Depth Of Knowledge - Core Objectives for Sustainability and Mathematics - Progressive learning - USA	
Grade Pre K	Develop vocabulary related to sustainability, such as recycling, conservation, or renewable energy, and use it in context. Engage in reading activities that introduce environmental themes and promote awareness of sustainable practices. Express ideas and feelings through drawing, storytelling, or simple writing activities related to the importance of caring for the environment. **Read Aloud and Explore:** ● Choose colorful and interactive picture books that introduce basic environmental concepts. For example, "The Earth Book" by Todd Parr or "We Planted a Tree" by Diane Muldrow. During reading, encourage children to point out pictures related to nature and sustainability. **Nature Walk and Show-and-Tell:** ● Take short nature walks around the school or local area. Collect simple items like leaves, twigs, or flowers. During show-and-tell time, have the children share their findings and talk about how nature is important. **Vocabulary Games:** ● Create simple games to introduce and reinforce vocabulary related to sustainability. For example, a recycling sorting game where children sort pictures of items into categories like "recycle," "reduce," and "reuse." **Arts and Crafts:**

	● Provide art supplies for children to create environmentally themed crafts. They can make collages using recycled materials, draw pictures of their favorite animals or nature scenes, or even create a small garden using recycled containers. **Interactive Storytelling:** ● Use puppets or stuffed animals to tell simple stories about taking care of the environment. Allow the children to interact with the characters and discuss what they can do to help. **Sensory Bins:** ● Create sensory bins with materials like sand, dirt, and small recycled items. Incorporate small toy animals to represent wildlife. This hands-on activity can help children explore textures and understand the importance of caring for the environment. **Dramatic Play:** ● Set up a dramatic play area where children can pretend to be involved in eco-friendly activities. This could include a pretend recycling center, a nature conservation area, or a garden. Encourage them to use related vocabulary during their play. **Simple Writing Activities:** ● Introduce basic writing activities where children can draw or scribble pictures related to caring for the environment. For instance, they can draw a picture of themselves recycling or reusing items. Display their creations in the classroom. **Nature-themed Songs and Rhymes:** ● Teach simple songs or rhymes related to nature and sustainability. Singing and movement can make learning fun and memorable for young children. **Classroom Garden:**

	● If possible, create a small classroom garden. Allow children to participate in planting and caring for plants. This provides a hands-on experience and teaches them about the importance of nurturing living things. **Guest Speakers or Storytellers:** ● Invite guest speakers or storytellers who can engage the children with interactive and age-appropriate stories about nature, animals, and sustainability.
Grade K	● Recognize and sort objects based on their attributes, such as recyclable and non-recyclable materials or natural and human-made resources. ● Engage in counting and comparing activities related to the quantities of natural resources, such as counting the number of trees in a given area. ● Introduce basic concepts of measurement and estimation using environmental contexts, such as measuring water usage or estimating energy consumption. **2. Teaching Point for Recognizing and Sorting Objects:** ● Show students a variety of objects and discuss their attributes, such as recyclable and non-recyclable materials or natural and human-made resources. ● Encourage students to sort a collection of objects based on these attributes. ● Provide hands-on activities where students practice sorting objects into different categories based on their attributes. ● Discuss the importance of categorizing objects correctly for environmental sustainability.

	2. Teaching Point for Counting and Comparing Natural Resources: ● Take students on a nature walk to observe the natural resources around them, such as trees in a park or forest. ● Engage students in counting the number of trees or other natural resources in a given area. ● Encourage students to compare the quantities of natural resources they observe, such as comparing the number of trees in different locations. ● Discuss the significance of natural resources and the importance of conserving them. 3. **Teaching Point for Introducing Measurement and Estimation**: ● Provide students with real-life examples of environmental contexts, such as measuring water usage or estimating energy consumption. ● Demonstrate how to measure water usage using a measuring cup or estimating energy consumption using simple calculations. ● Engage students in hands-on activities where they practice measuring and estimating in environmental contexts. ● Discuss the importance of being mindful of resource usage and the impact of conserving resources on the environment.
Grade 1	● Recognize and sort objects based on their attributes, such as recyclable and non-recyclable materials or items that use renewable and non-renewable resources. ● Engage in counting and comparing activities related to quantities of resources, such as counting the number of trees in a picture or estimating the amount of water used.

