Lesson Plan: Histograms and Frequency Polygons

Strand	Statistics and Probability
Sub-Strand	Histograms and Frequency Polygons
Specific Learning Outcome	Represent data using histograms and frequency polygons, and Interpret data from histograms and frequency polygons
Key Inquiry Questions	What is statistics? How do we represent data? How do we use statistics in day to day life?
Learning Resources	CBC Grade 10 textbooks, graph paper, rulers, calculators
Duration	40 minutes (1 lesson)
Class	Grade 10

Lesson Structure

Phase 1: Problem-Solving and Discovery (15 minutes)

Anchor Activity 3.1.11

Work in groups

In a school with 500 students, their heights were measured and recorded in the following table.

Table 3.1.69. Student Heights

Height (cm)	Number of Students (Frequency)
140 - 149	30
150 - 159	70
160 - 169	110
170 - 179	150
180 - 189	90
190 - 199	50

Tasks:

1. 1. Choose a suitable scale and represent the data on a histogram and a frequency polygon.
2. 2. Compare and discuss your graphs with other groups.

Teacher Facilitation:

• Distribute graph paper, rulers, and the data table to each group

• Circulate among groups, asking guiding questions:

- "What scale will you use for the x-axis and y-axis?"

- "Should there be gaps between the bars? Why or why not?"

- "How will you draw the frequency polygon?"

• Observe different approaches groups take

• Select 2-3 groups to share their graphs with the class

• Use student work as a bridge to formal instruction in Phase 2

Phase 2: Structured Instruction (10 minutes)

Key Takeaway 3.1.70

Definition:
A histogram uses adjacent bars to show frequency distribution, while a frequency polygon connects the midpoints of the bars with a line to show patterns.

Class Width:
Class Width is the difference between the upper and lower boundaries of a class.

• Equal class width means all bars have the same width.

• Unequal class width means bars have different widths to better represent uneven data.

Frequency Density:
Frequency density is a measure used in histograms to ensure that the area of each bar represents the actual frequency of observations, especially when class widths are unequal.

Formula:
Frequency density = Frequency / Class width

Where:
Frequency is the number of observations in a class interval.

Why Use Frequency Density Instead of Frequency?

• In a histogram, the area of each bar (not just the height) represents the frequency.

• If class widths are unequal, simply plotting frequency would distort the representation.

• Using frequency density ensures that the area of each bar remains proportional to the actual frequency.

Midpoint:
Midpoint of a class interval represents the central value of that range. It is the average of the lower and upper boundaries of the class.

Formula for midpoint:
Midpoint = (Lower bound + Upper bound) / 2

Scaffolding Strategies:

• Connect to student discoveries: "Many groups drew bars touching each other - this is correct for continuous data!"

• Address misconceptions: "Some groups left gaps - that would be for a bar chart (categorical data), not a histogram"

• Emphasize key concept: "The AREA of each bar represents frequency, not just the height"

• Demonstrate on board: Show how to calculate midpoints and frequency density step by step

Phase 3: Practice and Application (15 minutes)

Worked Example 3.1.71: Employee Salaries

Problem:
The table below presents the salary distribution of employees in a company.

Table 3.1.72. Employee Salaries

Salary Range (KSh)	Frequency
1000 – 1500	42
1500 – 2000	35
2000 – 2500	20
2500 – 3000	15
3000 – 4000	18
4000 – 5000	42

Task: Draw a histogram and a frequency polygon to represent the data.

Solution:
To draw a histogram and a frequency polygon, we need to find the frequency density and the midpoint of each class interval.

We use frequency density instead of frequency to draw the histogram because the class widths are unequal.

Table 3.1.73. Calculation Table

Salary Range	Frequency	Class Width	Frequency Density	Midpoint
1000-1500	42	500	0.084	1250
1500-2000	35	500	0.070	1750
2000-2500	20	500	0.040	2250
2500-3000	15	500	0.030	2750
3000-4000	18	1000	0.018	3500
4000-5000	42	1000	0.042	4500

Steps to draw histogram:

3. 1. X-axis: Salary ranges
4. 2. Y-axis: Frequency density
5. 3. Draw adjacent bars (no gaps) with heights equal to frequency density

Steps to draw frequency polygon:

6. 1. Plot midpoints on x-axis
7. 2. Plot frequency density on y-axis
8. 3. Connect the points with straight lines
9. 4. Extend to x-axis at both ends

Individual and Collaborative Practice:

• Students work individually on creating calculation tables

• Pairs check each other's calculations

• Teacher circulates to provide support

• Selected students present their solutions on the board

Phase 4: Assessment (5 minutes)

Exit Ticket

Exercise 1:

The following data represents the heights (in cm) of 30 students in a class:
150, 155, 160, 162, 165, 158, 170, 172, 168, 153, 163, 167, 175, 178, 161, 156, 169, 171, 159, 164, 173, 176, 157, 166, 174, 177, 154, 165, 179, 160

a) Create a frequency table with class intervals of 5 cm and midpoints of the data.
b) Using the frequency table you created, draw a histogram to represent the data.
c) Draw a frequency polygon on the same axes as your histogram.
d) Label your axes and give your graphs appropriate titles.

Exercise 2:

The following data represents the ages of 25 people in a community meeting:
20, 25, 30, 35, 40, 22, 28, 33, 38, 42, 27, 32, 37, 41, 24, 29, 34, 39, 43, 26, 31, 36, 44, 23, 45

(a) Create a frequency table with class intervals of 5 years
(b) Draw a histogram to represent the data.
(c) Draw a frequency polygon on the same axes.
(d) Label the axes and provide titles for your graphs.

Formative Assessment Strategies:

• Observation: Monitor group work during anchor activity - are students choosing appropriate scales?

• Questioning: Ask "Why do we use frequency density?" "What does the area of a bar represent?"

• Exit tickets: Collect and review to identify students who need additional support

• Peer assessment: Students compare graphs and provide feedback

Differentiation Strategies

For Struggling Learners:

• Provide pre-drawn axes with scales already marked

• Give step-by-step checklist for drawing histograms and frequency polygons

• Use smaller datasets with equal class widths first

• Pair with stronger students for collaborative work

• Provide calculation tables with some values filled in

• Use color coding: one color for histogram bars, another for frequency polygon

For Advanced Learners:

• Challenge with datasets having unequal class widths

• Ask to compare two distributions using frequency polygons on same axes

• Investigate: "How does changing class width affect the histogram shape?"

• Create their own data collection project and represent findings

• Estimate mean, median, and modal class from histograms

• Analyze real-world datasets (e.g., Kenya census data, weather patterns)

Extension Activity

Comparing Distributions Project

Task: Collect data on two different groups and compare their distributions using histograms and frequency polygons.

Example scenarios:

- • Compare test scores of two different classes
- • Compare heights of Grade 10 boys vs girls
- • Compare daily temperatures in Nairobi vs Mombasa over one month
- • Compare daily sales at two different shops

Steps:

10. 1. Collect or research data for two groups
11. 2. Create frequency tables for both datasets
12. 3. Draw histograms for both on separate axes
13. 4. Draw both frequency polygons on the same axes (use different colors)
14. 5. Write a paragraph comparing the two distributions:

- Which group has higher values on average?

- Which group has more spread out values?

- What patterns do you notice?

15. 6. Present findings to the class

This activity develops:

• Data collection skills

• Graph interpretation and comparison

• Critical thinking about distributions

• Communication of mathematical findings