Histograms: Snapshot

Key Learning Content

This film explains how some digital cameras have a histogram feature which helps photographers find the right exposure for their pictures. The histogram plots brightness level on the x-axis and pixel density on the y-axis, and so gives a visual impression of how light or dark the photo image is. Examples are shown. The importance of both brightness and contrast in composing a photograph are described. An example is given with unequal bar lengths in order to emphasise that frequency is proportional to area, not height.

Core Outcomes

Learning Points

- Be able to use and apply number in everyday personal, domestic or community life.
- Be able to interpret information presented in a histogram.
- Be able to construct histograms for unequal class intervals.

Suggested Activities

- Draw simple histograms.
- Read data from histograms.

Using the histogram in a digital camera can help photographers get the perfect shot.

Extension Outcomes

Learning Points

- Be able to set up problems involving direct proportion and relate algebraic solutions to graphical representation of the equations.
- Be able to find the area of simple shapes using the formulae for the areas of rectangles.
- Be able to understand the links between histograms and normal distribution curves.

Suggested Activities

- Complete histograms when partial data is provided.
- Explore how histograms would look as the average class interval tends to zero.

Related Films

To use before the lesson plan:

Nightingale's Diagram	This film describes how Florence Nightingale used a mathematical chart to draw attention to preventable deaths in the Crimean War.

To use after the lesson plan:

Distorted Graphs: Heatwave	This film shows how the alteration of scales and labelling can completely change the message from a graph.
The Power of the Sun	This film uses area and proportion to work out the amount of energy generated by the Sun.
Freak Waves	This film explores the theory behind histograms and explains how normal distributions work.

Guide Lesson Plan

Introduction

Make up three fictitious students and show on a bar chart their marks in a recent test: 50%, 70% and 90%, with equal width bars and height proportional to the mark. Then show three squares of sides 50, 70 and 90 representing each student. Ask which representation is better, and explore the reasons why.

Show Film

Histograms: Snapshot

Main Activity

Foundation

State the key features of a histogram: frequency proportional to area; frequency density on the y-axis; a continuous scale on the x-axis. Then take data showing the range of students' marks in a recent test (fictitious if sensitive) and get the students to plot this in different ways:

- As a bar chart with each bar standing for the same class interval
- As a bar chart with different bars standing for different class intervals
- As a histogram with equal class intervals
- As a histogram with unequal class intervals.

Discuss the similarities and differences between the representations, and explore which image best conveys the actual distribution of marks.

Main Activity cont...

Advanced

Give students examples of histograms with some of the data/information missing:

- A complete set of data but a partial histogram
- A complete histogram but partial set of data
- A partial histogram and partial data but with some overlap between them
- A histogram with no scale on the y-axis and data relating to the bars plotted.

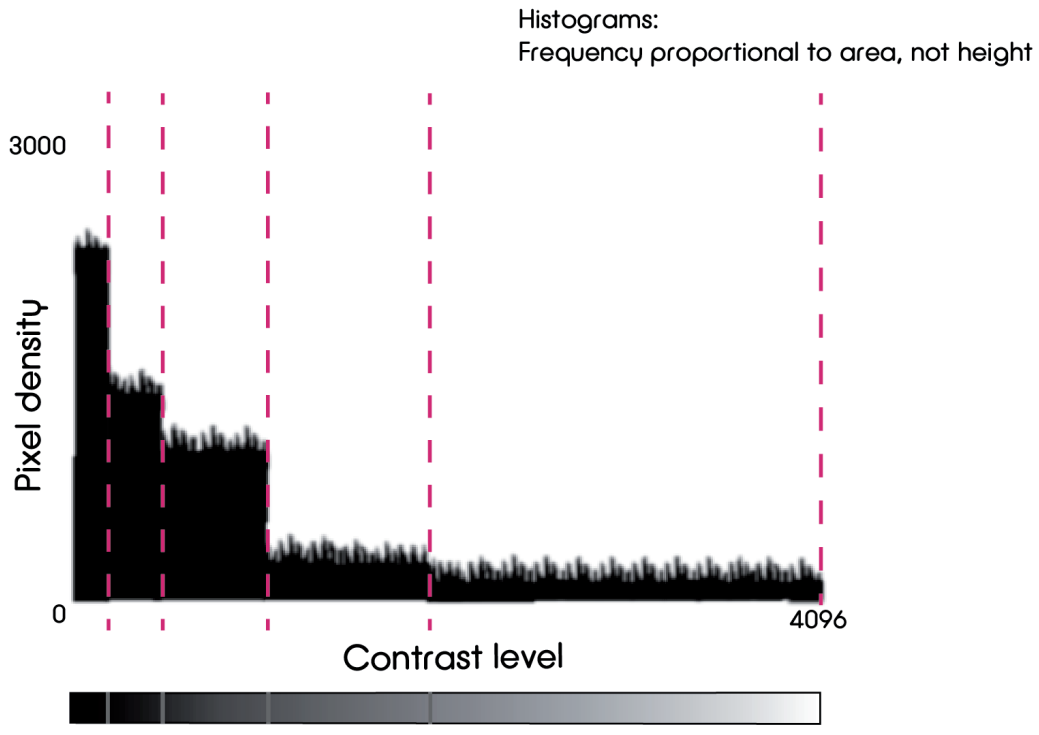
Ask students to fill in the gaps and identify the missing data/complete the histogram or data table.

Extension Activity

Find examples of histograms in the media or (more likely) in official publications and get students to interpret the information presented. Find (continuous) data presented as a bar chart and get students to redraw it as a histogram.

Optional Extra

Take data relating to every student in the school (e.g. height, entrance exam marks, number of late arrivals) and get students to draw histograms of the data, starting with large intervals (so only three or four bars to the histogram), then with more bars/smaller intervals. Ask what would happen as the class intervals got smaller and smaller, and agree that the histogram would 'look smoother'. Draw a normal distribution curve for the whole population, as a smooth curve, and explain how this relates to a histogram. Show examples of normal distribution curves from real life.



Unlike bar graphs, in histograms it is the area of the bar and not the height that indicates frequency.