Step-by-Step Presentation Script: Histograms and Frequency Polygons

Lesson Information

Subject: Mathematics (Grade 10)

Topic: Histograms and Frequency Polygons

Duration: 40 minutes

Learning Outcome: Represent data using histograms and frequency polygons, and interpret data from histograms and frequency polygons

Pre-Class Preparation

Materials Needed:

- ☐ Graph paper for each student (at least 2 sheets per student)
- ☐ Rulers for each student
- ☐ Calculators
- ☐ Chart paper for group work
- ☐ Colored markers (for frequency polygons)
- ☐ Printed copies of anchor activity data table
- ☐ Large demonstration graph paper or whiteboard grid
- ☐ Worked example prepared on chart or slides

Teacher Preparation:

- ☐ Review key concepts: histogram, frequency polygon, frequency density, midpoint
- ☐ Prepare large demonstration graphs for board work
- ☐ Practice drawing histogram and frequency polygon on board
- ☐ Prepare formula cards to display: Frequency density = Frequency/Class width, Midpoint = (Lower + Upper)/2
- ☐ Print exit tickets for assessment

Minute-by-Minute Presentation Script

Phase 1: Problem-Solving and Discovery (0:00 - 15:00)

Minutes 0-2: Introduction and Setup

[SAY] "Good morning, class! Today we are going to learn how to represent data visually using histograms and frequency polygons. These are powerful tools that help us see patterns in data that would be hard to spot in a table of numbers."

[DO] Divide class into groups of 4-5 students

[SAY] "You will work in groups to create graphs from real data. I will give you a table showing the heights of 500 students. Your task is to represent this data using a histogram and a frequency polygon."

[DO] Distribute graph paper, rulers, and data table to each group

Minutes 2-12: Group Work on Anchor Activity

[WRITE] Display the data table on the board:

Height (cm) | Number of Students

140-149 | 30

150-159 | 70

160-169 | 110

170-179 | 150

180-189 | 90

190-199 | 50

[SAY] "Read the tasks carefully. Task 1: Choose a suitable scale and represent the data on a histogram and a frequency polygon. Task 2: Compare and discuss your graphs with other groups. You have 10 minutes. Begin!"

[DO] Circulate among groups. Use guiding questions:

[ASK] "What scale will you use for the x-axis? For the y-axis?"

[ASK] "Should there be gaps between the bars? Why or why not?"

[ASK] "How will you draw the frequency polygon? What points will you plot?"

[LISTEN] Pay attention to:

- Are students drawing bars touching each other (correct) or with gaps (incorrect)?
- Are students calculating midpoints correctly?
- Are students choosing appropriate scales?
- Common misconceptions to address in Phase 2

Minutes 12-15: Group Sharing

[SAY] "Time is up! Let's see what you discovered. Group 3, please show your histogram to the class."

[DO] Select 2-3 groups with different approaches to share briefly (1 minute each)

[ASK] "What did you notice about your graphs? Did all groups get similar shapes?"

[SAY] "Excellent work! I noticed many groups discovered important features. Now let's formalize what you discovered and learn the proper techniques."

Phase 2: Structured Instruction (15:00 - 25:00)

Minutes 15-17: Connecting to Student Discoveries

[SAY] "Many groups drew bars touching each other - this is correct! This is called a histogram. The bars touch because height is continuous data - there are no gaps between 149 cm and 150 cm."

[WRITE] On board: "HISTOGRAM: Adjacent bars show frequency distribution"

[SAY] "Some groups connected the tops of the bars with lines - this creates a frequency polygon. It shows the same pattern but makes it easier to compare different datasets."

[WRITE] On board: "FREQUENCY POLYGON: Connects midpoints of bars with lines"

Minutes 17-20: Teaching Key Concepts

[SAY] "Let me teach you some important terms and formulas you need to know."

[WRITE] On board:

CLASS WIDTH = Difference between upper and lower boundaries

- Equal class width: All bars same width (like our example: all 10 cm)
- Unequal class width: Bars have different widths

[SAY] "In our example, all class widths are equal - they are all 10 cm wide. But sometimes data has unequal class widths. When that happens, we need to use something called frequency density."

[WRITE] On board (in a box):

FREQUENCY DENSITY = Frequency ÷ Class width

[SAY] "Why do we use frequency density? Because in a histogram, the AREA of each bar represents the frequency, not just the height. If class widths are unequal, we must adjust the heights using frequency density to keep the areas correct."

[EXAMPLE] Draw two bars on board:

Bar 1: Width 10, Frequency 20 → Height = 20 (equal widths)

Bar 2: Width 20, Frequency 20 → Height = 20/20 = 1 (unequal widths, use frequency density)

Minutes 20-22: Midpoint Formula

[SAY] "To draw a frequency polygon, we need to find the midpoint of each class interval. This is the middle value of the range."

[WRITE] On board (in a box):

MIDPOINT = (Lower bound + Upper bound) ÷ 2

[EXAMPLE] For class 140-149:

Midpoint = (140 + 149) ÷ 2 = 289 ÷ 2 = 144.5

[ASK] "What is the midpoint of 150-159?"

[LISTEN] Wait for student response: (150 + 159) ÷ 2 = 154.5

[SAY] "Correct! 154.5 is the midpoint."

Minutes 22-25: Addressing Misconceptions

[SAY] "Let me address some common mistakes I saw during group work."

[WRITE] On board:

❌ MISTAKE 1: Leaving gaps between bars

✓ CORRECT: Bars must touch (continuous data)

❌ MISTAKE 2: Using frequency when class widths are unequal

✓ CORRECT: Use frequency density = Frequency ÷ Class width

❌ MISTAKE 3: Not extending frequency polygon to x-axis

✓ CORRECT: Polygon should start and end on x-axis

[SAY] "Now let's practice with a worked example that has unequal class widths."

