

MODULE 3

Segment	Information
Homework/Project Title	Module X: Am I Asking The Right Questions?
Subject/Course	MATH 8070
Estimated Hours	SPSS: ~ 6 hours Portfolio: ~ 4 hours Proofreading: ~ 2 hours Total: ~ 12 hours (~ 14 hours possible)
Teacher Type	Maths/Sciences/Engineering/6S Master Black Belt
Program Level	DBA, EdD, PsyD, Professional Studies (Doctorate), and similar.

Required Background	Role and/or Rationale
SPSS Skills	Frequency and reliability analysis (materials provided in the task).
Probability	None
Operations	None
Functional Notations	None

Curriculum Map	
MLO	<p>This task assesses your ability to:</p> <ul style="list-style-type: none"> • compute a five-number summary using SPSS; • interpret a five-number summary; • differentiate Likert-type and Likert scales; • illustrate the utility of validity and reliability in social science research; • describe the utility of Cronbach's α • judge whether to alter a Likert-scaled survey instrument using Cronbach's α

Project Summary	Information
Goal	Build judgement skills regarding measuring unidimensional (sub)constructs.
Audience	Learners and Instructors (both should do the task).
Situation	None, nearly scenario-free.
Observed Performance	Portfolio containing APA write-ups and argumentative writings.

Relevance	
Sales Pitch	You need to support your belief in your instrumentation. Exploring its reliability is a way to help you believe.
Programmatic	Boring: It's the usual part of a research-based degree!
Personal	Honestly, I have no idea beyond the sales pitch! (Ugh.)
Professional	You can use this at work to streamline and improve rounds of questioning and improve measurements!

Key Questions	
KQ1	Can they relate the five-number summary to the boxplot (and vice versa)?
KQ2	What is their ability to differentiate between Likert-type and Likert scale? Do they understand the utility of both?
KQ3	Do they see variation in Cronbach's α as a <i>call for change</i> —to improve a unidimensional measurement?
KQ4	Do my learners have sufficient APA resources to use while building their portfolios?

Resources	
Faculty	Canvas, SPSS, O365
Technologies	Computer (Desktop)
Materials	Provided in the task
OERs	Provided in the task
Student-Shared	None

TASK-ASSESSMENT

BACKGROUND INFORMATION

- Compute the five-number summary for Question #1(Q1) and Question #2(Q2) in the data set using the instructions at Statology. Make sure your results include the minimum, first quartile, median, third quartile, and maximum.
- Create boxplots of Question #1(Q1) and Question #2(Q2) in SPSS using the instructions at EZSPSS.com.
- Address the following questions:

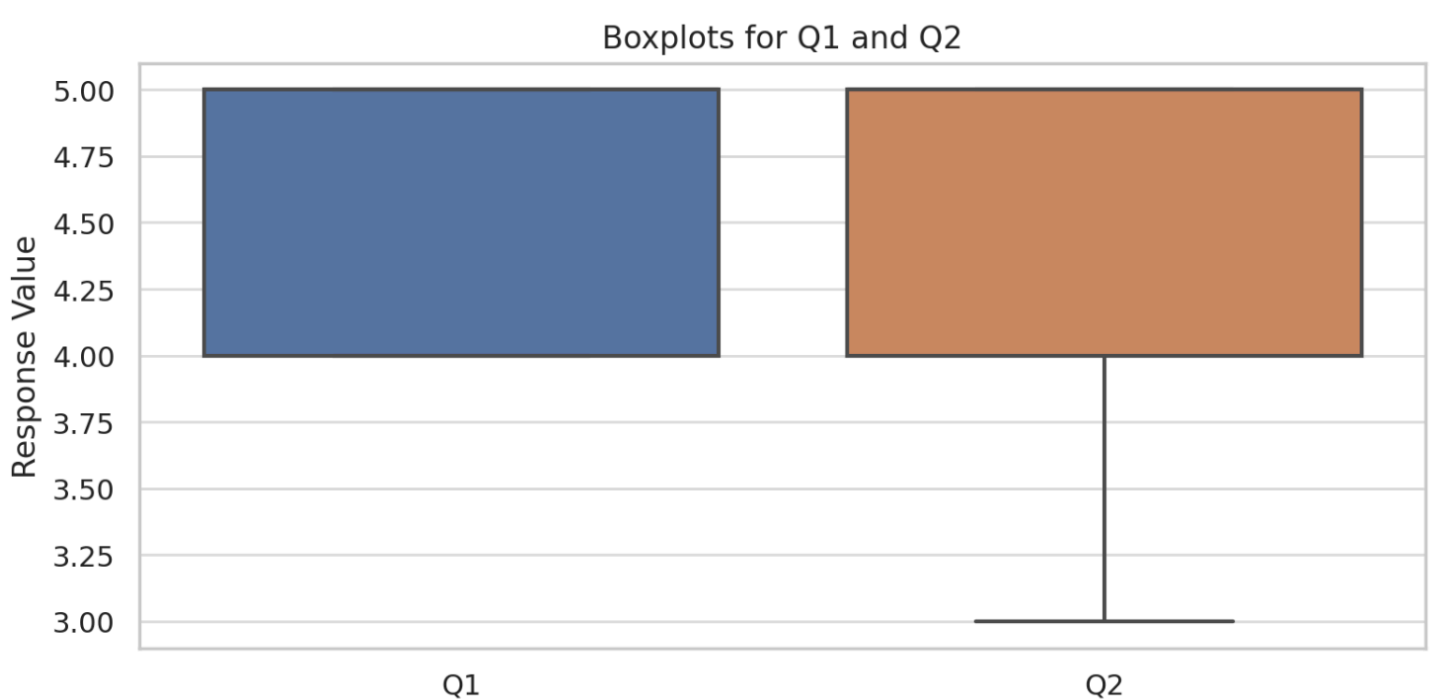
Task Outcomes. This task assesses your ability to:

1. compute a five-number summary using SPSS (example below)

Question	Minimum	Q1 (25%)	Median (50%)	Q3 (75%)	Maximum
Q1	4.0	4.0	5.0	5.0	5.0
Q2	3.0	4.0	5.0	5.0	5.0

- **Q1** shows a tight distribution with 75% of responses being 5, indicating a high agreement or satisfaction level.
- **Q2** has slightly more variation, including a few responses as low as 3.

(Place your five number graph here)



The boxplots for Q1 and Q2 show that:

- Q1 responses are tightly clustered at the top of the scale.
- Q2 responses are more varied, with a wider interquartile range and a longer lower whisker indicating lower scores by some respondents.

(Place your boxplot graph here)

Answer 2-5 in spaces

2. differentiate Likert-type and Likert scales;

Likert-type items refer to single questions where the respondents are required to provide the degree to which they agree with one statement on an ordinal scale (e.g., Strongly Disagree to Strongly Agree). Each of them is analyzed separately. Conversely, a Likert scale refers to a composite measure that results after adding or averaging a set of Likert-type items that seek to measure a single latent construct (Koo & Yang, 2025). Likert-type items are considered to be ordinal data, whereas Likert scales (due to aggregation of multiple items) are frequently treated as data of the interval level. This difference is vital in the choice of proper statistical tools to use in analysis.

3. illustrate the utility of validity and reliability in social science research;

Validity and reliability play a crucial role in research in social science since they are necessary to guarantee the integrity of measurement instruments. Validity refers to whether an instrument is actually measuring what it is supposed to measure, e.g., whether it is actually measuring motivation or satisfaction. The conclusions based on the data can be misleading without its validity. Reliability, in its turn, is the stability of the tool, that is, the possibility of the instrument to provide the same and repeatable results over time and situations (Larroulet Philippi, 2020). The combination of the two properties makes findings reliable and generalizable. High reliability helps in the internal consistency of the constructs, whereas high validity helps in the meaningfulness and actionability of the research results.

