Grade 4
Lesson Plan
“Everybody Loves Board Games!”

Subject:
• **Math:** Statistics, Data Analysis, and Probability
• **Language Arts:** Listening and Speaking
• **Science:** Investigation and Experimentation

Level:
Grade 4

Abstract:
• In this lesson, students will record the frequency of a number recurring in the throw of two dice. Before beginning the experiment, students will make predictions about the probability of a specific number (the sum of two dice) occurring most and least often from 20 throws.

• Using the raw data from the Dice Roll Tally Sheet, pairs of students will create a data set in Microsoft Excel to track the results and use the Chart Wizard to create appropriate histograms and circle graphs.

• Partners will express the outcomes numerically, visually, and orally.

• The class will identify patterns of frequency as the teacher gathers partners’ data on separate class graphs (Appears the Most and Appears the Least).

• Groups of four to six students will play a short board game that involves rolling dice.

Invitation:
What is your favorite board game? Most board games use the roll of dice to be able to determine how far each player may move. What would it be like to correctly guess which number your opponent would roll next?

Most board games use two dice. What sum (of the two dice) is most likely to appear?

Today we are going to predict what sum is most and least likely to appear after 20 rolls. We will gather this information, present it to our classmates, and play a short board game in small groups.
Situations:
- **Where:** This unit will occur entirely at school. However, students may wish to take the board games home to play with their younger siblings.

- **When:** This project is multi-disciplinary and could occur during math, language arts, science, or inter-disciplinary periods of time within your classroom structure.

- **How Long:** Depending on how you enhance or expand these activities, the completion of the unit could take anywhere from one to three days.

Tasks:
- **Task 1:** Students will predict the most and least popular sum of 20 rolls of two dice.

- **Task 2:** Students will work in pairs to discuss and test their predictions. Partners will test their hypothesis and record findings on the Dice Roll Tally Sheet. Partners will switch responsibilities of roller and recorder after 10 rolls.

- **Task 3:** Using the data from the Dice Roll Tally Sheet, partners will use an Excel spreadsheet to create a data table and charts. (See Step Sheet Sample.)

- **Task 4:** Students will use the Chart Wizard to create appropriate histograms and circle graphs.

- **Task 5:** Students will analyze their data, noting the most and least popular sum.

- **Task 6:** Students will prepare a summary of their findings noting patterns and irregularities as demonstrated by the histograms and circle graphs. Partners present this information to the whole class.

- **Task 7:** Back together as a large group, each student will report on some aspect of the experiment outcomes.

- **Task 8:** The teacher will facilitate a class discussion on the accuracy of student’s initial predictions.
• **Task 9:**
The class will identify patterns of frequency as the teacher gathers the class data on separate graphs on chart paper (titled Appears the Most and Appears the Least).

• **Task 10:**
The teacher will elicit hypotheses regarding the cause for the frequency of a specific number (seven). Students should note that seven occurs most often in the overall data.

• **Task 11:**
The teacher demonstrates the cumulative property of addition. (The order does not make any difference. For example, \(2+3 = 3+2\).) However, these combinations in a roll of the dice have a direct connection to the frequency of the occurrence of the sum of seven. There is only one way to roll a sum of two (1+1), while there are two ways to roll a sum of three (1+2 and 2+1). Likewise, there are three ways to roll a sum of four (1+3, 3+1, 2+2). See the following chart:

