### SESSION PLAN

**COURSE:** ABE Level 4 Award in Introduction to Quantitative Methods

**ELEMENT:** Element 4 – Statistical tools and data analysis

## **LEARNING OUTCOME 4**

**Analyse data using statistical tools and interpret the results**

4.1 Construct and interpret appropriate charts and diagrams from tabular data

4.2 Employ a set of descriptive statistics for analysis and interpretation of grouped and ungrouped data

4.3 Determine correlation between two business variables

4.4 Perform linear regression to make business forecasts

**NUMBER OF SESSIONS:** Four – approx. 18 hours

SESSION TOPICS: Session 1: Constructing and interpreting charts and diagrams

Session 2: Employing descriptive statistics for analysis and interpretation

Session 3: Correlation between variables

Session 4: Performing linear regression to make business forecasts

**Note to tutors: This is the recommended session plan for Learning Outcome 4, Element 4 of the ABE Level 4 Introduction to Quantitative Methods. You should follow the plan, using the activities provided. It is important to enhance all sessions with local examples and case studies, involving the learners ACTIVELY wherever possible. Note that for this unit, the activities come from the study guide owing to the progressive nature of the teaching and the volume of activities available.**

### SESSION 1: Constructing and interpreting charts and diagrams (5 hours)

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| **Topic** | **Tutor Activity** | **Slides** | **Learner Activity** | **Formative Assessment** |
| Introduction to session and learning outcomes | **4.1 Construct and interpret appropriate charts and diagrams from tabular data**  Use ‘4UIQM E4 Tutor Presentation’ PowerPoint  Introduce the session and learning outcomes and link these to chapter 4. | 1-4 |  |  |
|  | Show an example of the same information presented in two formats:   1. Textual 2. Graphical   Ask learners which format is likely to leave a clearer or a better impact.  On the basis of the answer introduce charts and graphs to the class.  Ask learners why tabulation of data (discussed in chapter three) is not enough and why charts and graphs are more relevant. Now show them slide 5. | 5 | The learners should actively participate in the discussion. |  |
| Constructing charts and graphs | Ask learners what they think makes a good chart or graph. Make a list of the answers provided by the learners.  Next, show slides 6 and briefly discuss the various guidelines on what makes a good graph. | 6 | The learners should actively participate in the discussion. |  |
| Components of a chart or graph | Show slide 7 to highlight the various elements or components of a chart or graph. | 7 |  |  |
| Types of charts and graphs | Show slide 8 to show the classification of charts and graphs. Emphasise that the choice of a chart or a graph depends on the type of data. | 8 |  |  |
| Bar chart | Start with charts and graphs for qualitative data.  Introduce a bar chart through an exemplar bar chart to the class. Highlight the properties of a bar chart by referring to the exemplar bar chart.  Let the class know that bar charts can be of different types.  Next, take the data in case study 1 (table 4.3) and construct a simple bar chart (Alternatively show slide 11). Ask the class what they can interpret from the chart. In light of the answers, discuss the interpretation of the bar chart.  Now, show slide 12 to highlight the situations in which a bar chart is appropriate. | 9-14 | The learners should actively participate in the discussion. |  |
| Next, take the data in case study 1 (table 4.4) and construct a multiple bar chart first in a vertical format and then in a horizontal format (alternatively use slides 13 and 14). Ask the class when do they think is horizontal bar chart preferred over vertical bar chart and what they can interpret from the either chart. In light of the answers, discuss the interpretation of the bar chart. |  | Learners should complete Activity 1 in the class and discuss any queries they may have | E4 LO4 Activity 1 |
| Component bar chart | Introduce the class to a component bar chart and highlight on the difference between a simple or multiple bar chart and component bar chart. Make sure the learners understand the relevance of legend and the relevance of height of each component in a bar.  Next use data in table 4.4 and construct and interpret a component bar chart (Alternatively use slide 16) | 15-16 | Learners complete Activity 2 individually in the class. | E4 LO4 Activity 2 |
| Pie chart | Introduce a pie chart through an exemplar pie chart to the class.  Explain to the learners that pie chart can be based on absolute values or on percentages.  Next, take the data in case study 1 (table 4.3) and construct pie charts both in absolute values as well as percentages. (Alternatively show slide 18). Ask the class what they can make out from the chart. In light of the answers, discuss the interpretation of the pie chart. | 17-18 | Learners should actively participate in the discussion.  Learners complete Activity 3 individually in the class. | E4 LO4 Activity 3 |
| Histograms | Next, move to charts and graphs for quantitative data.  Introduce a histogram through an exemplar histogram to the class.  Highlight the properties of a histogram by referring to the exemplar histogram.  Next let the class know that histograms can be drawn where class intervals of a distribution are equal and also where class intervals are unequal.  Next, take the data in table 4.9 of the study guide and construct a histogram where class intervals are equal. Show that area of the rectangular bars denotes the frequency for the respective class intervals. Ask the class what they can interpret from the histogram. In light of the answers, discuss the interpretation.  Next, take the data in table 4.10 of the study guide and construct a histogram where class intervals are unequal. Show that area of the rectangular bars denotes the frequency for the respective class intervals. | 19-22 | Learners complete Activity 4 individually in the class. | E4 LO4 Activity 4 |
| Frequency polygon | Introduce a frequency polygon by using the histogram constructed earlier.  Highlight the difference between a frequency polygon and a histogram.  Next, take the data in table 4.11in the study guide and construct and construct a frequency polygon. Ask the class to interpret it. In light of the answers, discuss the interpretation. | 23-24 |  |  |
| Ogive | Introduce an ogive through an exemplar.  Show slide 26 to describe an ogive with reference to the exemplar.  Next, take the data in table 4.12 and construct an ogive. (Alternatively show slide 26). Ask the class to interpret it. In light of the answers, discuss the interpretation. | 25-26 | Learners complete Activity 5 individually in the class. | E4 LO4 Activity 5 |
| Stem and leaf diagram | Introduce a stem and leaf diagram through an exemplar.  Next, take the data in table 4.13 and construct a stem and leaf diagram. (Alternatively show slide 33). Interpret the diagram for the class. | 27-28 | Learners complete Activity 6 individually in the class. | E4 LO4 Activity 6 |

