Food Waste

Numeracy Opportunities in Food Waste PBL (Grades K-12)

Regardless of grade level, students working with numeracy opportunities and demands will also be engaging in some/many of the guiding principles and standards for mathematical practices.

- **Guiding Principles:**
  - A clear and effective communicator
  - A self-directed and lifelong learner
  - A creative and practical problem solver
  - A responsible and involved citizen
  - An integrative and informed thinker

- **Standards for Mathematical Practice:**
  - Make sense of problems and persevere in solving them
  - Reason abstractly and quantitatively
  - Construct viable arguments and critique the reasoning of others
  - Model with mathematics
  - Use appropriate tools strategically
  - Attend to precision
  - Look for and make use of structure
  - Look for and express regularity in repeated reasoning

The following pages will provide you with information regarding naturally occurring numeracy opportunities focused on food waste:

- **Childhood (K-5)**
- **Early Adolescence (6-8)**
- **Adolescence (9-diploma)**
- **Possible guiding questions**

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Childhood (K-5)

Math Focus Strands:

- **Quantitative Reasoning:**
    - **Counting & Cardinality:** Counting food waste types.
    - **Numbers and Operations in Base Ten:** Calculating total food waste for a week, month, or year.
    - **Numbers and Operations: Fractions:** Comparing wasted vs. consumed food portions.
- **Algebraic Reasoning:**
    - **Operations and Algebraic Thinking:**
        - Calculating total food waste for a week, month, or year.
        - Comparing wasted vs. consumed food portions.
- **Statistical Reasoning:**
    - **Measurement & Data:**
        - Weighing and measuring food waste, using non-standard and standard units.
        - Creating bar graphs and pictographs to represent food waste trends.
        - Categorizing food waste types

Example Activities:

1. **Cafeteria Food Waste Audit** – Students sort food waste (e.g., fruits, vegetables, dairy) and count each type daily.
2. **Graphing Waste Data** – Students create bar graphs to compare different days or weeks.
3. **Estimation Games** – Predicting how much food is wasted in the classroom/school and comparing estimates to real data.
4. **Basic Ratios** – Comparing the number of whole apples thrown away vs. apple cores to discuss waste reduction.

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Early Adolescence (6-8)

Math Focus Areas:

- **Quantitative Reasoning:**
  - **Ratio and Proportional Relationships:** Comparing food waste amounts across time periods or locations.
- **Algebraic Reasoning:**
  - **Expressions and Equations:** Analyzing patterns in food waste data and making predictions.
- **Geometric Reasoning:**
  - **Geometry:**
    - Planning composting bins and storage layouts.
    - Using grams, kilograms, ounces, and pounds to analyze food waste.
- **Statistical Reasoning:**
  - **Statistics & Probability:** Determining average waste per person and modeling food waste reduction.

Example Activities:

1. **Data Collection & Analysis** – Students conduct a cafeteria waste audit, record weights, and analyze the data.
2. **Proportions & Reductions** – Students calculate how much food waste can be reduced if each person wastes 10% less.
3. **Geometric Planning** – Designing efficient composting bins with surface area and volume calculations.
4. **Statistical Predictions** – Using past data to predict future food waste and testing their models over a set period.

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Adolescence (9-diploma)

Math Focus Areas:

- **Algebraic Reasoning:**
    - **Creating Equations and/or Inequalities:** Modeling relationships between food waste reduction and economic savings.
    - **Reasoning with Equations & Inequalities:**
        - Analyzing relationships between food waste reduction and economic savings.
        - Predicting food waste trends over time and proposing mathematical solutions.
        - Assessing the economic impact of food waste on businesses and communities.
- **Statistical Reasoning:**
    - **Statistics & Probability: Interpreting Categorical & Quantitative Data:** Analyzing food waste trends using measures of central tendency (mean, median, mode).
    - **Statistics & Probability: Making Inferences & Justifying Conclusions:** Examining spoilage rates and expiration dates in relation to food storage practices.

Example Activities:

1. **Linear & Exponential Waste Models** – Students create functions to predict waste reduction based on intervention strategies.
2. **Cost-Benefit Analysis** – Students analyze the financial impact of food waste on schools, restaurants, and households.
3. **Regression Analysis on Food Waste Data** – Using real-world data sets to identify trends and make policy recommendations.
4. **Optimization Problems** – Designing the most cost-effective way to reduce waste using mathematical modeling.

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Alignment with Maine Solutionaries Framework

- **Systems Thinking** – Understanding how food waste contributes to the larger waste disposal system.
- **Problem-Solving & Critical Thinking** – Developing strategies to reduce food waste and/or make constructive use of food waste (e.g. composting)
- **Collaboration & Civic Engagement** – Presenting data-driven findings to local policymakers.
- **Innovation & Advocacy** – Using mathematical models to advocate for food waste reduction and mitigation policies.

Some guiding questions about food waste

Note: these questions might be good for all of the age ranges but might be answered differently by them.

1. Measuring it
   - How can we measure it?
   - Volume? How might we do that?
   - Weight? How might we do that?
   - Can we say anything about the relationship between weight and volume?
   - Are there ideas other than measuring weight or volume?
   - What role might sampling play in helping us measure it?
2. Classifying waste
   - What classification schemes are possible?
   - (e.g., different kinds of food?; brought vs bought?)
3. What actually qualifies as food waste? (For example, if someone takes one bite of an apple and tosses the rest, there is some sense that it has been wasted. If someone more-or-less eats the apple and tosses the core, is that food waste?)
4. How does waste at target school compare to state/national data?
5. What are some possible remediations and what % of wasted food will these address? (e.g. composting could address some but probably not all)
6. What are some already established ways to mitigate the problem of food waste? (see, for example, https://extension.sdstate.edu/food-waste-schools-and-strategies-reduce-it)
7. *Why* is the food wasted? Is a survey appropriate?
   - As we gather all of the data from the questions above, what are some ways to communicate what we have found?