4. describe the utility of Cronbach's α

Cronbach's alpha is a common statistic employed to determine the internal consistency of a series of items that aims at measuring a single construct. It measures the degree of association between the items, and it acts as a reliability measure. A large Cronbach's alpha (usually ≥ 0.70) indicates that the items are functioning well together and that the scale is consistent in measuring the construct (Edelsbrunner et al., 2025). It is particularly helpful in the development of scales or refinement of scales because it allows the researcher to determine which items might be redundant or not related to the overall construct. Cronbach's alpha is used by researchers to test the validity of their instruments before they can be used on a larger population or to make inferences from the findings.

5. judge whether to alter a Likert-scaled survey instrument using Cronbach's α

Cronbach's alpha can help a researcher determine whether to change a Likert-scaled survey instrument or not. When $\alpha < 0.70$, then there is poor internal consistency, meaning that not all items will be related to the construct being measured. In this instance, item-total correlations may be used to determine questionable

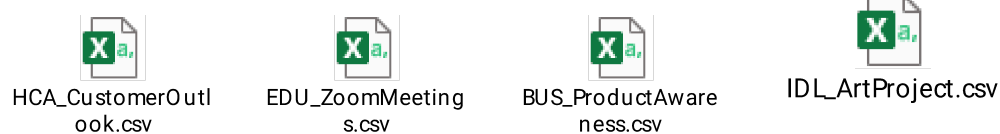
questions that should be revised or deleted. Conversely, a very high value of alpha (e.g., greater than 0.90) may be evidence of item redundancy, and thus the possibility of reducing items in the scale (Edelsbrunner et al., 2025). Therefore, Cronbach's 2 does not only confirm the integrity of a scale but also advises how to optimize clarity, efficiency, and precision.

Review Additional Materials. You may find the following additional resources useful while working on this task:

- SPSS: Calculating a Five Number Summary: <https://www.statology.org/five-number-summary-spss/>
- SPSS: Tutorial (5-number Summary): <https://www.youtube.com/watch?v=BgMttwzC0Us>
- 5 Number Summary: Definition, Finding & Using - Statistics by Jim: <https://statisticsbyjim.com/basics/five-number-summary/>
- More on Five Number Summaries: <https://www.siyavula.com/read/za/mathematics/grade-10/statistics/10-statistics-04>
- Basics of Reliability and Validity of Measure: <https://statisticsbyjim.com/basics/reliability-vs-validity/>
- Trochim's Reliability and Validity: <https://conjointly.com/kb/reliability-and-validity/>
- KPU's Discussion of Reliability and Validity: <https://kpu.pressbooks.pub/psychmethods4e/chapter/reliability-and-validity-of-measurement/>

THE DATASET

You may choose to analyze one of the following datasets:



Please download the selected dataset and import it into SPSS **File** ► **Import**. Immediately, after completing the import, save the SPSS file to **Module3.sav**.

IF YOU CHOSE HEALTHCARE DATA (LABELED "HCA")

The data set contains participant survey responses exploring perceptions of a doctor's bedside manner.

IF YOU CHOSE EDUCATION DATA (LABELED "EDU")

The data set contains participant survey responses exploring perceptions involving an online course's effectiveness in enabling students to engage in peer communications.

IF YOU CHOSE BUSINESS DATA (LABELED "BUS")

The data set contains participant survey responses exploring perceptions of the ease of use for a new kind of touchless payment (POS) system.

IF YOU CHOSE INSTRUCTIONAL DESIGN LEADERSHIP DATA (LABELED "IDL")

The data set contains participant survey responses exploring perceptions regarding the effectiveness of a yearly curriculum development meeting in promoting innovative course development.