### SESSION 2: Employing descriptive statistics for analysis and interpretation (6 hours)

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| **Topic** | **Tutor Activity** | **Slides** | **Learner Activity** | **Formative Assessment** |
| Descriptive statistics | **4.2 Employ a set of descriptive statistics for analysis and interpretation of grouped and ungrouped data**  Use ‘4UIQM E4 Tutor Presentation’ PowerPoint  Remind the class of ‘descriptive statistics’ they were introduced to in chapter 3 and mention that the current session will focus on two key elements of descriptive statistics, namely measures of central tendency and measures of variability or spread.  Next, using slide 31 and 32 briefly explain to the class the meaning of measures of central tendency and measures of spread. | 29-32 |  |  |
| Measures of central tendency | Show slide 39 to show the learners what all will be covered under measures of central tendency. | 33 |  |  |
| Arithmetic mean | Start with arithmetic mean. Show slide 34 to introduce formulae for calculating arithmetic mean for ungrouped, simple frequency, grouped frequency distributions and also grouped frequency distribution using assumed mean.  Using data in table 4.14 of the study guide show the class how to determine the mean of ungrouped data.  Next, using case study 2, show how to determine the mean under simple frequency distribution.  Next, using data in table 4.16 of the study guide show how to determine the mean for a grouped distribution and also how the method can be simplified using assumed mean.  Finally, show slide 35 to highlight the advantage and limitation of using mean as a measure of central tendency | 34-35 |  |  |
| Median | Show slide 36 to explain the meaning of median.  Using slide 37 introduce formulae for calculating median when there is odd number of observations, even number of observations and also for grouped frequency distributions.  Using example in the study guide show the class how to determine the median when there are odd number of observations.  Next, using data in table 4.23 of the study guide show how to determine the median when there is an even number of observations.  Next, using data in table 4.23 of the study guide show how to determine the median for a grouped distribution.  Finally, using data in table 4.23 show the class that median value can also be determined through an ogive. Illustrate this through slide 38. | 36-38 |  |  |
| Mode | Show slide 39 to explain the meaning of mode.  Using slides 40 introduce formulae for calculating mode for ungrouped distribution, simple frequency distribution, grouped frequency distribution (equal class interval) and grouped frequency distribution (unequal class interval)  Using an example show the class how to determine the mode for ungrouped distribution.  Next, using data in table 4.25 of the study guide show how to determine the mode of a simple frequency distribution.    Next, using data in table 4.26 of the study guide show how to determine the mode for a grouped distribution with equal class intervals.  Finally, using data in table 4.27 show the class how mode value is determined for a grouped distribution when the class interval is unequal. | 39-40 | Learners need to complete activity 7 individually not necessarily in the class. | E4 LO4 Activity 7 |
| Measures of dispersion-range, inter-quartile range and quartile deviation | List the three measures of dispersion. Show slide 41  Describe range as a measure of dispersion and how it is calculated. Calculate range for data in table 4.29 of study guide.  Next, highlight the advantages and disadvantages of range as a measure of dispersion (slide 42).  Next, show slide 43 to introduce the concept of quartiles to explain the second measure of dispersion: inter-quartile range or quartile deviation.  Show how inter-quartile range and quartile deviation are related to each other.  Use data in table 4.31 of the study guide to calculate inter-quartile range and quartile deviation.  Next, show slide 44 (ogive constructed earlier for data in table 4.23) to explain how quartiles can be determined from an ogive. | 41-44 |  |  |
| Measures of dispersion- standard deviation | Using slide 45 introduce the most popular method of dispersion, standard deviation.  Using slides 46 introduce formulae for calculating standard deviation for ungrouped distribution, simple and grouped frequency distribution. Also introduce learners to an alternative formula for calculating standard deviation for simple and grouped frequency distribution  Next, using data in table 4.33 of the study guide show how to determine the standard deviation for simple and grouped frequency distribution.  Finally, use data in table 4.35 of the study guide to show an alternative calculation. | 45-46 | Learners complete activity 8 individually in the class. | E4 LO4 Activity 8 |
| Skewness of data | Explain the concept of skewness by emphasising that in an ideal distribution, the data values are equally distributed on both sides of the mean and the distribution is symmetrical. However, in many distributions, a large number of values may gather either on the right side or left side of the mean, that is, data is skewed.  Highlight the relation between mean, median and mode when data is symmetrical and when it is skewed. | 47-48 |  |  |
| Karl Pearson’s coefficient of skewness | Explain to learners why it is important to measure skewness. Tell them that one of the methods for measuring the extent of skewness is Karl Pearson’s coefficient of skewness.  Introduce the formulae for calculating Karl Pearson’s coefficient of skewness when values of mean and mode are available and when mean and median are available.  Next, using data in table 4.39 show how to calculate Karl Pearson’s coefficient of skewness. | 49 |  |  |

