

## Mathematical Usage in Data Centers

Total Number of Lessons: 5

Total Estimated Time for Module: 5 days x 1 hour 15 minutes = 375 minutes

### SECTION 1: MODULE OVERVIEW AND CURRICULAR CONNECTIONS

- **Module goal:** At the end of this module, SWBAT demonstrate their understanding of data centers orally and through written language by performing mathematical operations, evaluating data, and converting unit measurements.
- **Connection to standards:**
  - Math:
    - **4.NS.5 (E):** Write tenths and hundredths in decimal and fraction notations. Use words, models, standard form, and expanded form to represent decimal numbers to hundredths.
    - **4.M.2 (E):** Within given measurement systems, convert larger units to smaller units, including km, m, cm; kg, g; lb, oz; l, ml; hr, min, sec, and use these conversions to solve real world problems.
    - **4.DA.1 (E):** Formulate questions that can be addressed with data. Collect, organize, and graph data from observations, surveys, and experiments using line plots with whole number intervals, single- and scaled bar graphs, and frequency tables. Solve real world problems by analyzing and interpreting the data using grade level computation and comparison strategies.
  - Computer Science:
    - **3-5.IC.1 (E):** Describe the positive and negative impacts of technology on one's personal life, society, and our culture.
    - **3-5.DI.5 (E):** Use data to highlight or propose cause-and-effect relationships, predict outcomes, or communicate an idea.
  - Reading:
    - **4.CC.7 (E):** Recognize claims in print, image, and multimedia and identify evidence used to support these claims.
- **RET materials/ideas to be leveraged:**
  - I am using my research project on data centers as the basis for this implementation in my classroom. I have modified it for 4th grade to understand, but the foundation comes from my summer research, as well as the foundations of AI and its inner workings. These were learned about in the first three sessions of the summer.

- Resources to be purchased:
  - [Tape measures](#) (class set) - x3 - \$30.12
  - [Classroom measurement set](#) - x1 - \$220.49
  - [“The Great Data Center Adventure” Book](#) - x1 - \$12.99
  - [Computer Science & AI Lego Education Set](#) - x1 (enrichment/application) - \$429.95
  - [Class set of flashlights](#) - \$35.09
  - [Data Detectives Classroom Resource](#) - \$5.00

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| SECTION 2: OVERVIEW OF MODULE FRAMEWORK – REQUIRED |
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- **Real-world context:**

- **Possible Lesson Ideas:** The lessons that are planned in this mini unit are all based off of my research for the summer, which refers to energy usage and effectiveness of data centers. This is something that is connected to our area in a very real way with the Amazon data center being constructed in New Carlisle, as well as the Microsoft data center in Granger. By starting with giving students context about the data centers and then looking explicitly at data including decimals and conversions, they will be able to state their opinions about the “best” data centers, as well as the impacts of data centers in our community. Allowing them to spiral review essential math concepts while providing a real world context will allow students to gain a deeper understanding of the content and applications.

- **Background STEM content:**

- **Possible Lesson Ideas:** Because this is a math mini unit, STEM is at the forefront of these lessons. Students will work on activities that meet three essential 4th grade math standards. Additionally, because of the context of the project, it is relating to science and engineering. Data centers have very real world applications environmentally, technologically, and analytically. By introducing students to data centers, they are going to be thinking critically about science, technology, and engineering in the community. Finally, there are also two computer science standards that are integrated, allowing students to continue to develop their critical thinking skills in technology.

- **Description of Main Activity/Project:**

- **Possible Activity/Project Ideas:** The goal is for students to garner a deeper understanding of data centers in the community while also utilizing a spiral review for three essential math standards. The timing of this mini unit is important because it will occur the week before spring break, which is a crucial time for ILEARN review. This unit will make the review more engaging for students. At the end, students will ultimately decide which type of data center is best for the community, taking into account their data analysis, unit conversions, and decimal measurements that they have worked with over the week.
- This is a 5 day mini unit. **Day 1** will include an introduction to data centers. What are they? How do they work? What is their impact? **Day 2** will begin the introduction to the project using math by beginning with a decimal review. We will review decimal place values (whole group), learn what decimals mean in the context of data centers, and compare decimals. Students will then be given various stats on data centers (energy use, speed, storage space) and will work individually to compare these numbers. **Day 3** will discuss conversions, starting with why they are used, especially in the context of data centers (whole group). Students will work individually to convert the decimal numbers that they worked with on Day 2. On **Day 4**, students will graph the numbers in groups from both Days 2 and 3 in order to have a visual comparison of the effectiveness of different aspects of data centers, focusing mostly on effectiveness and energy usage. Finally, on **Day 5**, students will utilize their graphs and what they have learned over the course of the week to decide if data centers have a positive or negative impact on our community, based on the data they have gathered. Students will discuss and share ideas in small groups and ultimately make their own decisions with individual evidence.

