Precision Measurement Lab

Mid-Valley
STEM-CTE HUB

www.midvalleystem.org
midvalleystemctehub@linnbenton.edu
Linn-Benton Community College
Albany Campus - CC-212

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Precision Measurement Lab

The Precision Measurement gives students the tools to investigate the world like scientists and engineers. Through hands-on measurement activities, students collect accurate data, analyze results, and develop essential STEM skills used in laboratories, manufacturing, engineering, environmental science, healthcare, and research careers.

Students learn how different measuring tools are designed for different purposes while practicing precision, observation, data collection, and critical thinking. The kit supports inquiry-based learning across mathematics, science, engineering, and Career and Technical Education (CTE) classrooms.

Grade Level

6th - 12th

Group Size

1 - 2 students per group

Time Duration

20 - 90 minutes

Content of Kits

Components

- 15 Stopwatches
- 15 Clicker Counters
- 15 Calipers
- 15 Probe Thermometers
- 15 12" Rulers
- 15 Architecture Rulers
- 15 Engineering Rulers
- 15 Soft Tape Measures

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Usage

Getting Started

1. **Inventory and Organize the Measurement Tools**

Begin by unpacking the kit and confirming that all stopwatches, clicker counters, calipers, thermometers, rulers, and tape measures are present and in good working condition. Organize the tools by type so each student or team has access to the appropriate equipment for the investigation.

2. **Introduce the Purpose of Each Tool**

Before beginning an activity, demonstrate how each measuring tool is used and discuss why different tools are designed to measure different quantities. Encourage students to compare the precision, units, and intended uses of each instrument.

3. **Practice Accurate Measurement Techniques**

Allow students time to practice using each tool with familiar classroom objects before collecting investigation data. Emphasize proper measurement techniques, careful observations, and consistent data recording to improve accuracy and reliability.

4. **Prepare a Data Collection System**

Provide students with data tables, science notebooks, or digital spreadsheets for recording measurements. Encourage them to include units, make repeated measurements when appropriate, and compare results with classmates to discuss precision, accuracy, and sources of error.

Storage

- **Clean and Organize Equipment**

Wipe down thermometers after each investigation. Return each tool to its designated storage location and verify that all equipment has been collected before storing the kit.

- **Protect Precision Instruments**

Store calipers, thermometers, and measuring tools in a clean, dry location where they will not be bent or crushed. Keeping precision instruments protected helps maintain their accuracy and extends their lifespan.

Troubleshooting

- **Measurements Vary Between Students**

If students obtain different measurements for the same object, review proper tool use, measurement techniques, and unit selection. Encourage students to repeat measurements and compare results to identify possible sources of error and improve consistency.

- **Tools Are Not Producing Accurate Results**

If a measuring tool appears to give incorrect readings, check that it is being used correctly and that the appropriate tool has been selected for the task. Inspect the tool for damage or obstructions and compare measurements with another instrument if needed.

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Activity Guide

Beginner

Measurement Tool Challenge
Students rotate through measurement stations to explore the purpose and precision of different measuring tools. They determine which tool is best suited for measuring length, circumference, temperature, time, and quantity while collecting accurate data.

Oregon Math Standards Alignment
6.GM, 7.DR, & HS.NQ.B.5

Procedure
1. Set up stations featuring different measuring tools.
2. At each station, students measure an assigned object or quantity using the appropriate tool.
3. Record measurements with the correct units.
4. Compare results with classmates and discuss any differences.
5. Reflect on why certain tools are better suited for specific measurements.

Intermediate

The Precision Investigation
Students investigate the difference between precision and accuracy by collecting repeated measurements of the same object using calipers, rulers, and tape measures. Students analyze variation in their data and identify possible sources of measurement error.

Oregon Math & Science Standards Alignment
MS-ETS1-3, 7.DR, 8.GM, HS.NQ, & HS.GM

Procedure
1. Select several classroom objects to measure.
2. Measure each object three times using different measuring tools.
3. Record and compare all measurements.
4. Calculate the average measurement for each object.
5. Discuss why measurements may vary and how scientists improve reliability.

Advanced

Data Collection Challenge
Student teams design and conduct their own investigation by selecting an object, event, or process to measure. Using multiple tools from the kit, students collect quantitative data, organize their findings, and present evidence-based conclusions.

Oregon Science Standards Alignment
7.DR.B, HS.NQ.B.5, HS.GM, & HS.DR

Procedure
1. Develop an investigable question that requires measurement.
2. Select the appropriate measuring tools.
3. Collect multiple sets of data.
4. Organize results into tables or graphs.
5. Present conclusions and explain why specific measuring tools were selected.

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Learning Extensions

STEAM Connections: Engineering - Math - Science - Tech

Learning Objectives:

- Select and use appropriate measurement tools to collect accurate and precise data.
- Measure and compare length, distance, temperature, time, and quantity using standard units.
- Record, organize, analyze, and interpret quantitative data to identify patterns and draw evidence-based conclusions.
- Explain the importance of precision, accuracy, and repeated measurements in scientific investigations and engineering design.
- Apply mathematical reasoning and data analysis to solve real-world problems.
- Develop and conduct investigations that use measurement to answer scientific or engineering questions.

Career Connections:

- **Mechanical Engineer –** Uses precise measurements to design and improve machines, equipment, and mechanical systems.
- **Manufacturing Technician –** Measures and inspects products to ensure they meet quality standards.
- **Quality Control Inspector –** Uses precision tools to verify that products meet required specifications.
- **Surveyor –** Collects accurate measurements to map land and support construction projects.
- **Industrial Engineer –** Uses data and measurement to improve manufacturing processes and workplace efficiency.
- **Research Scientist –** Designs investigations, collects accurate data, and analyzes results to answer scientific questions.

Essential Employability Skills:

- Data Literacy
- Critical Thinking
- Problem Solving
- Communication
- Collaboration
- Observation and Attention to Detail
- Responsibility

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Resources and Accessibility

Safety Guidelines

- **Use Measurement Tools as Intended**

Handle calipers, probe thermometers, rulers, and tape measures with care, using each tool only for its intended purpose. Avoid pointing probe thermometers toward others or forcing measuring tools beyond their normal range of use.

- **Maintain an Organized Work Area**

Keep measuring tools, cords, and materials organized throughout investigations. Return tools to the designated workspace after use to help prevent trips, dropped equipment, and inaccurate measurements caused by clutter.

Accessibility

- **Provide Multiple Ways to Participate**

Students can contribute by taking measurements, timing activities, counting objects, recording data, organizing materials, creating graphs, or presenting findings. Offering a variety of roles allows all learners to participate based on their strengths and abilities.

- **Support Learning with Visual and Hands-On Strategies**

Demonstrate proper use of each measuring tool before investigations begin and provide visual examples, labeled diagrams, and step-by-step measurement guides. Encourage students to communicate results through writing, speaking, drawing, tables, or digital tools to support a variety of learning styles.

Library Catalog

Library Resources

Feedback

QR to feedback survey