	• Explore measurement concepts by quantifying and comparing environmental factors, such as measuring the length of a garden or comparing the sizes of different recycling bins. Recognizing and Sorting Objects based on Attributes: 1. **Recyclable vs. Non-Recyclable Sorting Game**: Provide a variety of objects such as plastic bottles, paper sheets, cans, and fabric scraps. Have students sort these objects into two categories - recyclable and non-recyclable based on their characteristics. 2. **Nature Walk Scavenger Hunt**: Take students on a nature walk and ask them to collect items they find. Back in the classroom, students can group these items into recyclable and non-recyclable categories and discuss their choices. 3. **Classroom Recycling System**: Set up a classroom recycling system with labeled bins for recyclables and non-recyclables. Students can bring in items from home to properly sort and dispose of. Counting and Comparing Activities: 1. **Tree Counting**: Show students pictures of various landscapes with trees and ask them to count the number of trees in each picture. Discuss their counting strategies and encourage them to explain their reasoning. 2. **Water Estimation Challenge**: Present different scenarios involving water usage (e.g., watering plants, bathing) and ask students to estimate the amount of water used in each scenario. Compare estimations as a class and discuss their thought processes. 3. **Resource Comparison**: Provide pictures of different resources like trees, water bodies, and recycling bins. Have students compare the quantities of these resources in each picture, emphasizing the importance of conservation. Exploring Measurement Concepts: 1. **Garden Measurement**: Set up a mini-garden area in the classroom with different

	plants. Ask students to measure the length of each plant using rulers or measuring tapes. Encourage them to compare the lengths and discuss their findings. 2. **Bin Size Comparison**: Display pictures of different recycling bins of varying sizes. Have students measure and compare the sizes of these bins using measuring tools, promoting hands-on exploration of measurement concepts. 3. **Personal Space Measurement**: Ask students to measure their personal space in the classroom using measuring tapes. Discuss the concept of personal space and compare measurements to foster critical thinking and spatial awareness.
Grade 2	● Recognize and sort objects based on their attributes, such as recyclable and non-recyclable materials or natural and human-made resources. ● Engage in counting and comparing activities related to quantities of resources, such as counting the number of trees in a given area or estimating the amount of water used. ● Introduce basic concepts of measurement and estimation using environmental contexts, such as measuring the length of a garden or estimating the weight of recyclable materials. 2. **Why Certain Items Belong in Each Category**: ● **Activity**: Create a sorting game where students have a mix of pictures or descriptions of items (e.g., plastic bottle, wooden toy, paper cup) and they have to decide whether each item belongs in the recyclable or non-recyclable category. ● **Discussion**: After sorting, discuss the reasons behind why certain items belong in each category. Emphasize the importance of taking care of the environment by making informed decisions about waste. 3. **Counting and Comparing Activities**:

- **Activity 1 - Tree Counting**: Show students a picture with different types of trees and ask them to count the number of each type. They can then compare the quantities using terms like more, less, or equal.
- **Activity 2 - Water Usage Estimation**: Present scenarios where students have to estimate the amount of water used for various activities like washing dishes, taking a shower, or watering plants. They can compare the water usage in different scenarios using comparison terms.

4. **Measurement and Estimation**:
   - **Activity 1 - Garden Length Measurement**: Provide students with a small-scale garden map and ask them to measure and calculate the total length of the garden perimeter using rulers.
   - **Activity 2 - Recyclable Material Weight Estimation**: Show students different recyclable items and ask them to estimate the weight of each item by comparing with known objects of similar weight. They can then weigh the items to check their estimations.
5. **Real-Life Application**:
   - **Activity**: Challenge students to create a sustainability plan for their school or home. They can use math skills to estimate energy usage, water consumption, and waste production, and come up with solutions to reduce their environmental impact.
   - **Discussion**: Encourage students to reflect on how math helps them understand real-world sustainability issues and make informed decisions that positively impact the environment.