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| <b>SECTION 3: MODULE SEQUENCING AND ASSESSMENT – REQUIRED</b> |
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- **Brief description of sequenced learning objectives:**
  - Lesson 1: Following a presentation of data centers, their purpose, and their impacts, SWBAT describe what a data center does and explain the positives and negatives of having one in the community.
  - Lesson 2: After a review of decimals and their comparisons, SWBAT accurately compare real-world decimal numbers of both energy usage and cost of data centers.
  - Lesson 3: Following a review of unit conversions, SWBAT correctly convert real-world decimal numbers to various other units to further understand the impact of data centers.
  - Lesson 4: Utilizing numbers and information from previous lessons, SWBAT create a graph showing data points of multiple data centers and technologies.
  - Lesson 5: Following 4 days of instruction, SWBAT synthesize their project information from graphs, charts, and writings to communicate their opinions on data centers, supported by factual evidence.

- **Brief description of formative and summative assessment approaches:**

- Lesson 1: Students will complete an “exit ticket” answering basic questions about what they learned about data centers (**formative**). This will allow the instructor to have a quick overview of if students understand what the rest of the basis of the project will be. Students will be retaught missed aspects of data centers the following day.
- Lesson 2: Student responses will be monitored while reviewing decimals (**formative**). Students may be pulled to the teacher table to review decimals and comparisons if necessary. Students will complete the worksheet review comparing different companies’ costs and energy usages and will turn this in at the end of the lesson (**formative**). Feedback will be given before Lesson 4.
- Lesson 3: Student responses will be monitored while reviewing conversions (**formative**). Students may be pulled to the teacher table to review if necessary. Students will complete the next part of their worksheet review, converting the decimal numbers they worked with yesterday. Worksheets will be turned in at the end of the lesson (**formative**). Feedback will be given before lesson 4 the next day.
- Lesson 4: Students will submit the graphs that they worked on together as a small group (**summative**). This will demonstrate both their understanding of the numbers given, as well as provide a basis for their activity tomorrow. Feedback will be provided and shared before the final day of the mini unit.
- Lesson 5: Students will be monitored during peer discussions while sharing their thoughts about data centers and why they have this belief (**formative**). Students will turn in their final, written reflection about data centers at the end of this lesson, synthesizing all that they have worked on and learned throughout the week (**summative**). Students will be assessed on how well they support their claims with evidence, as well as what types of evidence they use.

- **Recommendations for implementation:**

- Numbers will change year to year. It might be possible to continue to update these numbers with a new subscription to different data sites, but it is also important to teach students about the speed at which some softwares are being developed, and how this could impact their data.
- This could be modified to any sort of data collection project; it does not have to be limited to just data centers. For example, students could practice collecting their own data, converting it, and doing a data analysis on it as a different sort of review.
- It is important to complete this mini unit after ensuring that the students have already been instructed on the core math topics, as this is structured as a review of essential standards. It is also likely to be more useful later in the year as a review/engaging project.

- It is important to preteach students the background knowledge of data centers before they begin working on this project. Do NOT skip the introduction day where it is important to demonstrate the importance of this project.

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| SECTION 4: MODULE FILES – ENCOURAGED/OPTIONAL |
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- **List of attached files:**

-  **CDI Module Day 1 Lesson** : This document details the outline that I have for the first lesson when introducing data centers. It includes resources and activities that will be used.
-  **CDI Module Day 2 Lesson** : This document details the outline that I have for the second lesson, reviewing decimals and their uses in data centers. The powerpoint and worksheet now include specific numbers from the 4 major “tech giants” and numbers from their data centers that students will be comparing.
-  **CDI Module Day 3 Lesson** : This document shows the structure for the conversion lesson of this mini unit. It includes the document that I have for worksheet review and the powerpoint that will be used during the lesson. After students complete this lesson, they will be ready to move on to graphing their data.
-  **CDI Module Day 4 Lesson** : This document contains all of the resources that students will need to use in order to graph the numbers that they have been working with all week. This will allow them a different perspective to compare the numbers and will help support them before the last day of the mini unit.
-  **CDI Module Day 5 Lesson** : This final lesson outlines what students will be working on as their summative assessment in this mini unit and includes an example of the summative assessment.