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| **Lesson Title**: Data Collection & Analysis w/Bivariate Bar Graph  **Created by:** Kathleen DeMars | | | **NRS Level of Lesson:**  NRS 2 & NRS 3 |
| **Intended Modality:** (check all that apply)  **x** In-person □ Virtual □ Hybrid | | | |
| **Content Area(s)** | **Targeted** [**IL ABE/ASE Content Standards**](http://www.excellenceinadulted.com/resources/abease-curriculum-project/) | | |
| **Math 2.OA.11** | Fluently multiply within 100 | | |
| **Math 2.MD.9** | Draw a scaled picture or scaled bar graph to represent a data set with several categories | | |
| **Math 3.SP.1 MWOTL** | Recognize a statistical question as one that anticipates variability in the data related to the question and accounts for it in the answers. | | |
| **Integrated** [**Essential Employability Skills**](https://www.illinoisworknet.com/DownloadPrint/ILEssentialEmployabilitySkills-Handout.pdf) | | | |
| **x** Personal Ethic *(Integrity, Respect, Perseverance, Positive Attitude)* | | □ Teamwork *(Critical Thinking, Effective & Cooperative Work)* | |
| **x** Work Ethic *(Dependability, Professionalism)* | | **x** Communication *(Active Listening, Clear Communication)* | |
| **Lesson Objectives *(Students will be able to)****:*   * Practice multiplication fast facts to increase fluency. * Create a table and bar graph using bivariate data collected ourselves. * Connect data analysis to our world and to career paths in a meaningful way. | | | |
| **Engagement is not “one size fits all.” How are you providing multiple ways to engage all learners? Click on** [**Multiple Means of Engagement**](https://udlguidelines.cast.org/engagement) **to learn more about providing options for learners and explain how you are including this below:**   * We will **optimize relevance, value, and authenticity** by collecting our own data to use in our graphing. The data we are collecting will help us see our fluency with multiplication, which is a key skill we are working to develop as mathematicians and one that is integral to our success moving deeper into our content. * We will **minimize threats and distractions** by letting students know exactly how long and how many times they are expected to collect data about their multiplication fluency. * We will **heighten salience of goals and objectives** by dividing our large goal into shorter specific goals. For example, first students will record their data. Next, students will create a table. Then, students will create a graph. Finally, students will analyze their results. * We will **promote expectations and beliefs that optimize motivation** by supporting activities that require self-reflection. Students will have the opportunity to reflect on their learning throughout this project. | | | |
| **Key Vocabulary**:  **Data:** information and facts that we collect and put together for reference or analysis.  **Variable:** a data element that can take on more than one value. A variable is also something that can change.  **x/y-axis:** axes used in the coordinate system and shown on a coordinate grid. (Show visual example)  **key:** a key explains to the reader what each color or symbol represents. For our graphs, we’ll use colors/patterns to represent each variable.  **Bar graph:** a bar graph is a way to represent data on the x and y axes. Bar graphs are used to represent categories of data. They are shown as bars and their heights are proportional to how much they represent.  **Bivariate bar graph:** This type of bar graph shows the relationship between two variables. In our application, it will show the relationship between our multiplication fluency at level 2 and our multiplication fluency at level 3. | | | |
| **Instructional Materials:**  Textbooks or online curriculum: Self-made project instructions  Websites:   * CBS News Jobs Report January 2022 (NOTE: Any monthly news clip about the National Jobs Report will work if this link becomes obsolete. Simply search online for a more current one): <https://www.cbsnews.com/video/business-analyst-jill-schlesinger-breaks-down-the-january-jobs-report/> * Multiplication Fact Monster: <https://www.factmonster.com/math/flashcards> | | | |
| **Lesson Activities:**   1. In one or two class periods, students will complete eight attempts at level 2 and level 3 of their multiplication facts by completing eight flashcard rounds of multiplication using the Fact Monster website: <https://www.factmonster.com/math/flashcards>      1. The students should record the raw score result from each round on the data collection sheet provided to them and included with the assessment activity.      1. Once students have warmed up by practicing their multiplication facts and fluency and have recorded the data, they’ll return to a large class discussion where they’ll receive direct instruction about the following concepts and vocabulary. This is an excellent time to model note taking skills for students. Additionally, it may be helpful for students to have scaffolded notes with the key terms and ideas typed in with ample space for students to include their own thoughts and examples.  * Data, variables, x/y-axis, key, bar graph, bivariate bar graph (Make sure to show pictures and give examples for each of the vocabulary terms because they will need to use them in their project.      1. Remind students of the bar graphs they created in our previous lessons. They already know that a bar graph represents categorical data. The categories they’ll be representing today are each of their 8 attempts at multiplication fact monster.      1. Walk students through the directions and the grading rubric’s top score column using direct instruction. It is important that the students know what is expected for them to do in order to be successful. Remind students about creating their graph such that the units are equidistant from one another. This is important so that when we read our graph, it is easy to see when one value is higher or lower than another.      