

Lab Framework

Text: Applied Mathematics

Unit number and title: 19 Working with Statistics

Short Description: Students will perform an industrial process, then collect data on the accuracy of the performance of that process. The mean and standard deviation for the process will then be calculated, and an acceptable range error (within design tolerance) established. The lab will be followed by a discussion of how industry uses statistical process control to maintain the consistency of manufacturing processes and the quality of products.

Developed by: Kevin Grayum, Boeing Educator Intern Program CQI Training, July 1995

Contact Information: Cascade High School, Everett SD,
Kgrayum@everett.wednet.edu

Date:

Lab Title If I had a Hammer

LAB PLAN

TEACHER: Teacher Prep/ Lesson Plan

- **Lab Objective**
 - Review measuring skills
 - Review data collection and graphing
 - Practice using statistical terminology
 - Determine the range of a set of data
 - Determine the mean median and mode of a range of data
 - Calculate the mean (average) variation in performance
 - Calculate the standard deviation for variations in performance
- **Statement of pre-requisite skills needed** (i.e., vocabulary, measurement techniques, formulas, etc.)
- **Vocabulary**
- **Materials List**
 - Lengths of 2 x 4 lumber, two feet long. One per students.
 - 8d bright box head nails (not galvanized, not finish head). Ten per student.
 - Masking tape
 - Rulers (metric) and pencils
 - Stop watch. One per team
 - Data collection sheets
- **GLEs (State Standards) addressed**

Math:

 - 1.1 Understand and apply concepts and procedures from number sense
 - 1.2 Understand and apply concepts and procedures from measurement

- 1.4 Understand and apply concepts and procedures from probability and statistics
- 3.1 Analyze information
- 3.2 Draw conclusions and verify results
- 4.1 Use observation to access and extract mathematical information
- 4.2 Organize and interpret information
- 5.1 Use conceptual and procedural understanding from multiple math content areas
- 5.2 Use mathematical thinking and modeling in other disciplines
- 5.3 Relate mathematical concepts to real life situations

Reading: If using the Data Collection sheet:

EALR 2: The student understands the meaning of what is read.

Component 2.1 Demonstrate evidence of reading comprehension.

- 2.1.7 Apply comprehension monitoring strategies for informational and technical materials, complex narratives, and expositions: determine importance and summarize the text

EALR 3: The student reads different materials for a variety of purposes.

Component 3.2 Read to perform a task.

- 3.2.2 Apply understanding of complex information, including functional documents, to perform a task.

Component 3.3 Read for career applications.

- 3.3.1 Apply appropriate reading strategies for interpreting technical and non-technical documents used in job-related settings.

Writing: If using the Data Collection sheet:

EALR 3: The student writes clearly and effectively.

Component 3.1: Develops ideas and organizes writing. W

- 3.1.1 Analyzes ideas, selects a manageable topic, and elaborates using specific, relevant details and/or examples.

Component 3.2: Uses appropriate style. W

- 3.2.2 Analyzes and selects language appropriate for specific audiences and purposes.

- 3.2.3 Uses a variety of sentences consistent with audience, purpose, and form.

Component 3.3: Knows and applies writing conventions appropriate for the grade level. W

- 3.3.1 Uses legible handwriting.
- 3.3.2 Spells accurately in final draft.
- 3.3.3 Applies capitalization rules.
- 3.3.4 Applies punctuation rules.
- 3.3.5 Applies usage rules.
- 3.3.6 Uses complete sentences in writing.

<https://wa-appliedmath.org/>

- **Leadership Skills**
- **SCAN Skills/Workplace Skills**
- **Set-up information**

- **Lab organization**(-Grouping/leadership opportunities/cooperative learning expectations; -**Timeline required**)
- **Teacher Assessment of student learning** (scoring guide, rubric)
- **Summary of learning** (to be finished after student completes lab)
 - discuss real world application of learning from lab
 - opportunity for students to share/present learning
- **Optional activities**
- **Career Applications**

Washington Applied Math Council

<https://wa-appliedmath.org/>

LAB TITLE: _____

STUDENT INSTRUCTIONS:

- **Statement of problem addressed by lab**

- **Grouping instructions and roles**

- **Procedures** – steps to follow/instructions
 - Organize class into teams of three or four students.
 - Distribute materials.
 - Scribe a line down the center of the wide face of the 2 x 4.
 - Mark every 5cm along the length of the line just scribed.
 - Wrap a masking tape “flag” around each of the 8d nails so that the bottom edge of the tape is 25mm below the underside of the head of the nail.
 - When every team member has their board and nails prepared, one at a time, each member will have 30 seconds to drive each of their nails into their board at the points marked along the center line to the depth marked by the bottom edge of the tape.
 - The nails must be driven in straight and precisely on the point mark.
 - After all ten nails have been driven the distance from the board to the underside of each nail is carefully measured and recorded.
 - Determine the range of all the measurements in the group.
 - Determine the average of all the measurements in the group.
 - Determine the standard deviation of all the measurements in the group.
 - Each member will create a histogram of their measurements by plotting the measurement of each nail.
 - Draw horizontal lines at plus or minus one standard deviation distance on the histogram.
 - Count the number of nails that lie outside the range indicated by the standard deviation lines. Equipment with only a few marks outside the range needs adjustment or repair. Equipment with many marks outside the range should be replaced.

- **Outcome instructions**

- **Assessment instructions** (peer-teacher)
 - Data collection sheet 10%
 - Mean and standard deviation computations 30%
 - Histogram 15%
 - Outside of range count 5%
 - Questions answered 30%
 - Writing standards 10%

Lab Data Collection

Student: _____ Date: _____

Unit: _____

Lab Title:

Criteria: Write the problem/objective in statement form

Data Collection: Record the collected/given data

Calculations: Complete the given calculations to solve for an answer(s)

Summary Statement:

Other Assessment(s)

<https://wa-appliedmath.org/>