Grade 10 Mathematics Lesson Plan

Median (Grouped)

Strand:	**Statistics and Probability**
Sub-Strand:	Grouped Data
Specific Learning Outcome:	Determine mean, mode and median of grouped and ungrouped data
Duration:	40 minutes
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, calculators, chart paper, markers

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

Anchor Activity 3.1.9: Pocket Money Median

Objective: Students work in groups to discover cumulative frequency and identify the median class for grouped data.

Work in groups to analyze the following scenario:

Using the pocket money data provided below:

Pocket Money (Ksh)	Frequency
100–199	8
200–299	15
300–399	22
400–499	20
500–599	10

Tasks:

- 1. Construct a Cumulative Frequency (CF) column for this data. (Hint: CF is the running total of frequencies)
- 2. Identify the class interval where the middle student lies.

Discussion prompts for teachers:

- How many students are there in total?
- Which student is in the middle position? (Hint: Total ÷ 2)

- How can we find which interval contains that middle student?
- What is cumulative frequency and how does it help us?

Phase 2: Structured Instruction (10 minutes)

Key Takeaway 3.1.51: Calculating Median

For grouped frequency data, we use interpolation to estimate the median using the following formula:

Median = L + ((n/2 - CF) / F) × C

Where:

- L = Lower boundary of the median class
- n = Sum of all frequencies (Σf)
- CF = Cumulative frequency before the median class
- F = Frequency of the median class itself
- C = Class width

Step-by-Step Process

1. Step 1: Add a Cumulative Frequency (CF) column to the frequency table (running total)
2. Step 2: Find n/2 (half of total observations, where n = Σf)
3. Step 3: Identify the median class (first interval where CF ≥ n/2)
4. Step 4: Identify the values: L (lower boundary), CF (before median class), F (frequency of median class), C (class width)
5. Step 5: Apply the formula: Median = L + ((n/2 - CF) / F) × C
6. Step 6: Interpret the result (half the data is below, half above)

Important Notes

- Cumulative Frequency (CF) is the running total - always increases or stays the same
- Last CF should equal n (total observations) - use this to verify
- The median class is where the middle observation falls
- The formula estimates where in the median class the median lies
- The median is an ESTIMATE, not an exact value (we assume even distribution within class)

Phase 3: Practice and Application (15 minutes)

Worked Example 3.1.52 (Race Times)

Problem: The data below represents the times (in seconds) recorded in the heats of a 100 m race. The data has been grouped into intervals of width 0.5 seconds. Estimate the median time based on the frequency table below.

Class Interval	Frequency

11.5 - 11.9	2
12.0 - 12.4	4
12.5 - 12.9	5
13.0 - 13.4	4
13.5 - 13.9	5
14.0 - 14.4	6
14.5 - 14.9	5
15.0 - 15.4	4
15.5 - 15.9	1

Solution:

Step 1: Add Cumulative Frequency column

Class Interval	f	CF
11.5–11.9	2	2
12.0–12.4	4	6
12.5–12.9	5	11
13.0–13.4	4	15
13.5–13.9	5	20
14.0–14.4	6	26
14.5–14.9	5	31
15.0–15.4	4	35
15.5–15.9	1	36

Step 2: Find n/2

n = 36 (total observations), n/2 = 36/2 = 18

Step 3: Identify median class

Look for first CF ≥ 18. CF of 13.5–13.9 is 20 (first one ≥ 18)

Median class: 13.5–13.9

Step 4: Identify formula values

- L = 13.5 (lower boundary of median class)
- n = 36, n/2 = 18
- CF = 15 (cumulative frequency before median class)
- F = 5 (frequency of median class 13.5–13.9)
- C = 0.5 (class width)

Step 5: Apply formula

Median = L + ((n/2 - CF) / F) × C

Median = 13.5 + ((18 - 15) / 5) × 0.5

Median = 13.5 + (3/5) × 0.5

Median = 13.5 + 0.6 × 0.5

Median = 13.5 + 0.3

Median = 13.8 seconds

Therefore, the estimated median race time is 13.8 seconds.

Phase 4: Assessment (5 minutes)

Exit Ticket

1. A group of 40 athletes recorded their finishing times (in minutes) during a practice run at Karura Forest.

Time (min)	Frequency
120 - 129	4
130 - 139	12
140 - 149	15
150 - 159	9

Calculate the median finishing time.

2. A county hospital in Machakos surveyed the waiting time (in minutes) for 60 patients at the outpatient department.

Time (min)	No. of Patients
0 - 19	10
20 - 39	25
40 - 59	15
60 - 79	10

Estimate the median waiting time for a patient.

Differentiation Strategies

For Struggling Learners:

- Provide pre-filled CF columns to focus on formula application.
- Use smaller datasets (4-5 intervals) to build confidence.

- Provide step-by-step worksheets with spaces for each value (L, CF, F, C).
- Use visual number lines to show where median class is located.
- Work in pairs with peer support.
- Provide formula cards with clear labels for each variable.
- Practice identifying n/2 and median class before applying formula.

For Advanced Students:

- Explore datasets with more intervals (10-12 classes).
- Compare median from grouped data vs ungrouped data to see estimation error.
- Investigate how changing class width affects the median estimate.
- Calculate mean, median, and mode for the same grouped dataset and compare.
- Research real-world applications: census data, health statistics, economic indicators.
- Create their own grouped datasets from real data and calculate median.

Extension Activity: Understanding the Median Formula

Scenario: Explore what each part of the median formula represents.

Use the pocket money data from the anchor activity:

Median class: 300–399 (contains the 37.5th student)

Tasks:

1. 1. Calculate n/2. What does this number represent?

2. 2. Find CF (cumulative frequency before median class). How many students are below the median class?

3. 3. Calculate (n/2 - CF). What does this tell us?

4. 4. Find F (frequency of median class). How many students are in the median class?

5. 5. Calculate (n/2 - CF) / F. What fraction of the median class do we need to go through?

6. 6. Multiply by C (class width). Why do we do this final step?

7. 7. Add to L (lower boundary). What is the final median estimate?

Expected Findings:

- n/2 = 37.5 represents the middle position (between 37th and 38th student)
- CF = 23 means 23 students are below the median class
- (n/2 - CF) = 14.5 means we need to go 14.5 students into the median class
- F = 22 means there are 22 students in the median class
- (n/2 - CF) / F = 14.5/22 ≈ 0.66 means we go about 66% through the class
- Multiply by C = 100 converts the fraction to actual Ksh value
- Add to L = 300 gives starting point, final median ≈ 366 Ksh
- The formula systematically locates where the middle value lies within the median class