### SESSION 3: Correlation between variables (4 hours)

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| **Topic** | **Tutor Activity** | **Slides** | **Learner Activity** | **Formative Assessment** |
| Correlation | **4.3 Determine correlation between two business variables**  Use ‘4UIQM E4 Tutor Presentation’ PowerPoint  Explain the concept of correlation using examples. Highlight why it is important to understand the concept and how it is used in business situations.  Explain positive, negative and no correlation. | 50-51 |  |  |
| Scatter graph to find correlation | Introduce scatter graphs to the learners. It is important that learners understand that scatter graphs are diagrammatic presentation of the relationship between two variables, an independent variable and a dependent variable. It shows how a change in the independent variable affects the dependent variable.  Next, use data in table 4.41 to show how to construct a scatter graph, also called a scatter diagram. Make sure learners understand how to fit a line of best fit.  Finally, help learners interpret the scatter graph (diagram). | 52 |  |  |
| Pearson’s coefficient of correlation | Show slide 53 to introduce Pearson’s coefficient of correlation. Learners should understand that it is represented by the letter r or R and the value lies between -1 and+1.  Show slide 54 to depict perfect positive correlation, perfect negative correlation and no correlation.  Show slide 55 to introduce the formula of Pearson’s coefficient of correlation.  Finally, demonstrate calculation of Pearson’s coefficient of correlation by using data in table 4.41 of the study guide. | 53-55 |  |  |
| Spearman’s rank correlation | Emphasise to learners that Spearman’s rank correlation measures the strength and direction of association between the rankings of two variables. It is important that learners understand that this method is used to measure the association between variables when the variables tend to change together, but the rate of change may not necessarily be constant.  Introduce the formula of Spearman’s rank correlation.  Finally, demonstrate calculation of Spearman’s rank correlation by using data in table 4.43 of the study guide. | 56 |  |  |

### SESSION 4: Performing linear regression to make business forecasts (3 hours)

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| **Topic** | **Tutor Activity** | **Slides** | **Learner Activity** | **Formative Assessment** |
| Simple linear regression | **4.4 Perform linear regression to make business forecasts**  Use ‘4UIQM E4 Tutor Presentation’ PowerPoint  Introduce the concept of linear regression by linking it to the previous session of correlation between two variables and how correlation coefficient could measure the strength of their association. Simple linear regression goes a step further and attempts to fit a linear equation to the observed data on the two variables for modelling their relationship. With this background, introduce the simple linear regression line.  Make sure that learners understand **predictor** or **explanatory** variable and **response** or **outcome**.  Next, introduce to learners to the use of least square regression method. Show slide 59 to highlight the two ways in which values of ‘b’ can be determined. Demonstrate the two methods using data in table 4.41 of the study guide. | 57-59 |  |  |
| Using regression equation | Show slide 60 to explain how regression equation is used for extrapolating of data or for forecasting. Demonstrate this by using data in Table 4.41 and additional information. | 60 |  |  |
| Review of session and learning outcomes | Discuss the key points covered in the chapter and ask learners if they have any queries. | 61 |  |  |