

Mathematics: The Language of STEM

Best in the World

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CONTENT AND TASK DECISIONS

Grade Level(s): 3rd – 5th

Description of the Task: Students create proposals for the Best in the World hall of fame for a person/object of their choice in this problem-based activity. Students use research, foundational math skills, and statistical knowledge to develop a presentation and argument for why their selections are the best in the world at what they do.

Indiana Mathematics Content Standards: 5.DS.1: Formulate questions that can be addressed with data and make predictions about the data. Use observations, surveys, and experiments to collect, represent, and interpret the data using tables (including frequency tables), line plots, bar graphs, and line graphs. Recognize the differences in representing categorical and numerical data.

3.DA.1: Create scaled picture graphs, scaled bar graphs, and frequency tables to represent a data set—including data collected through observations, surveys, and experiments—with several categories. Solve one- and two-step “how many more” and “how many less” problems regarding the data and make predictions based on the data.

Indiana Mathematics Process Standards: PS.3: Construct viable arguments and critique the reasoning of others.

Mathematics Content Goals: Students will collect, analyze, and compare numbers/statistics from a variety of sources and in a variety of settings. Students will make judgements about the relative values of numbers and statistics in real world contexts. Students will manipulate and present numbers and data to achieve a specific purpose.

Language Objectives: Students will orally share their presentation and argument for why their selections are the best in the world at what they do.

Materials:

- iPads, computers, or other devices for online research
- Books with statistical information and numerical data on a variety of topics based on student selections
- Presentation materials: poster board, presentation software (PowerPoint, Slides, Prezi, etc.), chart paper
- Best in the World Problem-based Scenario (see below)
- Best in the World Organizer (see below, optional)

THE LESSON

*This lesson would take place over three days. Day One would cover the Before section of these plans. Day Two would cover the During section, and Day Three would cover the After section. A fourth day could be added if you choose to allow students to present their proposal to an authentic audience for feedback (principal, parents, peers, community members, or even city council members or the mayor). Giving students the opportunity to present to an authentic audience is highly recommended.

Before: Prior to this lesson create groups of two students for your class. Present students with the

problem-based task and build anticipation for the activity.

- **Activate prior knowledge,** Show students pictures of 3-4 selections from a specific category (ex. brands of soda, bridges, snakes, popular singers/actors, popular sports stars). Ask students: Which of these is the best? Allow some students to share their opinions. When a student answers the question above, involve additional students by asking questions like “What do you think about that?” or “Do you agree or disagree with that thinking?”

Ask students: How did you decide which one was the best? Could different data be used to determine which was the best? For each question, ask students to justify and explain their thinking. Encourage students to evaluate each other’s answers and thinking.

Next, ask students to come up with a list of criteria that could be used to determine whether something is the best in its category. Examples of criteria could include:

- Height
- Weight
- Speed
- Popularity
- Points scored
- Earnings
- Age
- Taste

Next, explain to students that the city has decided to build a museum called the Best Hall of Fame to increase tourism. Young people can be major drivers of tourism. So the mayor has asked for proposals for exhibits for the museum and would like students to develop some of these and present them to a group of community members for evaluation and possible use in the museum. The mayor has asked that students work in pairs to allow for collaboration and a variety of unique ideas.

Ask students to think and write independently for two minutes about some of the things people, and places that they think are the best in specific categories. Remind students that they should spend the entire time writing and that the goal of this time is to generate ideas that could be used for their proposals. Once, students have finished writing for two minutes, have students pair up and share ideas with another student. These could (but do not have to be) their partners for the proposals. Students should feel free to ask questions of their partners and to write down any ideas that they hear from their partners that they would like to think about for their own proposals.

- **Be sure the problem is understood,** pass out the Best in the World Proposal Guidelines from the mayor (see below) and read through it with the students. Address any questions that students may have about the guidelines. Keep in mind that students may have additional questions as they begin to create their proposals. Answer these questions in a way that will provide students with the most flexibility and the most opportunity to design their proposals creatively.

Next, assign students to their partners and provide each group with a work area. Give each student a copy of the Best in the World Organizer and explain the expectations for developing their proposals. For their proposals, each pair should review the lists of selections they think are the best in their categories and decide cooperatively on ONE category and selection that they can both support. Students should then determine the three types of data to include to determine if their choice is in fact the best in its category (ex. for the category restaurant hamburgers the three data types could be size/weight, taste, and value/cost). Pairs should also choose three other selections from the same category to use for comparison (ex. for the category restaurant hamburgers the selections could be Big Mac [best], Wendy’s double cheeseburger, Whopper, and Hardee’s Monster Burger). Partners should determine how they will

collect their data and how they will present their choice and design their proposal.

- **Establish clear expectations**, review the Best in the World Proposal Guidelines from the mayor. Explain the expectation that each group member should complete a copy of the Best in the World Organizer. Remind students of classroom expectations for group work. Students should work collaboratively. They should work to include all members of the group. If a group member is not participating, the other members of the group should actively draw her/him into the work by asking questions, seeking input, and providing opportunities to participate. All members of a group should have their ideas and work represented in the final proposal. When disagreements arise, students should use their group work strategies to reach a compromise or come to consensus.