<table>
<thead>
<tr>
<th>Sum</th>
<th>Combinations of numbers possible with two dice</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Not a valid roll with two dice!</td>
</tr>
<tr>
<td>2</td>
<td>1+1</td>
</tr>
<tr>
<td>3</td>
<td>1+2, 2+1</td>
</tr>
<tr>
<td>4</td>
<td>1+3, 3+1, 2+2</td>
</tr>
<tr>
<td>5</td>
<td>1+4, 4+1, 2+3, 3+2</td>
</tr>
<tr>
<td>6</td>
<td>1+5, 5+1, 2+4, 4+2, 3+3</td>
</tr>
<tr>
<td>7</td>
<td>1+6, 6+1, 2+5, 5+2, 3+4, 4+3</td>
</tr>
<tr>
<td>8</td>
<td>2+6*, 6+2, 3+5, 5+3, 4+4</td>
</tr>
<tr>
<td>9</td>
<td>3+6, 6+3, 4+5, 5+4</td>
</tr>
<tr>
<td>10</td>
<td>4+6, 6+4, 5+5</td>
</tr>
<tr>
<td>11</td>
<td>5+6, 6+5</td>
</tr>
<tr>
<td>12</td>
<td>6+6</td>
</tr>
</tbody>
</table>
*Note: 1+7, 7+1 is not valid because six is the highest number on most dice!

- **Task 11:** Students will form groups of four or fewer to play a simple board game that re-enforces the content of the lesson. (See Board Game.)

**Interactions:**
- **Full Class:** The teacher will facilitate full class brainstorm sessions and discussions. The teacher will clarify the tasks at hand and indicate whether the group is using a brainstorm style, where anyone can make a suggestion without it being discussed, or whether they are in a discussion style, where students can make cases for their arguments and disagree with statements of others.

- **Partners:** Students will cooperate with one or more partners in gathering and presenting the data.

- **Small Group:** Students will take turns rolling dice and moving across a simple board game.

- **Individual:** Each student records their own predictions and works with a partner to identify the accuracy of the predictions. You can request that students create spreadsheets, histograms, and circle graphs individually.

**Standards:**
- **Math:** Statistics, Data Analysis, and Probability
  - Students make predictions for simple probability situations.
  - Students organize, represent, and interpret numerical and categorical data and clearly communicate their findings.
  - Represent all possible outcomes for a simple probability situation in an organized way (for example, tables, grids, and tree diagrams).

- **Language Arts:** Listening and Speaking
  - Present effective introductions and conclusions that guide and inform the listener’s understanding of important ideas and evidence.
  - Emphasize points in ways that help the listener or viewer to follow important ideas and concepts.
  - Use details, examples, anecdotes, or experiences to explain or clarify information.
  - Make informational presentations.

- **Science:** Investigation and Experimentation
  - Conduct multiple trials to test a prediction and draw conclusions about the relationships between predictions and results.
Assessment:
• **Oral Presentation Rubric:** To be completed by the teacher to determine partners’ understanding of probability and their ability to graphically represent data using Excel spreadsheets. (See Oral Presentation Rubric.)

• **Individual Assessment Projects:** To be completed by students to determine their ability to predict results, graph those results using Excel, and interpret and present those results. (See Probability Hypothesis and Dice Roll Tally Sheet.)

Tools:
• “Microsoft Excel” spreadsheet application.

Project Tips and Alternatives:
• **Tip #1:** Emphasize the importance of accurate recording by establishing what qualifies as a “valid” throw.

• **Tip #2:** This lesson can easily be narrowed down by focusing only on the data collection and creation of tables and charts using Microsoft Excel spreadsheet.

• **Tip #3:** Depending on whether your students have had prior experience with Microsoft Excel, you may want to walk through the Step Sheets with them the first time.

• **Tip #4:** You can modify the text and forms of the board game using Microsoft Word to relate directly to interdisciplinary themes.

Related Units:
• Excel Grade 5 – “We All Scream for Ice Cream”

Attachments:
• “Step Sheet: Creating a Data Table and Charts”
• “Step Sheet Sample: Data Table and Charts”
• “Probability Hypothesis”
• “Dice Roll Tally Sheet”
• “Board Game”
• “Oral Presentation Rubric”

Web Resources
• A list of linked web resources on Excel can be found on the Excel Resources page.
**Assistive Technology:**

- Please refer to the [Assistive Technology](#) section for information on methods and devices to help ensure that all students have access to the curricula in the least restrictive environment.