint in multiple colors
- Chart paper—one large piece per group
- Bucket of water or access to a sink/bathroom
- Meter sticks—one per group
- Writing utensils
- "Hands-On Data Collection & Analysis" handout (attached)

Lesson: Day 1—Data Collection

Setting up the Lesson

1. Set up stations around the classroom to allow sufficient space for each group to work.
2. Place the materials needed at each station to facilitate time on task for student groups.
3. Hang chart paper on the wall at the appropriate height. (Remember, students will be jumping as high as they can!)
4. If using a bucket of water for students to wash hands, put it in the middle of classroom for easy access.
5. Divide students into groups of three. Each student will rotate through the three roles:
   - Making handprint
   - Cleaning
   - Measuring and recording

Teaching the Lesson

1. Introduction: 5 minutes
   - Provide students with a short preview as to what they will be doing in class. For example, "We will be conducting an experiment that involves jumping and using finger paint in order to collect and analyze data."
2. Explaining the lab: 5 to 10 minutes
   - Distribute the "Hands-On Data Collection & Analysis" handout.
   - Hold a class discussion to develop guidelines for completing each of the handprint techniques.
   - Once the guidelines for the four types of jumps are decided, have students record these in questions one through four on the "Hands-On Data Collection & Analysis" handout.

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Lesson: Day 1—Data Collection (Continued)

- Choose a student to model the correct way to perform the different handprint techniques.
- Explain the procedures for washing hands/cleaning up.
    - If there are no sinks available, a bucket of water in the center of the classroom works well.
- Explain the procedures for measuring.
    - Take the chart paper off the wall and place on a table to make measurements.
    - Use the meter stick to measure the vertical distance between the highest point on the standing handprint and the highest point on the appropriate jump handprint.
- Measure to the nearest centimeter and record on data collection sheet.
- Address student questions/concerns as needed.

3. Participate in the lab: 25 to 30 minutes
    - Students should work collaboratively to collect and manipulate data. Each student should rotate through specific roles to ensure that all students will be actively engaged in the lab.
    - Students should enter their data on the "master list" on the white board, so that all students will have access to the class data.
    - The teacher should address student questions/concerns as needed.
    - While students are working, the teacher should circulate and probe student reasoning. Here are some prompts:
        - Explain what you are currently doing.
        - Why are you doing the activity this way?
        - Is your result efficient? Why or why not?
        - Where else could measures of central tendency be used?
        - Explain the difference between mean and median.
        - Why is range an interesting quantity to measure?
4. Closure: 5 minutes
    - Ensure that all students have entered data on the "master list," and instruct students to record the "master list" data in their data tables.
    - Discuss how the lab will be extended the following period.

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Lesson: Day 2—Data Analysis

Setting up the Lesson

Arrange desks so students have space to work in the same groups (three people) as they did on Day 1.

Teaching the Lesson

1. Introduction: 5 minutes
   - Ask students to recap what they accomplished during the previous class period.
   - Lead a class discussion as to the expectations for completing the lab.
2. Participate in the lab: 30 to 35 minutes or longer, depending on ability level
   - Students should work collaboratively to explore measures of central tendency and variation, by completing the analysis and exploration questions on the handout.
   - The teacher should teach (or review) the features of a histogram.
   - Students should work collaboratively to graphically represent their data from question #10 using any of the following tools:
     - Hand-drawn graph
     - Computer spreadsheet
     - Tablet computer
   - The teacher should address student questions/concerns as needed.
3. Closure: 10 minutes
   - Lead a class discussion where students share their conclusions. At least review exploration questions one through four.
   - Encourage students to ask questions of each other to further explain their thoughts.
   - Ask students to complete an "exit slip"–find mean, median, mode, and range of a sample set of data, and hand slip to the teacher upon exiting the classroom.

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Teacher Expectations

The teacher should expect this lesson to actively engage students in the collection and analysis of data. The hand printing activity creates a "hook" for students at the beginning of the lesson, motivating them to engage in the mathematical concepts embedded throughout the lesson. The raw data collected will be used multiple times within this activity and in different extension/remediation exercises, to solidify student understanding of statistical variability and distributions.

Student Outcomes

Students are expected to exit this lesson with an understanding of data collection and analysis, including making predictions from a random sample and calculating measures of central tendency and variability. Students will use the attached handouts to record and analyze their data throughout the exploration.

Lesson Notes and Suggestions

It may take students more than one period to finish the exploration questions and histogram. It is recommended that, at the end of Day 2, you have students share their responses to exploration questions one through four. This will allow students to know they are working in the right direction, and will provide them with feedback to aid in the completion of the lesson.