Phase 3: Practice and Application (25:00 - 40:00)

Minutes 25-27: Introducing Worked Example

[SAY] "Here is a real-world example: The salary distribution of employees in a company."

[WRITE] Display table on board:

Salary Range (KSh) | Frequency

1000-1500 | 42

1500-2000 | 35

2000-2500 | 20

2500-3000 | 15

3000-4000 | 18

4000-5000 | 42

[ASK] "Look at the class widths. Are they all equal?"

[LISTEN] Students should notice: First 4 are 500 wide, last 2 are 1000 wide - UNEQUAL!

[SAY] "Correct! The class widths are unequal. So we MUST use frequency density."

Minutes 27-32: Building Calculation Table Together

[SAY] "Let's create a calculation table together. We need 5 columns: Salary Range, Frequency, Class Width, Frequency Density, and Midpoint."

[WRITE] Draw table on board with headers

[SAY] "Let's do the first row together. Salary range 1000-1500."

[ASK] "What is the class width? How do we calculate it?"

[LISTEN] 1500 - 1000 = 500

[WRITE] Fill in: Class Width = 500

[ASK] "Now, what is the frequency density? Use the formula."

[LISTEN] Frequency density = 42 ÷ 500 = 0.084

[WRITE] Fill in: Frequency Density = 0.084

[ASK] "What is the midpoint?"

[LISTEN] Midpoint = (1000 + 1500) ÷ 2 = 1250

[WRITE] Fill in: Midpoint = 1250

[SAY] "Good! Now work with your partner to complete the rest of the table. I will give you 3 minutes."

[DO] Students work in pairs. Teacher circulates and assists.

[WRITE] After 3 minutes, complete the table on board with student input

Minutes 32-37: Drawing Histogram and Frequency Polygon

[SAY] "Now we will draw the histogram. Remember: X-axis shows salary ranges, Y-axis shows frequency density."

[DO] Draw axes on board with appropriate scales

[SAY] "I will draw the first bar. For 1000-1500, the frequency density is 0.084. I draw a bar from 1000 to 1500 with height 0.084."

[DO] Draw first bar, emphasizing it touches the next bar

[SAY] "Notice: The bars touch! No gaps. Now you try drawing the rest on your graph paper."

[DO] Students draw histogram. Teacher completes demonstration on board.

[SAY] "Now for the frequency polygon. We plot the midpoints on x-axis and frequency density on y-axis, then connect with straight lines."

[DO] Demonstrate plotting points: (1250, 0.084), (1750, 0.070), etc.

[DO] Connect points with straight lines, extending to x-axis at both ends

[SAY] "The frequency polygon shows the same pattern as the histogram but makes it easier to see the trend."

Minutes 37-40: Individual Practice

[SAY] "Now you will practice individually. Complete the exit ticket exercises."

[DO] Distribute exit ticket with two exercises

[SAY] "You have 3 minutes to work on these. Do your best!"

[DO] Circulate and provide support as needed

Phase 4: Closure (40:00)

[SAY] "Excellent work today! Let's review what we learned."

[ASK] "What is the difference between a histogram and a frequency polygon?"

[LISTEN] Histogram uses bars, frequency polygon uses lines connecting midpoints

[ASK] "When do we use frequency density?"

[LISTEN] When class widths are unequal

[SAY] "Perfect! For homework, complete any unfinished exit ticket questions. Next lesson, we will learn how to interpret and analyze data from histograms and frequency polygons. See you next time!"

[DO] Collect exit tickets for assessment

Teaching Tips

Before the Lesson:

• Practice drawing histograms and frequency polygons on board beforehand

• Prepare large demonstration graphs that all students can see clearly

• Have extra graph paper available

• Review common student errors from previous years

During the Lesson:

• Emphasize "bars touch" for histograms (continuous data)

• Use color: one color for histogram bars, different color for frequency polygon

• Stress "AREA = frequency" concept repeatedly

• Connect to real-world examples: salary distributions, test scores, heights

• Allow students to use calculators freely for frequency density calculations

• Circulate constantly during group work to catch misconceptions early

Common Student Errors to Watch For:

❌ Leaving gaps between histogram bars

→ Remind: Continuous data, bars must touch

❌ Using frequency instead of frequency density for unequal class widths

→ Emphasize: Area must represent frequency

❌ Calculating midpoint incorrectly (e.g., just picking middle number)

→ Show formula: (Lower + Upper) ÷ 2

❌ Not extending frequency polygon to x-axis

→ Demonstrate: Polygon starts and ends on x-axis

❌ Poor scale choices (too small, too large, uneven)

→ Guide: Scale should use most of the graph space without distorting

❌ Forgetting to label axes or include units

→ Checklist: Always label x-axis, y-axis, title, units

❌ Confusing histogram with bar chart

→ Clarify: Histogram = continuous data (no gaps), Bar chart = categorical data (gaps)

Differentiation in Practice:

- For struggling students: Provide pre-drawn axes, work one-on-one during practice
- For advanced students: Challenge with unequal class widths, ask to compare distributions
- Use peer tutoring: Pair stronger students with those needing support
- Provide step-by-step checklists for students who need structure

Assessment Notes:

- Observe during group work: Are students collaborating? Using correct techniques?
- Check calculation tables: Are frequency density and midpoint calculations correct?
- Review exit tickets: Identify students needing additional support
- Look for: Correct bar placement, appropriate scales, proper labeling, accurate calculations

Follow-Up for Next Lesson:

- Review exit ticket results and address common errors
- Provide additional practice for students who struggled
- Move to interpreting histograms and frequency polygons
- Connect to measures of central tendency (mean, median, mode from grouped data)