

14-16 YEARS SESSION 2: Cumulative Frequency Graphs

Subject: Mathematics

Age range: 14-16 years

Time: 1 hour

<p>Outline Learners use cumulative frequency graphs to compare the wealth index of WCA and non-WCA members in Ethiopia and Mali.</p>		
<p>Learning objectives</p> <ul style="list-style-type: none"> To be able to consider the advantages and disadvantages of grouped data and understand the notation as it would be assessed at this level. To learn how to draw a cumulative frequency graph and find its quartile values and interquartile range. To understand how to directly compare two cumulative frequency graphs. To be able to apply the comparisons of the two data sets to their greater context. 	<p>Learning outcomes</p> <ul style="list-style-type: none"> Learners will be able to plot their own cumulative frequency graph and find the median and lower/upper quartile from the graph. They will be able to describe what this means for the women who are members of the WCA and those who aren't. 	
<p>Key questions</p> <ul style="list-style-type: none"> How do I find the position of the median, upper and lower quartile values? What is implied by a higher median? What is implied by a higher interquartile range? What does the data tell you about the financial benefit of being a member of the WCA? 	<p>Resources</p> <ul style="list-style-type: none"> Session 2 PowerPoint Learner Worksheet 2A Learner Worksheet 2B: Cumulative Frequency 	
<p>Curriculum links</p>		
<p>England Maths</p> <ul style="list-style-type: none"> Apply statistics to describe a population Construct and interpret diagrams for grouped discrete data and continuous data, i.e. histograms with equal and unequal class intervals and cumulative frequency graphs, and know their appropriate use Interpret, analyse and compare the distributions of data sets from univariate empirical distributions through appropriate measures of central tendency (median, mean, mode and modal class) and spread (range, including consideration of outliers, quartiles and inter-quartile range) 	<p>Wales Maths</p> <ul style="list-style-type: none"> Use a cumulative frequency curve to estimate the median, quartiles and interquartile range Use the interquartile range to compare distributions Compare sets of data and their distributions, using appropriate methods Recognise and use the most appropriate data to compare distributions 	<p>Scotland Maths</p> <ul style="list-style-type: none"> 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. MNU 4-20a 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. MTH 4-21a



Starter (15 min)

What is WCA (Women's Collective Action)?

Explain to learners that in Session 1 they found out about the Women's Collective Action groups producing honey in Ethiopia. In this session they will be introduced to Women's Collective Action groups producing shea butter in Mali too. Display slide 3 of the Slideshow 2. Get learners to read through the section on WCA in Session 2 Learner Worksheet 2A in pairs. Ask them to write three key points on a sticky note that they feel summarises the information about WCA. Ask three or four pairs to share their bullet points with the rest of the learners.

Display slide 4-6 of the Slideshow 2. Ask learners to read the rest of the information about WCA in Mali shea production on Session 2 Learner Worksheet 2A. In pairs summarise the information and again ask a few pairs to feed back their summaries to the class.

Display slide 7 to show learners more about Mali. This slide highlights that there are built-up, urban areas in Mali and that the WCA groups highlighted in this project do not represent all women or environments in Mali.

Finish by explaining that the data learners will use in this and the next session is taken from both Ethiopia and Mali.

Activity 1.1 (35 min)

Cumulative Frequency

Show slide 8 and point out the first column of the table. Check the learners' understanding of this notation. x is the wealth index so $0 \leq x < 10$ means a wealth index that is greater than or equal to zero but less than ten. This means that a wealth index of ten exactly would need to go in the next category. From the table, we can see that three women in the Women's Collective Action Group have a wealth index of between zero and ten. At all times the categories should be referred to as 'class intervals' as they would be in an assessment. e.g. "Which is the modal class interval?" This question should remind learners of the idea of the 'mode' being the class interval with the highest frequency. This is something introduced at 11-14 years but frequently forgotten. You may need to check the understanding of the term 'Wealth index', a definition is provided on slide 8.

Show learners how to complete the cumulative frequency table on slides 10-13 "adding up as you go to keep a running total". Note how the class intervals now start from zero and so include all data up to that point.

When showing learners the graph on slide 14, really emphasise that points should be plotted at the 'top' of the class interval. This is a really common misconception at 14-16 years and often we see learners incorrectly trying to use the midpoints. Continue through Slideshow 2.

At slide 19, hand out Session 2 Learner Worksheet 2B and ask learners to plot their own cumulative frequency graph for the non-WCA members in Ethiopia (Page 1). Points should be plotted at the 'top' of the class intervals and joined up with a smooth curve (drawn freehand). Slide 25 should be used if addressing learner questions from the front of the classroom. Slide 27 allows them to check they have drawn theirs correctly before moving on to page 2 and 3 (see bullet point below). Using the formulae at the bottom of the sheet, ask students to find the lower quartile, median and upper quartile. To find the interquartile range they should do the upper quartile and subtract the lower quartile. Not all learners will get exactly the same answers but they should be in a similar range to

each other. Show up to slide 28 and then fill in the missing cells for the non-WCA members on slide 29 using the learners' findings and make comparisons between the two data sets of WCA members and non-WCA members in Ethiopia.

They can then find the lower quartile, median and upper quartile for Mali's WCA members (Page 2) and Mali's non WCA members (Page 3). These values should be transferred to Page 4, alongside the data that was found in the Slideshow 2 example. At this point, students can compare the four different data sets from Mali and Ethiopia. At GCSE level, learners would be expected to compare by recognising a higher median as a greater average and a smaller IQR as more consistent data. In this case, that means that the women's wealth index was similar to other women from the same group.

Encourage learners to make statements about their calculations, such as: "The non-WCA members in Mali all have a really similar wealth index as the IQR is smaller which means the data is close together." For exam board purposes, encourage the use of the word consistent instead of similar but feel free to use the word similar to increase understanding.

Plenary (10 min)

Remind learners of the context of the data, slide 30 might help to get learners thinking about the big picture of the data and what the data might tell us about the women in the WCA groups. Look at slide 31. Ask learners to silently read each question to themselves and give them a minute to think on their own about how they might answer each one. Then ask them to discuss each question in pairs. After a minute or two, ask the learners to share their conclusions with the class. Try to create debate amongst the learners through questioning.

What did you notice about how many people were surveyed? What difference might this have made?

The more people you ask, the more reliable your data is. One group had 352 members and another had 571.

Is it financially beneficial to be a member of a WCA in Mali or Ethiopia?

Learners should use their median values to compare. The data that has the highest median for the wealth index would indicate the group that has the most wealth. This is of course an average and not all that matters but it is a good place to start! Learner's calculations should indicate that it is financially beneficial to be a member of a WCA.

Did being a member of the WCA make the wealth of the women more or less consistent?

This question is aimed at getting the students to compare interquartile ranges. A bigger interquartile range means the data is more spread out and less consistent. A smaller interquartile range means the data is close together and therefore more consistent.

The data in the table is grouped together into 'categories' or 'class intervals' - what are the advantages and disadvantages of this?

We do not have the original data. We know how many people were in each category but they might all be at the top end or the bottom end. Without the original list of data we don't know.

Equally, a graph containing 571 pieces of data might take us a while to draw! Using class intervals makes the data far more manageable.

These graphs only look at the impact the WCA has on wealth. What other benefits do you think the WCA has on the women of Ethiopia and Mali?

Talk about benefits such as empowerment, opportunities and access to equipment.

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