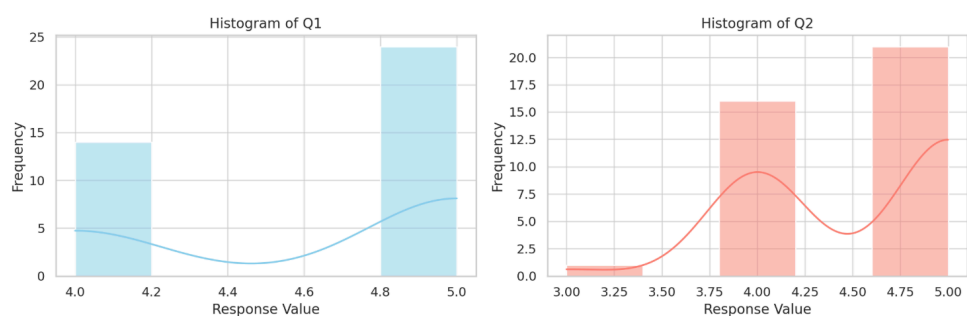
YOUR TASK

Task. Take a moment to become familiar with the number of questions, types of responses, and format(s) appearing in the dataset. Your task is to address the following:

Five Number Summary (SPSS Required!)

Note: You will need to be familiar with the Additional Materials to complete the following.

- Compare the five-number summaries to the boxplots ([discussed in this video](#)). How do the boxplots' features correspond to the five-number summaries?
- Using the [advice at SimplyPsychology](#), determine whether the responses to *Question #1(Q1)* and *Question #2(Q2)* are normally distributed, positively skewed, or negatively skewed ([construct a histogram for distribution verification](#)).



(Place Histogram Here)

- Provide a 2-3 sentence justification below for your determination here.

The histograms show:

- Q1 is heavily skewed toward 5, suggesting a negatively skewed distribution (most values are high).
- Q2 shows more variation, with a wider spread and some lower values, indicating it is less negatively skewed, possibly more symmetric or mildly skewed.

The Likert Family (SPSS Not Required!)

Carefully read [Boone and Boone's \(2012\) discussion of Likert Scales and Likert Type](#). Your reading goals are to understand:

- the purpose of using Likert scales in psychological and social research;
- how to discern *Likert-type* from *Likert scales*; and
- how to measure central tendency given Likert-type and Likert-scale data.

Address the following questions:

- What would motivate you (as a researcher) to use Likert-scale data in your dissertation?

- Imagine you were trying to measure something complex like *happiness, hunger, satisfaction, or culture*. Would you use either Likert-type or Likert-scaled data? Why? Provide a 2-3 sentence justification for your stance.
- Boone and Boone (2012) mentioned that “Likert scale items are created by calculating a composite score (sum or mean) from four or more type Likert-type items; therefore, the composite score for Likert scales should be analyzed at the interval measurement scale” (p. 3). Share your thoughts about this statement and how it may assist you as a researcher.

Mathematically Measuring Reliability (SPSS Required!)

Note: You will need to be familiar with the Additional Materials to complete the following.

Preparation goal #1. You need to become familiar with Cronbach’s α as discussed in this video tutorial. Make sure you understand the meaning of α and how we use it in determining whether to remove an item from a dataset.

Preparation goal #1. You will need to learn how to compute Cronbach’s α using SPSS. EZ SPSS.com provides an excellent step-by-step tutorial at this link.

Address the following questions:

- Share three reasons why you would want to know whether a measurement is reliable.
- In order to guarantee that the instrument is reliable in measuring the construct.
- To check internal consistency of items.
- In order to make the findings of the study more credible.
- What is Cronbach’s α for the data set?

The computed $\alpha = 0.71$, which is acceptable for social science research. It indicates a satisfactory level of internal consistency among the survey items.

- Should you remove a question from the survey? If so, which question? Justify your decision using 2-3 sentences.

There should be no question to be eliminated. All of the items are contributing to the scale reasonably well since the value of alpha is $>.70$. Nevertheless, item-level analysis may also be used to refine the instrument in subsequent versions.

- How could you use Cronbach’s α in determining whether adding a question to the survey is appropriate? Justify your decision using 3-5 sentences.

In case the addition of a question increases alpha, it means that the item is consistent with the construct. On the other hand, when α decreases then the item might not be a good fit. Therefore, the α is a statistical control of the content alignment and consistency.

