Models

Did you ever stop to consider what Fantasy Football and scientific modeling have in common? Now is opportunity you have been waiting for!.

GRADES 9-12

ISRI
Voice of the Recycling Industry

JASON Learning

PREPARE:

Time Required: 2 class periods (90 minute) without extensions

- Divide students into groups of 3-4.
- Make copies of the activity page (one per student).
- Make copies of the Challenge Cards (1 card per group).
- Confirm students will have access to computers and Internet.
- Confirm students will have access to spreadsheet software (Excel).
- Confirm students will have access to presentation software (PPT or Prezi).

MOTIVATE:

- Ask students if they have ever created a fantasy sports team.
- Ask those who have created a team to share how they pick their players. What factors do they consider?
- It's likely they have a "model." It may not be formal; in fact, they may not even consider it as being scientific. But they have hypotheses that are usually backed up by some evidence.
- Explain to students that science works that way too. When evidence supports a hypothesis, it is considered a theory. A physical or mathematical theory that can be used to make predictions is a model.

TEACH:

- Tell students that in this activity they will be presented with a problem, a challenge that requires them to collect mathematical data to predict the effect of some specific change in recycling and develop a mathematical hypothesis, a model.
- Pass out the Challenge cards to the groups. There are several ways this can be done, depending on the readiness of the group. The student groups can choose a challenge based on collective interest or you can assign a challenge.
- For each challenge, good web resources have been provided for beginning support. To develop a good model, students will have to dig deeper. They will need to find reliable data that can be used to create a data set and a graph. Then they will use that data to make a prediction for the future, and make some inferences about their predictions.
- After they have developed their model, they will make a prediction and support that prediction with their data.
- Remind them that they will have to choose their data very carefully to get a reliable model.
- Once students have developed their model, they will create a presentation to share with the class that defines the challenge as well as explains the data, predictions and inference the group has made.

REFLECT/ASSESS

Students should be able to:

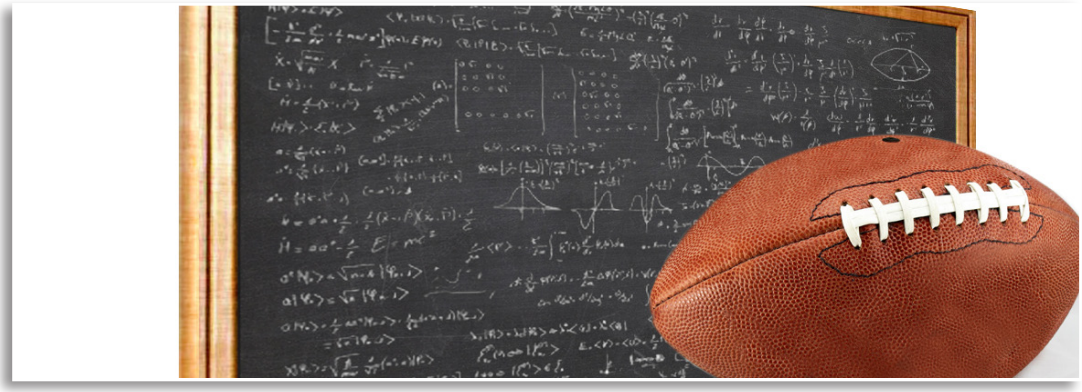
- Reflect on data they found inconsistent or difficult to use.
- How information on the web can be confusing for readers.

EXTEND

Within their groups, have students develop their own Challenge Card based on personal interest. They should find reliable websites to use for data collection and develop a valid model for their challenge. Have students create a presentation to share their personal inquiry and findings with the class.

JOURNAL QUESTION

Have students consider why being able to develop a scientifically sound and valid models is so important in science. Have students discuss some “real life” examples of how these models might be used to make predictions and inferences..



Models

When evidence supports a hypothesis, it is considered a theory. A physical or mathematical theory that can be used to make predictions is a model. In this activity, you will be presented with a problem—a challenge—that requires you to collect mathematical data and develop a model. You will then make a prediction supported by data. Choose the data carefully to get a scientifically valid and reliable model.

Materials

- Computer with Internet Access
- Spreadsheet program
- Presentation program
- Challenge card

Part 1: Collect Data and Create Your Model

1. With your group, carefully read and discuss the Challenge card provided by your teacher.
2. Begin your research by going to the suggested websites
3. Carefully look at the data that is provided and determine its reliability.
4. Once you have several pieces of data, use the spreadsheet program to create a graph of your data. This is the model you will use for your predictions and inferences.

REMEMBER: It is important to continually refer to the following rubric as you create your database as well as make your predictions and recommendations. Your goal is a scientifically sound model.

Criterion	Illogical	Common Knowledge	Scientifically Sound
Quality of Data	The Predictions don't rely on data	Data is provided, but the reliability of the sources can't be determined.	Data comes from reliable sources
Use of Data	No analysis	Some analysis and study of data	The data is used in a mathematically sound way to create a prediction/model.
Interpretation of Data	Conclusions are not related to the data	Some conclusions and inferences related to data	All conclusions and recommendations are based on data.