Extension

- Have students look at the data for the entire 6th grade, not just their class. Analyze the data to find the measures of central tendency and variability for the extended set of data. Students should then compare this data to just their class data and reflect upon the differences.
- If there is only one 6th grade class in the school, students can try this same statistical experiment with another population to see how the data varies.
- Students can rank their jump by percentile, and compare their percentiles across the three different types of jumps measured.

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Common Student Missteps

- When measuring, make sure students see where the ruler markings begin. (Note that ruler markings are often not exactly aligned with the physical end of the ruler.)
- Students may want to measure the diagonal distance from fingertip to fingertip for the measurements, but we are only interested in the vertical difference. Students can draw a horizontal line across the paper at each of their fingertips and measure the distance between the lines to correct this misstep.
- When finding the median, students often forget to put the numbers in numerical order. This must be done before students can find the median.
- When calculating the mean, students often make a mistake when finding the sum or the number of numbers in the data set. Students should be advised to double check all calculations.

Alternate Method for Data Collection

As an alternative to making handprints, your students could use the paint only on their fingertips to make fingerprints on the chart paper. Another option is to have the students use a marker to make the marks on the chart paper. If you choose the marker option, please explain that each student should hold the marker the same way for each jump, to ensure consistent and accurate results.

Accommodations for Students with Disabilities

Place chart paper on a table, and have each student make one handprint with his or her arm relaxed at the table, and then a second handprint with his or her arm extended as far as possible.

Additional Resources

NCTM *Illuminations*, "Comparing Properties of the Mean and Median through the use of Technology"
http://goo.gl/mQ2cy

Karen LoBello, *Teaching Math: Mean, Median, and Mode*
http://goo.gl/2XVy1

Illustrative Mathematics, *Content Standards Kindergarten Through Grade Eight* (see Statistics and Probability for grade 6)
http://goo.gl/51ni1

Sans Washington, *Math Data Collection Analysis and Display*
http://goo.gl/zstI4

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Name.....

Hands-On Data Collection & Analysis Handout

For this activity, you will be making four handprints on a piece of chart paper. You will make a standing handprint, followed by handprints after a standing jump, a single-step jump, and a multiple-step jump. To ensure the consistency of the data, the entire class must follow the same guidelines when performing the experiment.

1. What are the guidelines for a standing handprint?

2. What are the guidelines for a standing jump handprint?

3. What are the guidelines for a single-step jump handprint?

4. What are the guidelines for a multiple-step handprint?

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Data Collection Table

Collect data for your group. Later, share data with other groups until you have the data for all the students in your class.

Name	*Standing Jump*	*Single-Step Jump*	*Multiple-Step Jump*
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			
23			
24			
25			
26			
27			

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Analysis and Exploration

1. Look at each column of the data; is there a number that appears the most in each column? If so, what is it?

   Standing Jump..... *Single-Step Jump*..... *Multiple-Step Jump*.....

2. Organize the numbers in each column in order from least to greatest. Circle the middle number (or the middle two numbers) in each group. If there are two middle numbers, find the average of those two numbers and circle that, too.

   Standing Jump

   Single-Step Jump

   Multiple-Step Jump

3. Find the sum of the numbers in each column, then divide by the number of entries in each column.

   Standing Jump..... *Single-Step Jump*..... *Multiple-Step Jump*.....

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4. You just found three measures of central tendency, which are single numbers that are used to summarize a larger set of data. Three measures of central tendency are mean, median, and mode. The mean is a number that could replace every entry in the column, and still result in the same sum of all entries. The median is the number in the middle when the entries are listed in order (or the midpoint of the two numbers in the middle). The mode is simply the entry that appears most frequently. Which measure of central tendency did you calculate in questions 1, 2, and 3?

Question 1–

Question 2–

Question 3–

5. The range of the data, a measure of variability, is the difference between the largest number and smallest number. Calculate the range for each column of data.

Standing Jump..... *Single-Step Jump*..... *Multiple-Step Jump*.....

What does this number mean? Is it the same for each type of jump? Explain.

6. Look at the mean for each category. Which is the highest? What does this represent?

7. Find the mean, median, mode, and range for only your group's set of data. Is this similar to the values you calculated for the class data? Explain.

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8. If you had to estimate the standing jump height of a 6th grader in the entire school, what measure of central tendency would you use? Explain.

9. Other than estimating the jump height of a fellow 6th grader, what else could this data sampling be used for?

10. Using an interval of 3 cm for the horizontal labels, create a histogram relating jump height and number of students. Discuss appropriate labels for the axes. Complete on a sheet of graph paper or with a computer spreadsheet program.

11. Describe the distribution of data in your histogram.

12. A professional basketball player had measurements of 90 cm for a standing jump, 88 cm for a single-step jump, and 84 cm for a multiple-step jump. How does adding this data to our class data change the mean, median, mode, and range?