During: Students will be working in pairs to research and create a proposal based on the guidelines provided by the mayor.

- **Let go**, facilitate students collecting and organizing materials, give students space to begin researching and creating their proposals, ask open-ended questions, and give students chances to discuss their thinking with each other and with you.
- **Listen actively**, as you move around the room, listen to student conversations. Look for opportunities to engage with students about their thinking about understanding/using data and, the ways they record data, the mathematics they use to create graphs, and any connections or noticings they have as they create their proposals. Listen for agreement or disagreement between and within groups. Encourage meaningful, constructive discussion. Encourage students to explain their thinking and problem solving methods. Listen for students coming to consensus on their ideas.
- **Provide appropriate support** Guide students in researching and creating their proposals, having them check their proposals against the guidelines provided by the mayor. Ask for explanations of students' calculations and for justifications about why they selected their data and about how they choose to present their data. Encourage students to make their thinking visible in multiple ways: drawing, labeling, writing, mathematics, graphing, and speaking.
- **Provide worthwhile extensions**. Students could do additional research about how data is used in advertising to influence opinions. Students could explore product packaging for claims that use data (ex. kills 99.9% of germs) and then research and evaluate what those claims actually mean.

The teacher could also create additional problems/guidelines for groups as they create their proposals based on the real needs of a museum exhibit. Can students select 5 visuals to use in their exhibit? Can students select 2 objects/artifacts for display related to their category and selection? Can students create an activity for museum visitors to do related to their category?

Finally, students could build a model of their exhibit for use in their proposal, or they could create an actual exhibit/display in the school that other students, teachers, and community members to explore.

After: Each pair spends a short amount of time reviewing their proposal and developing their reasoning and justifications for the decisions that they made. Then each group pairs with another group to present their proposals. Finally, the class comes together to share ideas about data, graphing, and evaluating information.

- **Promote a mathematical community of learners**. Students work with their partners and another pair of students. Each group should share their proposal and their reasoning for some of the choices they made, like data types and selections. Then the two groups will compare their proposals. What are the similarities? Did students use similar methods to select their data types or to collect their data? Is one method more efficient than another? What differences are visible in the two proposals? Are there any ideas from the other pair's proposal that you might want to

incorporate into your proposal?

- **Listen actively without evaluation.** As students present their proposals, mention specific things that they did and mention what that did for you and for the audience or ask a question about why students made that choice. Examples: “I noticed that you chose to collect data using a class survey.” and “You presented that data with a double bar graph. Why did you do that? How did it help you?”
- **Make connections.** Ask students to find similarities and differences in the ways they selected, located, and presented their data. Have students share different methods for evaluating data. Have students share some of their justifications for their choices.
- **Summarize main ideas** Use student proposals and comments during the final whole class discussion to generate lists of tips for finding data and for evaluating data. This information could be used as the foundation for future investigations into data and problem-based learning such as evaluating advertising claims, understanding data in the news, and evaluating real-life choices (like car cost) based on comparisons of data.

ASSESSMENT

Observe: Look for where in the process students are successful. Can they determine what types of data they will need? How are they locating their data? How are they determining which data will be most useful for their proposals? Can students explain their mathematical thinking and justify their answers with words? With pictures? With numbers?

Ask:

Which of the guidelines from the mayor is most difficult?

What did you determine which selection would be the best in your category?

What is one of your data types for proving that your selection is the best?

Where did you find the data for that comparison?

What type of graph are you planning to use to present that data?

What scale will you use for your graph?

What other information could you include in this graph to help your audience understand it better?

What else can you include to improve your proposal presentation?

Have you considered other points of view?

Would another person choose a different selection for the best in your category? How could you convince that your selection is better?

What other data could you include to convince your audience?

Best in the World Proposal Guidelines

Students,

Thank you for being willing to create proposals for exhibits in our new museum and present these to our exhibit approval panel. Your input will definitely be helpful in creating a museum that will be interesting to all of our future visitors. Below are the guidelines for exhibits from the museum planning committee. These guidelines **MUST** be followed. The topic of the exhibit and how you present the data is up to you. Good luck! I will be eagerly awaiting your proposals.

Sincerely,

Mayor

Exhibit Proposal Guidelines:

- Chosen category should be appropriate for all ages of museum visitors
- Besides the “best” in the category, **THREE** other options should be presented for comparison
- At least **THREE** types of data should be used to determine “best” in a category
- At least **TWO** graphs should be created to display data to teach museum visitors about your topic and why it is the best
- A 1-3-minute oral presentation should be created to share the proposal with the committee
- Additional data and displays may be included such as photographs, interactive quizzes, videos, and text.
- Proposals **WILL NOT** be accepted if they do not include at least **THREE** types of data and **TWO** graphs

Best in the World Organizer

Our Category: _____

Our Best in the World: _____

Our Data Types:

1. _____

2. _____

3. _____

How do you plan to collect this data?

- ☐ Survey?
- ☐ Website
- ☐ Database?
- ☐ Book
- ☐ Other: _____

Three Other Selections in our Category (for comparison):

1. _____

2. _____

3. _____

How do you plan to present your proposal?