Part II: Present Your Model

1. Develop a presentation to share your model with the class. Document your references.
2. Include the predictions and inferences from your Challenge card.
3. Share presentations with the class.

Reflect and Apply:

1. Did your group find data they thought was inconsistent or difficult to use? Why do you think that data was published?
2. Did your group find that some of the information on the web to be confusing? Was the intended audience specific or was it poorly published? Defend your argument.

Extension:

Within your group, develop a Challenge card based on personal interest. Find reliable websites to use for data collection and develop a valid model for your challenge. Create a presentation to share your personal inquiry and findings with the class.

JOURNAL QUESTION

Why is being able to develop a scientifically sound and valid model so important in science? Discuss some "real life" examples of how these models might be used to make predictions and inferences.

Challenge #1: Aluminum Cans

Aluminum is a valuable non-ferrous metal. If all aluminum scrap processed in the United States were used solely to produce standard soda cans, the lined-up cans would stretch 25 million miles, the distance from Earth to Venus.(www.isri.org)

Since aluminum is so valuable, it seems logical that everyone would recycle those cans. Is that happening? Research the rate of recycling for aluminum and develop a model to predict how many of our cans will be recycled by the year 2020. Does your model show an effective use of the resource? If not, suggest ways to change it.

You might start your research with the data at these sites: http://business.highbeam.com/industry-reports/metal/metal-cans

ISRI's Fact Sheets at http://www.isri.org/recycling-industry/commodities-specifications/recycling-fact-sheets#.Vpcn_MYr-LIU

Challenge #2: Bag-gage

It seems they are endless—those plastic bags we get at groceries, big box stores and malls. Are we recycling more of them? Look at the data.

Compare the increase in the number of bags we produce and use to the increase in the amount of bags that are recycled. Are we making progress? If the trend continues, will there be more or fewer bags in our landfills in 2020?

Use the data to make a prediction and then create recommendations for the trends you see. You might start your research with the data at: http://plasticsnews.com/headlines2.html?id=24423

ISRI's Fact Sheets at http://www.isri.org/recycling-industry/commodities-specifications/recycling-fact-sheets#.Vpcn_MYr-LIU

Challenge #3: Glass

Glass is 100 percent recyclable, and many states require it. But most of our glass bottles and other materials still end up in landfills, where they last for centuries.

Look at the trends in percentage of glass recycled. Is it increasing in proportion to the increase in the number of glass containers we use? If not, how might we change attitudes and behaviors?

Develop a model which helps you make a prediction, then create recommendations for the trends you see. You might start your research with the data at: http://kandkrecycling.net/glass/

ISRI's Fact Sheets at http://www.isri.org/recycling-industry/commodities-specifications/recycling-fact-sheets#.Vpcn_MYr-LIU

Challenge #4: Electronics

They are everywhere! Cell phones and other handheld devices. The technology increases so quickly that old phones are obsolete in months. Where do they go?

Cell phones and other handheld devices contain metals like copper, silver, gold, palladium and platinum. These non- ferrous metals are valuable—and recyclable. Predict the number of these devices that will be obsolete in 2020 and then brainstorm ways to get their "treasures"—metals—back for use by industry.

Look at the increase in the number of cell phones, and the trend in recycling them. You might start your research with the data at: http://news.cnet.com/8301-1023_3-57352095-93/2011-ends-with-almost-6-billion-mobile-phone-subscriptions/

ISRI's Fact Sheets at http://www.isri.org/recycling-industry/commodities-specifications/recycling-fact-sheets#.Vpcn_MYrLIU

Challenge #5: Fiber and Paper

It's probably right in front of you—paper. Do you need it? In our technological world, paper may be more of a crutch than a necessity. But it still ends up on our desks, in our backpacks and in our landfills.

Look at the rate at which we recycle paper. Is it improving? How much of our fiber and paper will be recycled in the year 2020 if current trends continue?

Predict how much paper we will recycle in the year 2020, then make recommendations to increase it even further. You might start your research with the data at: ISRI's Fact Sheets at http://www.isri.org/recycling-industry/commodities-specifications/recycling-fact-sheets#.Vpcn_MYrLIU
http://www3.epa.gov/epawaste/conserve/imr/

Challenge #6: Total Solid Waste

That's not a scenic mountain in your view. It's a landfill. And if current trends continue, you will see more of those in the future.

Our landfills are often cluttered with glass, metal and fiber that would be valuable raw materials for new products if they were recycled.

Look at the trends in solid waste. Predict the increase in solid waste by 2020 and then create recommendations to help your municipality prepare for the future. You might start your research with the data at: http://www.epa.gov/osw/nonhaz/municipal/index.htm
ISRI's Fact Sheets at http://www.isri.org/recycling-industry/commodities-specifications/recycling-fact-sheets#.Vpcn_MYrLIU