Using Box Plots to Investigate Data
Lesson Plan

Subject Area: Math

Grade Levels: Grades 6–12 (ages 11–18).

Time: At least one 50-minute class period; time outside of class as necessary

Lesson Objectives:
Students will:
• Learn to create and use box plots.
• Develop an understanding of the basic concepts of central tendency and variation and how they can be used in real-world situations.
• Build data literacy skills by using statistics and dynamic, visual plots to analyze data, interpret results, and draw conclusions.
• Explain their findings with writing and visual slide shows.

Standards:
Common Core State Standards:

Common Core State Standards for Mathematics:
Mathematical Practices
• Make sense of problems and persevere in solving them.
• Reason abstractly and quantitatively.
• Use appropriate tools strategically.

Measurement and Data
• Represent and interpret data.

Statistics and Probability
• Summarize and describe distributions.

College and Career Readiness Anchor Standards for Writing:

Standard 6. Use technology, including the Internet, to produce and publish writing and to interact and collaborate with others.
Overview:
In this lesson, students will use movie data to look for connections between a film’s length, ratings, and the type of recognition it has received. Using the InspireData Box plot tool, students will investigate the distribution of movie lengths and the impact of other variables on that distribution. They will gain a deeper understanding of the 5-number summary and learn how to use quartiles to describe data. Students will explain their findings in annotated slide shows.

Preparation:
• This lesson requires the InspireData® software application published by Inspiration Software, Inc. You can download a 30-day trial at http://www.inspiration.com/InspireData.

Lesson:
1. Take an informal class survey about the top-grossing movies of all time. Some potential questions are:
   • On average, are movies that win Academy Awards longer, shorter, or the same length as movies that don’t win Academy Awards?
   • On average, which movies are longer in length—those rated G, PG, or PG-13?
   • On average, which movies have the largest range of length—those rated G, PG, or PG-13?

2. Open the Movies database: InspireData
   Starter>Databases>
   Mathematics>Movies.

3. Discuss the contents of the table, including the field notes.
4. As a demonstration, switch to **Plot View** and create an axis plot for the distribution of movie lengths by selecting **Axis plot** from the **Plot** menu.

5. Add a box plot by selecting **Box Plot** from the **Plot** menu as shown on the next page. Add numeric labels to the plot by checking **Add numeric labels to box plots** under **Box Plot Options**.
6. Lead a class discussion on the interpretation of box plots and how to use them to describe the distribution of a set of data in the context of a real-world situation. For example, ask students which number on the box plot represents the median (or average) movie length. Explain that median is just one way to describe the “central tendency” of a range of numbers. For example, if they were writing about this box plot, they could say: “Fifty percent of the movies were less than 150 minutes in length.” Be sure to include a discussion of the whisker length. What does it mean if we notice that whiskers are short in comparison to the box? Or vice versa? Does our data show that one whisker is longer than the other? What does that mean about movie lengths?

Box Plot with 5-Number Summary
7. Demonstrate how to use the **Notes** area, and create a slide by using the **Capture Slide** button in the **Slide Sorter**.

![Diagram of a scatter plot with stars indicating data points]

8. Switch back to **Table View** and review the Investigation Questions in the **Notes** area with students, and/or other questions you would like them to investigate with the data. Questions include:
   - How are movie lengths distributed?
   - What is the relationship between a movie’s rating and length?
   - What is the relationship between Academy Awards won and length?
   - What is the relationship between movie genres and length?
   - How are worldwide gross revenues of the top 25 movies distributed?

9. Divide students into as many groups as there are computers available and direct them to answer the questions below using box plots. For each plot, have students summarize their findings in the **Notes** area and capture a slide. *(Optional: Ask students to include observations involving percentages.)*
10. Reconvene the class, and assign a group or multiple groups to present their slides to the class. For each slide, ask for additional observations from individual students. What interesting discoveries did they make using the box plots? Discuss how box plots inform answers to the initial survey questions in Step 1.

**Adaptations/Extensions:**

- For younger students, analyze more of the data fields as a whole class, until all students seem to understand the process of creating and analyzing box plots.
- If students have experience with describing the distribution of data (uniform, normal, skewed left, skewed right), have them use the terms to describe each distribution from the box plot. Then they can examine stack plots or bar charts to confirm answers.
- Have students add data from their favorite movies to the database. Data can be entered directly or by using the **Survey** or **e-Survey** tools.
- Have students choose another area of interest, conduct research to collect data, and use box plots to interpret their data set.
Pass out the “Learn to Use Axis Plots” and “Learn to Use Plots” handouts in InspireData for student reference (Help>Documentation>Handouts>Learn to Use Axis Plots and Learn to Use Plots). Students can enhance their plots by adding other InspireData features and computations.

Note: Follow the steps above (1-4) to create a stacked bar chart using the Change Stack Plot button and selecting Rating or another field in the Color by Field tool.


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