

# 14-16 YEARS SESSION 3: Pie Charts / Histograms

**Subject: Mathematics**

**Age range: 14-16 years**

**Time: 1 hour**

<p><b>Outline</b></p> <p>Learners use pie charts to compare the marital status of WCA and non-WCA members in Ethiopia and Mali. They will also look at histograms considering the years of experience of women in Ethiopia. Summary of learning from the three sessions.</p>		
<p><b>Learning objectives</b></p> <ul style="list-style-type: none"> <li>To consider the advantages and disadvantages of using a pie chart to display data.</li> <li>To be able to consider the advantages and disadvantages of grouped data and understand the notation as it would be assessed.</li> <li>To learn how to draw a histogram using frequency density.</li> <li>To be able to apply the comparisons of the two data sets to their greater context.</li> </ul>	<p><b>Learning outcomes</b></p> <ul style="list-style-type: none"> <li>Learners will be able to plot their own histogram using frequency density. They will learn how to calculate frequency density using class width.</li> <li>They will be able to explain the limitations of using a pie chart to display data whilst also knowing when they can be useful.</li> <li>They will be able to apply the data to the greater context and explain how it relates to what is happening in Ethiopia and Mali.</li> </ul>	
<p><b>Key questions</b></p> <ul style="list-style-type: none"> <li>If it wasn't stated by the titles, could you tell how many people were included in each pie chart? Why might this be a good thing?</li> <li>Histograms are brilliant when the class widths are unequal - what is the first thing you need to work out in order to plot a histogram?</li> <li>What does the data tell you about the amount of experience amongst the women of Ethiopia?</li> </ul>	<p><b>Resources</b></p> <ul style="list-style-type: none"> <li>Session Three Slideshow</li> <li><i>Learner Worksheet 3A: Pie Charts</i></li> <li><i>Learner Worksheet 3B: Histograms</i></li> <li><i>Summary Activity</i></li> </ul>	
<p><b>Curriculum links</b></p>		
<p><b>England</b> <i>Mathematics</i></p> <ul style="list-style-type: none"> <li>Apply statistics to describe a population</li> <li>Construct and interpret diagrams for grouped discrete data and continuous data, i.e. <b>histograms with equal and unequal class intervals</b> and cumulative frequency graphs, and know their appropriate use</li> <li>Interpret and construct tables, charts and diagrams, including frequency tables, bar charts, <b>pie charts</b> and pictograms for categorical data</li> </ul>	<p><b>Wales</b> <i>Mathematics</i></p> <ul style="list-style-type: none"> <li>construct and interpret graphs and diagrams (including pie charts) to represent discrete or continuous data, with the learner choosing the most appropriate representation including histograms with unequal class widths</li> </ul>	<p><b>Scotland</b> <i>Numeracy and Mathematics</i></p> <ul style="list-style-type: none"> <li>I can evaluate and interpret raw and graphical data using a variety of methods, comment on relationships I observe within the data and communicate my findings to others. <b>MNU 4-20a</b></li> <li>I can select appropriately from a wide range of tables, charts, diagrams and graphs when displaying discrete, continuous or grouped data, clearly communicating the significant features of the data. <b>MTH 4-21a</b></li> </ul>



## **Starter (10 min)**

### *Pie Charts*

Hand out Session 3 Learner Worksheet 1A and ask learners to consider the four different pie charts. Ask them to write around the edges any thoughts they have. For example: “How many people are married?” “How many are widowed?” Make the point that unless told, the pie chart could represent an extremely small sample size and would therefore make any conclusions far less credible. One pie chart could represent 10 people, and another 500 - we only know proportions. It can also be very difficult to accurately compare the sectors on pie charts. To build learners’ understanding and to contextualise the information you could ask “What do you think a similar pie chart would look like for the England and Wales? Remind learners this is not comparing like for like.

You might want to explore some further questions to help students understand the limitations of representing the data this way and the importance of understanding the importance of sample size. E.g. What does this tell us about the women, what doesn’t this tell us? Why is it relevant?

Look at the questions on slide 6. The pie charts indicate that more of the women in Mali are widowed than in Ethiopia. Learners might think this implies there is a lower life expectancy for men in Mali than in Ethiopia and in fact, according to data gathered by the World Bank, men in Mali do indeed have a lower life expectancy (58) than men in Ethiopia (62). However, it is important to explain to learners that there are problems with drawing this conclusion because there are many other possible explanations. It is not valid to compare a small sample of women in a localised area with a national statistic about life expectancy. Safer conclusions might be drawn if there was a statistic about the life expectancy of men in the same part of the country where the women are living. However, even then there are many potential issues. Take time to discuss other options with your learners, alongside questions around what life expectancy does and does not tell us. You may wish to explore the other possible explanations for why there are more widows in the group from Mali than in the group from Ethiopia. See background notes for further information.

## **Activity 1.1 (30 min)**

### *Cumulative Frequency*

Show learners the diagram on slide 7, which has a histogram of years of experience of non-WCA members in Ethiopia. At this point, emphasise how big the last bar looks and how that doesn’t match up with the data in the table. “Only 42 women had over 25 years’ experience so why is this bar so big?” “If the bar is wider because of the class interval, we will need to adjust the height so that the area of the bar is in proportion to the others.” There is a need to calculate frequency density here because we don’t have sufficient data to create evenly-sized class sizes.

At slide 12, compare the size of each of the bars with the frequencies in the table. Compare again with slide 7 if you feel further emphasis of the point is needed.

