



Pareto Analysis in Quality Improvement

A Practice Understanding Task

Purpose: The purpose of this lesson is to work with a Master Process Pro with John Deere to allow students to select a problem that is not working as well as it should in society. Students will then use proper sampling techniques in order to determine the causes of inefficiency in their problem. Once data is collected, students will need to categorize and synthesize their responses. Students will then use the Pareto Principle to analyze and create graphical representations of their data. Students will then discuss potential causes for the top 80% of the problems and generate solutions to implement.

The goal of this activity is to be utilized as more of a cumulative project for surveying techniques and analyzing data.

Career Field:

John Deere

Product Support/Diagnostics, Business Management, and Quality Engineering

NC Math 4 Standards:

NC.M4.SP.1 Create statistical investigations to make sense of real-world phenomena.

NC.M4.SP.1.1 Construct statistical questions to guide explorations of data in context. NC.M4.SP.1.2 Design sample surveys and comparative experiments using sampling methods to collect and analyze data to answer a statistical question.

NC.M4.SP.1.4 Interpret non-standard data visualizations from the media or scientific papers to make sense of real-world phenomena.

Unit Alignment:

NC Math 4 - Unit 5: Exploratory Data Analysis

Common Core State Standards for Mathematical Practice

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.

In partnership with



WAKE COUNTY
PUBLIC SCHOOL SYSTEM



Prerequisite Skills

- Students should have a basic understanding of entering data and creating graphical representations in Excel
- Students should be familiar with categorizing groups of data with similar responses and features
- Students should be able to create a survey and select an appropriate sampling technique in order to have unbiased results

Time Required

The time required to complete this activity is approximately 180 minutes. The first day (45 minutes) will be spent on launching the activity, introducing examples with the Pareto Principle, and student groups selecting their topic and survey methods. During non-class time, students will administer their survey. On the second day, students will spend 45 minutes categorizing their responses, creating their Pareto Graph, and analyzing results. The student groups will brainstorm solutions to enhance the effectiveness of their problem and share out the results. The groups will then share their findings with the class in short presentations of up to 5 minutes.

Materials Needed

- Student Activity Sheet
- Computer for Excel Spreadsheet

The Teaching Cycle:

Launch: Have students complete the [Desmos Launch Activity \(opens in a new window\)](https://teacher.desmos.com/activitybuilder/custom/5ffc8f5455f4250cd8d7cc77?collections=5f6cae0049988f0bfcd6f9f8) [plain text link: <https://teacher.desmos.com/activitybuilder/custom/5ffc8f5455f4250cd8d7cc77?collections=5f6cae0049988f0bfcd6f9f8>]

Explore:

- Students will use Excel for this activity. Teachers should anticipate struggles with adapting to using this technology tool. Within the Student Sheet, there are instructions on how to use Excel for this activity, however teachers should monitor groups closely to mitigate problems. Additionally, there is an [Excel tutorial video](#) that could be given to students as well.
- 3 examples of Pareto Principle - Student Excel sheet guides the students through 3 examples of how to use the Pareto Principle. Example 1 - Cafeteria Survey is very structured with step-by-step instructions. Example 2 - Low Student Performance, has the tables set up for students to fill in. Example 3 - Problems with Dodge RAM 2500 has students creating categories for the raw data responses given. They will then complete the Pareto chart and draw conclusions for the Dodge RAM.

This is meant to be a culminating activity for the Unit if time allows. If you choose to do the last part of the activity, students should collect their data outside of class to save time. On the last page of the Excel Student Sheet there is a rubric for students to follow to ensure they are including all aspects of the assignment in their presentation.

- Work on survey - Students will determine a problem that they would like to help improve. They will devise a survey question to determine causes of the problem and administer the survey in an unbiased manner. Teachers should monitor and have students share how they plan on collecting data in order to ensure they are reaching their target audience and collecting unbiased information.
- Tabulating Data - Students will then categorize their survey answers and create a Pareto chart and graph.

- Students will analyze data in in their groups:
 - a) Where is the numerical turn in the data that separates the vital few from the trivial many?
 - b) What issues will have the most impact toward improvement?
 - c) What is the amount of the top percentage you will focus your energy on?
 - d) What possible solutions do you have for management regarding your survey results?
 - e) What risk or uncertainties exist?
 - f) What other factors are important to consider?

****NOTE:** If time does not permit for students to complete their own survey, there is an [additional data set](#) from a Wake Technical Community College survey of students' feelings on the advising program at the school. This data can be used to practice grouping data and creating Pareto charts.

Discuss:

Groups will then present their findings including their initial survey, how they collected their responses, their data, graphs, and conclusions. Class can discuss how to best go about making changes that will improve outcome. Teachers can encourage other students to question the group about misleading or incorrect conclusions that they presented. Discussion should also include whether the cause of the problem may not be something in their ability to change due to outside factors and limitations (budget, time, etc.).

Exit Ticket:

As an exit ticket, ask students the following questions:

"Which group do you think would have the most success solving their problem and why?"

"Is there any group that you think miscategorized their data or could have collected their data differently to get alternate results?"