

Lesson Plan: Exploring Sampling Distributions with Chocolate Bars

Objective: Students will explore the concept of sampling distributions and apply the Central Limit Theorem to analyze whether a chocolatier's claim about the weight of their chocolate bars holds true. This lesson will reinforce students' understanding of distributions, mean, variance, and the practical application of statistical analysis in quality control.

Grade Level: IB Diploma Programme Mathematics Applications and Interpretation SL (AI SL 4.9).

Duration: 60 minutes

Warm-up Activity (5 minutes)

- Inquiry Question: What does it mean when we say a dataset is normally distributed?
- Activity: A brief discussion to recap the properties of a normal distribution, including its shape, mean (μ), and variance (σ^2).

Introduction to the Scenario (10 minutes)

- Presentation: Introduce the scenario involving the chocolatier's claim that their signature chocolate bars weigh precisely 110 grams, with a variance of 32 grams squared.
- Objective: Explain that the class will conduct a statistical analysis to verify the claim using the concept of sampling distributions.

Understanding the Distribution (10 minutes)

- Group Discussion: Discuss what a normal distribution implies about the weights of chocolate bars and the significance of the mean and variance in this context.
- Exploration: Explain how sampling will be used to investigate the claim and introduce the Central Limit Theorem and its relevance to sampling distributions.

Sampling Activity (15 minutes)

- Simulation: In groups, students will simulate taking random samples of size 6 from the production line and repeat this process to create a dataset of 100 sample means.
- Data Collection: Each group will calculate the mean and variance of their sample means to compare with the theoretical values.

Statistical Analysis (10 minutes)

- Group Work: Analyze the collected sample means to determine if they align with the chocolatier's claim.
- Comparison: Discuss how the experimental mean and variance of the sample means compare to the theoretical values of the entire production line.

Decision Making and Discussion (5 minutes)

- Debate: Based on the observed sample mean and variance, students will decide if the chocolatier's claim is likely true and discuss the implications of any discrepancies.
- Real-world Connection: Highlight the importance of statistical analysis in quality control and the consequences of failing to maintain product consistency.

Reflection and Questions for Investigation (5 minutes)

- Reflection: Encourage students to reflect on how understanding sampling distribution can help businesses ensure quality control.
- Investigation Questions: Pose questions for further investigation, such as exploring potential reasons for discrepancies in average weight and explaining the concept of variance using the chocolate bar weights as an example.

Homework Assignment:

- Students will write a brief report on their findings, including whether the chocolatier's claim holds, potential reasons for discrepancies, and the real-world importance of maintaining product weight.

Materials Needed:

- Whiteboard and markers
- Computers or calculators with statistical functions
- Handouts detailing the investigation steps

Assessment:

- Formative Assessment: Participation in group discussions and activities.
- Summative Assessment: Completion of the homework assignment and understanding demonstrated through the written report.