Hand out Session 3 Learner Worksheet 3B and ask students to start to draw their own histograms. The key information is written at the bottom of the worksheet. You may find it useful to display slide 14 whilst the learners are working on this so that any questions can be answered in front of the whole class.



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The frequency density and frequencies are all smaller in the WCA Member data - this is due to fewer people being asked. You may wish to pose the question: "Does the fact that the bars are shorter mean that the WCA members have less experience?"

Emphasise that it is difficult to make comparisons between our histograms because a different number of people were asked.

Show slide 18 and ask: "Why is a pie chart helpful in this situation?" "Does it make sense that the people who are part of the WCA have fewer years of experience?" "Why might that be?" "Could the sample size have made a difference to the data?" Because the number of people is different, we need to look more at the proportions or percentages in each category. Since pie charts specifically compare proportions, not amounts, it is a sensible choice of data representation.

It is important that students understand that the more people you survey (the bigger sample size), the more reliable your data is.

### **Plenary (20 min)**

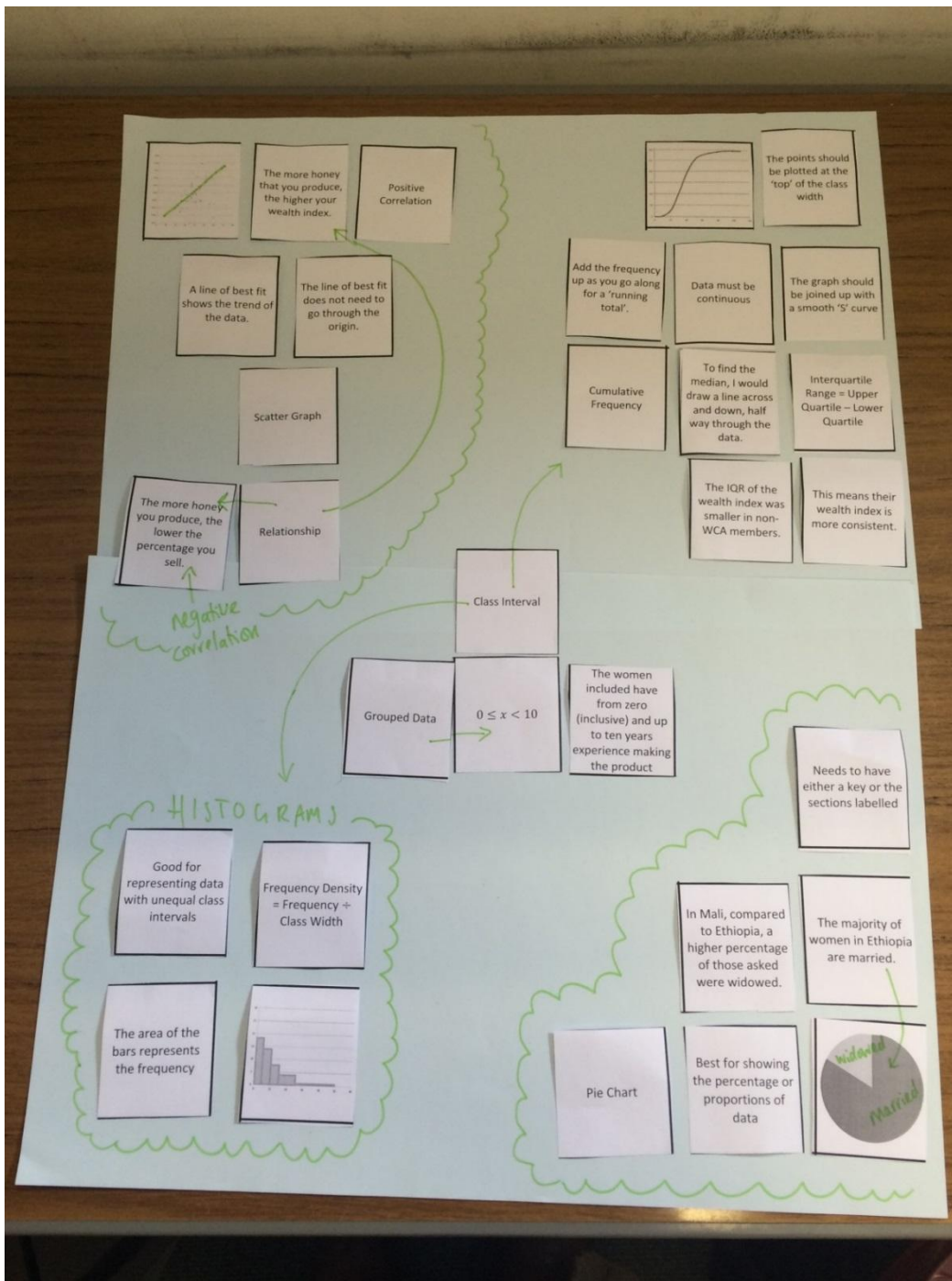
#### *Summary Activity*

Hand out Session 3 Summary Activity either already cut into individual cards or for learners to cut out themselves. In pairs, ask them to group the cards, matching up the things they have learnt in the previous sessions. There is no set number of cards that go together and learners may group differently.

Ask the learners to rotate around the classroom and assess the way in which other pairs have grouped their cards. If possible, give the learners sticky notes so that they can add questions or comments for other pairs on their desks.

If time allows, learners could stick the cards to a large piece of paper, allowing them to draw arrows to show connections and/or to annotate their links with further descriptions. See below for a possible layout.





Again, if possible, get learners to display their work around the room and invite comments from other students.

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