LECTURE 2: LEVELS OF MEASUREMENT

Quantitative data can be captured/ collected through two main levels of measurement: 1) Categorical data and 2) Numerical data. Categorical data are divided into two distinct subcategories: A) Nominal data and B) Ordinal data. Similarly, numerical data are also divided into two subcategories: A) Interval data and B) Ratio data. It is necessary to understand these different types of measurement as they are necessary for choosing the appropriate statistical analyses. The following table summarizes the different types of data and their qualities:

	CATEGORICAL DATA		*NUMERICAL DATA*	
	Nominal data	**Ordinal data**	**Interval data**	**Ratio data**
Can be named	✓	✓	✓	✓
Can be ordered		✓	✓	✓
Equal & meaningful distance between values			✓	✓
Has an absolute zero value				✓

1. Categorical data
Categorical data (also known as qualitative variables) describe qualitative attributes.

A. Nominal data
Nominal data are a type of categorical data that are "labeled" or "named" data which can be divided into various groups that do not overlap. Data are not measured or evaluated in this case; they are just assigned to multiple unique groups. "We may, for example, ask participants to report whether they are native or non-native speakers of English. Here, for statistical analysis (e.g., frequency counts or percentages), we can code this data by assigning 1 to native speakers of English and 2 to non-native speakers of English." (Phakiti, 2010, p. 40)[1]. Other examples of nominal data include gender, country of birth, nationality, eye color …etc.

As demonstrated in the examples, nominal data are alphabetical with qualitative property/ nature. For example, while we can calculate the number of male/female students in a particular context, gender in itself is not something we can measure. Because of this qualitative nature, it is impossible to calculate the mean for nominal data. Furthermore, because nominal data do not overlap, they do not have an intrinsic order. For example, there is no natural order for gender or being a native or a non-native speaker of English.

B. Ordinal data
Ordinal data is a type of categorical data where the variables have a natural order. The following table provides some examples of ordinal data:

Question/ item	Options				
Likert scales: How satisfied are you with the course?	1. Very satisfied ☐	2. Satisfied ☐	3. Indifferent ☐	4. Dissatisfied ☐	5. Very dissatisfied ☐
Educational level:	Kindergarten ☐	Primary school ☐	Middle school ☐	High school ☐	University ☐
Age group:	0 – 18 ☐	19 – 34 ☐	35 – 49 ☐	50 – 64 ☐	65 + ☐

"Ordinal data can tell us that an individual is greater or less than others in a characteristic or aspect being measured, but they do not tell us how much greater or lesser in terms of equal intervals (i.e., the distance between categories is not precise). For example, in an agreement scale ranging from 1 (strongly disagree) to 5

[1] Phakiti, A. (2010). Analyzing quantitative data. Continuum companion to research methods in applied linguistics, 39-49.

(strongly agree), we can see that one is greater or less than another in terms of levels of agreement, but we cannot say that the distance between the scores of 4 (agree) and 5 (strongly agree) is the same as the distance between the scores of 1 (strongly disagree) and 2 (disagree)" (Phakiti, 2010, p. 40)[2].

2. Numerical data

Numerical data (also referred to as continuous variables) describe quantitative attributes.

A. Interval data

Interval data are a type of continuous numerical data which are measured along a scale, in which each point is placed at an equal distance from the other (i.e., equidistant). For example, the distance between 10° and 11° is the same as the distance between 20° and 21° (i.e., 1 degree Celsius). Examples of interval data include time, date, temperature, IQ (Intelligence Quotient) test … etc.

A distinctive feature of interval data is that they often do not have an absolute zero (unlike ratios). In other words, the value 0 in interval data, does not imply the absence of the attribute. For example, the value 0 degree in Celsius refers to the freezing temperature of water. In fact, interval data can go below zero (e.g., -10 degrees Celsius).

B. Ratio data

Ratio data is defined as a type of numerical data that can be categorized, ranked, with an equal and definitive distance between values and an absolute "zero" being treated as a point of origin. Examples of ratio data include age, height, weight, speed, monthly income … etc.

A true zero means there is an absence of the variable of interest. In other words, there can be no negative numerical value in ratio data (the value zero mean the lack of something).

ACTIVITY

Indicate the type of data in each of these examples:

Duration of completing a reading task	Nominal ☐ Ordinal ☐ Interval ☐ Ratio ☐	Number of students in a classroom	Nominal ☐ Ordinal ☐ Interval ☐ Ratio ☐	Language proficiency level	Nominal ☐ Ordinal ☐ Interval ☐ Ratio ☐	Number of grammatical errors in an essay	Nominal ☐ Ordinal ☐ Interval ☐ Ratio ☐
Country of residence	Nominal ☐ Ordinal ☐ Interval ☐ Ratio ☐	Self-reported frequency of taking in class notes	Nominal ☐ Ordinal ☐ Interval ☐ Ratio ☐	Language teaching approach	Nominal ☐ Ordinal ☐ Interval ☐ Ratio ☐	Percentage of lectures attended	Nominal ☐ Ordinal ☐ Interval ☐ Ratio ☐
Reading strategy	Nominal ☐ Ordinal ☐ Interval ☐ Ratio ☐	IELTS/ TOEFL score	Nominal ☐ Ordinal ☐ Interval ☐ Ratio ☐	Frequency of speech intonation/ pitch	Nominal ☐ Ordinal ☐ Interval ☐ Ratio ☐	Students' Excel knowledge (beginner, intermediate, advanced)	Nominal ☐ Ordinal ☐ Interval ☐ Ratio ☐

---

[2] Phakiti, A. (2010). Analysing quantitative data. Continuum companion to research methods in applied linguistics, 39-49.