1. Distribute the graphing tools: graph paper, colored pencils, rulers, pencils/erasers.      1. Ask students if they know where to begin. You should expect them to answer by creating their table from their collected data if they have not done so already. If they don’t respond, remind them that it is important to organize our data in a clear and readable way and refer back to the directions of the project, which list the process step by step.      1. Allow students ample time to work. They will need to be careful and neat as they organize their data and graph. Circulate around the room and answer any questions and clarify any misunderstandings.      1. Optional: provide an example graph of the project or create one alongside your students so that they can see the process you’re using. You may consider using an overhead projector or document camera if you choose to create alongside your students. Why is this valuable? It’s valuable because the students can witness the process used to move successfully through the steps and it may guide them as they attempt to space their categories equidistant from one another or as they determine color schemes, how to create a key, and what to label their axes. Everyone’s data is unique, so the assistance will be purely structural.      1. Once everyone has completed their tables and graphs, they should turn their attention to the data analysis question provided in the instructions. Students need to state an observation (something they SEE) about their graph and then draw a conclusion or make an inference about what that observation mean about their mathematical fluency. Refer students to the scoring rubric and instructions for specific details about how much to include. A few well-crafted sentences up to a paragraph in length is sufficient.      1. Please circulate and ask questions about how students are approaching their work as the project is ongoing. This can be all a student needs to stay on track. Examples of questions may include, “What are you going to do next?” “How did you know to space each bar 3 squares apart? How did you figure that out?” “What made you pick these colors?” “What sort of axes labels will make the most sense here?” etc. | | | |
| **Learners vary in the way that they react to and grasp information that is presented to them. Click on** [**Multiple Means of Representation**](https://udlguidelines.cast.org/representation) **to explore ways that you can provide options for representing content and explain how you are including this below:**   * We will **offer ways of customizing the display of information** by providing full autonomy for students in how they create their graphs. There are guidelines to make the graphs consistent and easy to read, but color, spacing, and styling are completely left to the student to decide. * We will **offer alternatives for visual information** by providing subtitles for our video media. * We will **clarify vocabulary and symbols** by pre-teaching the vocabulary needed to succeed in this project. * We will **highlight patterns, critical features, big ideas, and relationships** by highlighting previously learned skilled, using vocabulary outlines, and emphasizing key elements of our graphs and tables. Examples will also be provided to guide students in their creation. | | | |
| **Performance Tasks:**  Students will collect their own data using multiplication fact monster. They will record their data on the provided worksheet. Then, the students will create a table that clearly represents their data as instructed in the project. From there, the students will use the table to create a bivariate bar graph that represents their 8 attempts at each level and the scores they earned each time. Finally, the students will answer the data analysis question provided based on what they see on their bivariate bar graph. | | | |
| **Learners best express what they know in different ways. Click on** [**Multiple Means of Action & Expression**](https://udlguidelines.cast.org/action-expression) **to explore ways to offer options for learners and explain how you are doing this below:**   * We will **vary the method for response and navigation** during our data collection. Students who are visually impaired are welcome to work with a teammate to respond verbally and have their data recorded. Similarly, students are welcome to use physical flash cards if the online component hinders their ability to demonstrate mathematical fluency. Students may also use assistive technology on their cell phones to complete their data collection. This may include, but is not limited to enhanced font size, reading programs, and screen contrast adjustments. * We will **build fluencies with graduated levels of support for practice and performance**. Students will have had prior access and practice using the multiplication fact monster website. They will also have had prior practice reading data from and creating tables. Students will have prior experience creating a univariate bar graph. Their prior knowledge will be synthesized into a larger project. * We will **enhance capacity for monitoring progress** by providing students with step-by-step instructions and a rubric. Additionally, the nature of the project allows students to visually see their mathematical growth in the data they’re representing graphically. | | | |
| **Notes:**  **Math Practice(s) taught and practiced by students:**  **MP1:** Make sense of problems and persevere in solving them. See relationships between various representations.  **MP2:** Reason abstractly and quantitatively. Ability to represent a problem symbolically and make sense of symbols in a problem.  **MP6:** Attend to precision. Calculate efficiently and accurately. Communicate precisely with others and try to use clear mathematical language. | | | |