Grade 3	● Recognize and sort objects based on their attributes, such as recyclable and non-recyclable materials or items that use renewable and non-renewable resources. ● Engage in counting and comparing activities related to quantities of resources, such as estimating the amount of water used or counting the number of trees in a picture. ● Explore measurement concepts by quantifying and comparing environmental factors, such as measuring the length of a garden or comparing the sizes of different recycling bins. 1. Thematic Activity: "Eco-Friendly Sorting Adventure" Description: Set up a sorting station with various items like paper, plastic bottles, glass jars, and compostable materials. Label two bins - one for recyclable items and one for non-recyclable items. Challenge students to sort the objects correctly based on their attributes. Discuss the importance of recycling and how it contributes to sustainability. 2. Thematic Activity: "Resource Quantity Quest" Description: Create stations around the classroom or outdoors where students engage in resource-related activities. For example, at one station, students estimate the amount of water used during different daily activities. At another station, provide pictures showing different tree counts and have students compare and tally the numbers. Through these activities, students practice counting and comparing resource quantities while understanding the importance of conservation. 3.

	4. Thematic Activity: "Sustainable Measurement Mission" Description: Transform the classroom into a sustainability-themed measurement lab. Students can measure the length of a "garden" (paper cutouts representing plants) using rulers or measuring tapes. Another activity could involve comparing the sizes of recycling bins by measuring their dimensions. Encourage students to discuss the significance of accurate measurements in environmental awareness and sustainable practices.
Grade 4	• Apply mathematical skills to analyze and interpret data related to environmental issues, such as population growth, waste management, or energy consumption. • Utilize mathematical reasoning to solve problems related to sustainability, such as calculating resource usage, comparing data sets, or estimating environmental impacts. • Explore measurement concepts by quantifying and comparing environmental factors, such as length, area, or volume of natural resources. 1. **Thematic Math and Sustainability Teaching Point**: "Analyzing Population Growth" i. **Objective**: Apply mathematical skills to analyze and interpret data related to environmental issues like population growth. ii. **Teaching Point**: "Let's use our math skills to understand how populations in different areas are growing. We can collect data on population numbers over the years and create graphs to visualize the changes. By analyzing this data, we can identify trends and patterns to better understand the impact of population growth on the environment." **2. Thematic Math and Sustainability Teaching Point**: "Solving Waste Management Problems"

	iii. **Objective**: Utilize mathematical reasoning to solve problems related to sustainability, such as waste management. iv. **Teaching Point**: "Today, we are going to solve a waste management problem using math. Let's estimate the amount of waste produced in our school each day and compare it to the amount that is recycled. By using math to calculate percentages and ratios, we can determine the effectiveness of our waste management practices and brainstorm ways to minimize waste and promote recycling." **3. Thematic Math and Sustainability Teaching Point**: "Measuring Environmental Factors" v. **Objective**: Explore measurement concepts by quantifying and comparing environmental factors like natural resources. vi. **Teaching Point**: "We are going to explore measurement concepts by quantifying the length, area, and volume of natural resources in our local ecosystem. Let's measure the length of a stream, the area of a forested area, and the volume of a lake. By applying math skills to environmental factors, we can better appreciate the value of these resources and learn how to conserve and protect them for future generations."
Grade 5	● Apply mathematical skills to analyze and interpret data related to environmental issues, such as population growth, pollution levels, or energy consumption. ● Utilize mathematical reasoning to solve problems related to sustainability, such as calculating carbon footprints, comparing resource usage, or analyzing trends in environmental data.