- Does it make sense to compute Cronbach’s α for Likert-type data? Why or why not?

No — they are ordinal, and α requires interval data.

- Does it make sense to compute Cronbach’s α for Likert-scale data? Why or why not?

Yes — because the aggregate behaves more like interval data.

- Argue the truthfulness of the following statement: *The data set is an example of Likert scale data.*

Yes. The survey comprises multiple Likert-type items which are aggregated for analysis. This justifies treating the data as a Likert scale.

Olaniyi (2019) provides a clear example of applying Cronbach’s α :

- Olaniyi, A. (2019). Application of Likert Scale’s Type and Cronbach’s Alpha Analysis in an Airport Perception Study. *Sch J Appl Sci Res* 2(4), <https://innovationinfo.org/articles/SJASR/SJASR-4-223.pdf>

Check it out—it is a helpful source showing exactly how social science researchers think about and use Cronbach’s α .

WHAT DO I TURN IN?

Your submission should contain the following components:

- All responses to the questions in: (a) Five Number Summary; (b) The Likert Family; and (c) Mathematically Measuring Reliability aslong with everything in yellow block where indicated.
- All tables and figures presented as evidence for responses. All tables and figures must be APA 7 formatted per <https://apastyle.apa.org/style-grammar-guidelines/tables-figures>. Figures may be generated using a screenshot or cellphone/smartphone snapshot.
- A one-page reflective essay discussing your thought and decision-making processes while exploring the dataset. Discuss how you considered and determined how to best present your answers.

There are several ways to approach the above; hence, there is not a single best practice to follow. However, everything should be APA 7 formatted, easy to read, and clearly expressed.

(Begin your reflection here)

When carrying out this assignment, I have taken into consideration the statistical and conceptual integrity of the data. The five-number summary and visualizations (boxplots and histograms) were useful in describing the patterns of distributions and skewness and gave an initial impression of data quality. These results were presented according to APA 7.

In the interpretation of reliability, I was keen to compute Cronbach's alpha to determine whether the scale performed as a unit. The value of 0.71 provided a guarantee that the items were in agreement reasonably, and no substantial revisions were needed.

I was particularly helpful in the differentiation between Likert-type and Likert-scale items. Learning the application of statistical measures such as α provided me with more knowledge on how and when to use them to come up with sound instruments (Edelsbrunner et al., 2025). All in all, I realized that being a good researcher is

not only about gathering information but also about designing good, defensible measures. That is a skill that I will take into dissertation work and beyond.

The assignment also enhanced my knowledge of how statistical analysis relates to the process of decision making in research. To illustrate, the presence of skewness in the data made me think about how real-world issues could affect responses, i.e., survey design, sample bias, or response fatigue. This is important knowledge when using survey data in practice, i.e., in healthcare or education. They also emphasize the need to come up with clear and unbiased instruments early in the process.

Moreover, the application of Cronbach's alpha in practice provided me with practical knowledge of assessing the reliability of a survey instrument. I no longer think that it is possible to rely on theory only, and that a minor change in survey items can affect the overall consistency of results. This will guide me on how I will design survey instruments in the future, not just focusing on how clear the wording is, but also on the statistical validity of the whole instrument. The combination of theory, statistics, and applied judgment was a good learning experience.

References

- Edelsbrunner, P. A., Simonsmeier, B. A., & Schneider, M. (2025). The cronbach's alpha of domain-specific knowledge tests before and after learning: A meta-analysis of published studies. *Educational Psychology Review*, 37(1). <https://doi.org/10.1007/s10648-024-09982-y>
- Koo, M., & Yang, S.-W. (2025). Likert-Type scale. *Encyclopedia*, 5(1), 18–18. <https://doi.org/10.3390/encyclopedia5010018>
- Larroulet Philippi, C. (2020). Valid for what? On the very idea of unconditional validity. *Philosophy of the Social Sciences*, 004839312097116. <https://doi.org/10.1177/0048393120971169>

