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ADVANCE

Advancing Sustainable Agricultural Value Chains through Strengthening Transdisciplinary Skills and Cooperation in East African Doctoral Education

Erasmus+
project
conducted
by:



UGANDA CHRISTIAN
UNIVERSITY
A Centre of Excellence in the Heart of Africa



UNIVERSITY OF NAIROBI



and
supported
by:

European Alliance in Agricultural Knowledge for Development, Belgium; National Agricultural Research Organization, Uganda; National Council of Higher Education Uganda, Uganda, Kenya Agricultural and Livestock Research Organisation, Kenya; Ministry of Education Science and Technology, Kenya



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Nature of Measurement

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Measurement

- Measurement is the foundation of any scientific investigation
- Everything we do begins with the measurement of whatever it is we want to study
- Measurement—involves categorizing and / or assigning values to variables.

Key terminologies

- Measurement
- Evaluation
- Assessment
- Testing

Principles of measurement

- Reliability - consistency
- Validity - Accuracy
- Objectivity – Freedom from bias
- Practicability –feasibility and efficiency
- Interpretability –ease of understanding
- Relevance –Appropriateness of purpose
- Standardization - Uniform procedures

Scales of measurement

Four important properties:

- ① Identity
- ① Magnitude - property of “moreness”. Higher score refers to more of something.
- ① Equal intervals - is the difference between any two adjacent numbers referring to the same amount of difference on the attribute?
- ① Absolute zero - does the scale have a zero point that refers to having none of that attribute?

Types of Measurement Scales

1. Nominal

2. Ordinal

3. Interval

4. Ratio

Nominal Scale

- The only property they have is **identity** or **name** (nominal=name).
- Numbers if used are simply codes for the real names of the properties.

Types of Measurement Scales

Nominal Scales - there must be distinct classes but these classes have no quantitative properties. Therefore, no comparison can be made in terms of one category being higher than the other.

Eg. - the variable gender - males and females. There are no quantitative properties for this variable or these classes and, therefore, gender is a nominal variable.

Other Examples:

country of origin

biological sex (male or female)

married vs. single

Political Orientation e.g NDC, NPP, CPP

Nominal Scale

What is your livelihood occupation?
(Please tick the number of all that apply)

- 1 Farming
- 2 Business
- 3 Paid labour
- 4 Government job
- 5 Private job

Nominal Scale

Select the land based categorization of the farm family.

1 Landless Farmer

2 Marginal farmer

3 Small farmer

4 Large farmer

Nominal Scale

- ⊙ Sometimes numbers are used to designate category membership

- ⊙ Example:

Country of origin of supplies used

1 = Kenya

3 = Tanzania

3 = Uganda

4 = Other

- ⊙ However, in this case, it is important to keep in mind that the numbers **do not have intrinsic meaning**

Ordinal Scale

Numbers denote a rank order
examples

- Age (youngest; young; old; older).
- Size (smallest; small; big; biggest).
- Quality (Poor; good; excellent).
- Income (low; middle; upper).
- Achievement at school (poor; moderate; high).

Ordinal Scale

Ordinal variables have ORDINALITY

i.e Have magnitude (order). $A > B > C > D$. We know relative order.

Some examples

Age (youngest; young; old; older).

Size (smallest; small; big; biggest).

Quality (Poor; good; excellent).

Income (low; middle; upper).

Achievement at school (poor; moderate; high).

There are distinct classes but these classes have a natural ordering or ranking. The differences can be ordered on the basis of magnitude.

Ordinal Scale

- Another example - final position of amount of yield for three experimental plots gives an ordinal variable. The plots will be ranked first, second, third.
- We know the ORDER So we can RANK them in that order. But we do not know how close the competition was between the plots.

Ordinal Scales

We DO NOT KNOW the relative difference between two magnitudes.

- $A > B > C > D$. We know relative order, but not how much A is better than B.

Eg. In an examination candidates are graded A , B, C, D, ect. according to performance. We know that A is better than B which is also better than D. But is A 4 times better than D? Is it 2 times better than D. We do not know this.

Ordinal Scales

Ordinal Scale does not assume that the intervals between numbers or magnitudes are equal.

- The distance between two adjacent categories on ordinal scales are not equal and cannot be determined.

Ordinal Scales

- Example

Consumers of a product are asked to indicate whether the product is the best on the market by checking one of these responses:

Strongly disagree

Disagree

Undecided

Agree.

Strongly agree

Ordinal Scales

Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
(1)	(2)	(3)	(4)	(5)

- The difference between the responses Strongly disagree and Disagree is probably not equivalent to the difference between Strongly agree and Agree

Interval Scales

This scale has all the characteristics:

- Identity/category (Helps researcher to determine whether 2 values are the same or different)
- Ordinality
- Magnitude - Can determine whether one value is greater or smaller than the other
- Can also determine the degree of difference between values
- Equality of interval - Contains equidistant values
- **But it has no zero point (no absolute zero!)**

Interval Scales

Example

We can group students according to their IQ

1. 200
2. 100
3. 140

This means that the students have different IQs (remember that this is a nominal measurement).

Interval Scales

We can also rank and order the students from the highest to the lowest (Remember that this is an ordinal measurement).

We can also calculate the difference in IQ among the students and conclude that the IQ of the first student is 100 points higher than the second student. (This is a characteristic which the ordinal and nominal scales don't have).

There is equal interval but no true zero point.

Interval Scales

Example - Celsius temperature is an interval variable. M

Meaningful - 25 degrees Celsius is 3 degrees hotter than 22 degrees Celsius,

Notice, however, that 0 degrees Celsius does not have a natural meaning. That is, 0 degrees Celsius does not mean the absence of heat!

Ratio Scales

Ratio Scales - captures the properties of the other types of scales, but also contains a true zero, which represents the absence of the quality being measured.

Eg- heart beats of an animal per minute has a very natural zero point. Zero means no heart beats. Weight (in grams) is also a ratio variable. Again, the zero value is meaningful, zero grams means the absence of weight.

Ratio Scales

- Example:
 - If the number of times a cow has calved is 0, it quite literally means *none*
A cow that has calved 4 times has had twice as many as calves as one which has had 2
- Therefore due to the absolute zero, **we can make ratio statements about ratio variables**

Hierarchy and Properties of the scales

- Each of these scales have different properties (category, magnitude, equality of intervals, and absolute zero) and allows for different interpretations.
- The scales are listed in hierarchical order. Nominal scales have the fewest measurement properties and ratio having the most properties
- The goal is to be able to identify the type of measurement scale, and to understand proper use and interpretation of the scale.

LEVELS OF MEASUREMENT



NOMINAL

Categorizes data without any order



ORDINAL

Categorizes data with a meaningful order



INTERVAL

Measures differences between data points



RATIO

Measures differences and has a true zero

Group task

- Funding partners are increasing amounts of information about youth farmers before deciding on the whether to support them. Classify each of the following types of data required as **quantitative or qualitative** and also specify the **scale of measurement**.
 - Age of participant
 - Sex of the participant
 - Level of education of the head of household
 - Acreage of land owned
 - Monthly income in Usd
 - Variety of crops grown
 - Expected Yield in Kgs

PILOT FARMER SURVEY QUESTIONNAIRE

DATE	
DISTRICT	
LOCATION	

1. DEMOGRAPHIC QUESTIONS

Name	
Age	
Gender	
Did you complete secondary school?	
If NO: Did you attend secondary school?	
Have you received support from any NGO or government programs in the past year?	

?

**Thank you for
your attention**

Questions?