	● Explore measurement concepts by quantifying and comparing environmental factors, such as area, volume, or weight of recyclable materials. ● 1. **Activity for Math and Sustainability Objective 1:** Title: Population Growth and Pollution Analysis Description: Provide students with a dataset containing population growth rates in different urban areas and corresponding pollution levels. Guide students to use statistical methods to analyze the data, calculate correlations, and create visual representations (such as scatter plots or line graphs). Encourage discussions on how increasing populations impact pollution levels and the environment. 2. **Activity for Math and Sustainability Objective 2**: Title: Calculating Carbon Footprints Description: Present students with scenarios involving various activities (e.g., car commuting, biking, using public transportation, energy consumption at home). Ask students to calculate the carbon footprint of each activity using given formulas and data. Engage students in problem-solving discussions on how different choices impact carbon emissions and how these calculations can influence sustainable decision-making. 3. **Activity for Math and Sustainability Objective 3:** Title: Measuring Environmental Factors Description: Set up stations with different measuring tools (e.g., rulers, scales, calculators) and environmental samples (e.g., soil samples, emission data). Assign students to quantify and compare environmental factors like the area of deforested land, volume of greenhouse gas emissions, or water pollution levels. Facilitate discussions on the significance of these measurements in understanding human impacts on the environment and promoting sustainable practices.

Grade 6	- Apply mathematical skills to analyze and interpret data related to environmental issues, such as population growth, pollution levels, or energy consumption. - Utilize mathematical reasoning to solve problems related to sustainability, such as calculating carbon footprints, estimating resource availability, or analyzing trends in environmental data. - Explore measurement concepts by quantifying and comparing environmental factors, such as area, volume, or rates of change in natural systems. <ol start="2"> - Thematic Math and Sustainability Teaching Point: "Analyzing Pollution Levels" - Objective: Apply mathematical skills to analyze and interpret data related to environmental issues like pollution levels. - Teaching Point: "Today, we will use math to analyze pollution levels in our community. By collecting data on air quality or water pollution, we can apply statistical analysis techniques to interpret the data and understand the impact of pollution on our environment. Let's work together to identify trends and patterns in the data and brainstorm solutions to reduce pollution levels." - Thematic Math and Sustainability Teaching Point: "Calculating Carbon Footprints" - Objective: Utilize mathematical reasoning to solve problems related to sustainability, such as calculating carbon footprints. - Teaching Point: "Let's calculate our carbon footprints today! By using math to quantify our energy consumption, transportation habits, and waste production, we can estimate the amount of carbon dioxide we are responsible for emitting. This exercise will help us understand the impact of our daily choices on the environment and motivate us to reduce our carbon footprints through sustainable practices."

	4. **Thematic Math and Sustainability Teaching Point**: "Quantifying Rates of Change in Natural Systems" • **Objective**: Explore measurement concepts by quantifying and comparing environmental factors like rates of change in natural systems. • **Teaching Point**: "Today, we will explore how math can help us quantify and compare rates of change in natural systems. We can measure the area affected by deforestation over time, the volume of water in a river during different seasons, or the rate of glacier melting. By applying math to these environmental factors, we can gain a deeper understanding of the changes occurring in our natural world and brainstorm ways to protect and preserve our ecosystems."
Grade 7	• Apply mathematical skills to analyze and interpret data related to environmental issues, such as climate data, population growth, or resource consumption. • Utilize mathematical reasoning to solve problems related to sustainability, such as calculating energy efficiency, estimating carbon footprints, or analyzing trends in pollution levels. • Explore mathematical concepts, such as proportions, ratios, and statistics, in the context of sustainable practices and environmental science.
Grade 8	• Apply mathematical concepts and formulas to analyze data related to environmental issues, such as carbon footprint calculations or population growth projections.

	• Utilize mathematical models to assess the long-term impacts of resource consumption and waste generation. • Solve problems involving economic and financial aspects of sustainability, such as cost-benefit analyses of renewable energy investments.
Grade 9	• Apply mathematical models and statistical analysis to explore sustainability-related concepts, such as population growth, carbon footprints, or economic implications of sustainable practices. • Utilize mathematical reasoning to evaluate the costs and benefits of sustainable solutions, including conducting life cycle assessments and analyzing data on resource consumption. • Solve problems involving mathematical relationships and formulas related to environmental science, such as calculating energy efficiency, carbon emissions, or ecological footprints.
Grade 10	• Apply mathematical models and statistical analysis to explore sustainability-related concepts, such as population growth, carbon footprints, or the economics of renewable energy. • Utilize mathematical reasoning to evaluate the costs and benefits of sustainable practices, including calculating energy efficiency or conducting life cycle assessments. • Analyze and interpret data related to environmental issues, such as climate data, pollution levels, or biodiversity indicators.