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Game of Likert Scale: When and Where to Use

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ABSTRACT
Short questionnaire based surveys are a very useful gadget for data collection, in social and physical sciences. Relevant information on skills, behavior, psychometric traits, social differences, and ability can be collected and compared through short questionnaire surveys very easily. Gathering information through questionnaire comprises of two techniques; every question measures a different variable, and some questions are compound together into a single index. Collection of information is these two cases and its analysis can be done through a Likert scale proposed in 1932. Likert scale is a five point's scale that measures the level of agreement and disagreement to a certain question called item. Each item individually is called Likert type item, while adding it to index a new unobservable latent variable is termed as Likert scale. In this paper the scale of measurements used for Likert type and Likert analysis is discussed and some statistical analysis is proposed.

Keywords: *Likert Scale, Likert Type, Level of Measurements, Analysis, Psychology*.

Introduction

Short questionnaire based surveys are a very useful gadget for data collection, in social and physical sciences. It can easily and very quickly provide an idea for testing variation in various traits amongst individuals. For example relevant information on skills, behavior, psychometric traits, social differences, and ability can be collected and compared through short questionnaire surveys very easily. Gathering information through questionnaire comprises of two techniques; every question measures a different variable, and some questions are compound together into a single index. For example behavioral preferences in food, clothing and living style can be measure

separately from different questions. While on the other hand attitude towards personality traits, ability, and social status can be indexed from various attributes. The most commonly used questionnaire amongst the class of rating scale for attitudes and behavior is called the Likert-type scale. This scale was first proposed by Likert (1932), for measuring the extent of agreement or disagreement to a series of questions asked about a certain topic. The format of this scale is a fixed choice response and is designed to measure the extent of attitude towards some pre defined problem (Bowling, 1997; Burns et al., 1997).

Likert proposed a five point's scale, and the individual is allowed to select a point such that how much he agree or disagree with the specified statement. For instance, they could rate the item on a 1 to 5 response scale, where 1 represents "Strongly Agree" and 5 represents "Strongly Disagree" with a neutral decision "Neither Agree Nor Disagree" at the center. However it also reasonable in some circumstances to drop the neutral decision and make it a forced-choice response scale (Burns et al., 2008; Dawes, 2008). Once all the responses are collected and all of the questionnaires are completed, then each item may be analyzed in two separate manners. Either critically investigate each item individually, or some items may be summed together to form a single index from them. The former one is called a Likert type response scale, while the latter one is known as Likert scale items.

Agriculture researchers commonly used the individual Likert-Type item to assess different categorical ordered phenomenon. A variety of ordinal and interval level statistical tools are being applied for the purpose of its data analysis. This has been done without proper investigation and testing of the nature of data set, that which and why this technique should be adopted (Dennis et al., 1994). While in some cases, traditionally the values assigned to each selected option is summed together to create an overall score for the respondents.

One of the most important considerations in the discussion of scoring phase and analysis of the Likert scale is its data level of measurements. Since the values assigned to Likert scale are arbitrary and have no objective weight of numerical values, therefore it is considered as ordered categorical data and measured on ordinal scale (Jamieson et al., 2004; Norman et al., 2010). However in the literature it is observed that an assumption is made that the attitudes can be measured and intensity of experiences is considered as linear from "Strongly Agree" to "Strongly Disagree". It is assumed that the difference between category 1 and 2 is same as the difference between 3 and 4. Hence many researchers placed the Likert Scale items in the category of interval scale of measurements and apply various parametric tests for its analysis (Reips et al., 2008).

Frequently used variables in psychology and medicine

A scientific study of behavior and mental ability constitutes an applied discipline called psychology. The duties of a professional practitioner or full time researcher in the field of psychology, is to understand the mental functions and behavior differences in a single or group of individuals. It's particularly useful in treating the mental health problems and investigating the impacts of behavioral changes in individual on society (Fernald, 2008). Detail review of the literature reveals that the psychological studies recognize relation among social factors and biological, cognitive, mental, and behavioral traits. Also it is widely accepted that the physical health is mostly influenced by the social environment of the patient and his mental conditions. This can clearly be indicated by the abnormal variation in blood pressure due to mental stress, and reduction in pain by controlling the level of anxiety (David et al., 2008). This suggests that the psychological research

may be proved as good and important as medical research in determining the health indicators of the community.

The modern medical and psychometric research emphasis on using latent variables in the model that cannot be measured directly, and rather can be indexed from various unobservable phenomenon. These modeling include factor analysis, latent classes, and item response (categorical Likert scale with observed latent categories) (Sophia et al., 2008). Thus Psychologists can explore the concepts of perception, cognition, attention, emotion, phenomenology, motivation, brain functioning, personality, behavior, and interpersonal relationships using Likert Scale.

Thoughts of a quality research and the analysis phase in it cannot be materialized unless some significant variables are selected and clearly defined. Data collection should be done in a manner so that harmonizing statistical tools can be suggested. An epidemiology research and discipline of biostatistics requires a comprehensive knowledge of the nature of study variables (Avan et al., 2001).

Taxonomy of variables

In psychology, over and over again individual people are considered as the cases while the attributes posses by those are thought as variables. For example a researcher might be interested in the number of times a child lied to his friends, siblings or parents in a particular period of time. In this case lying is an attribute and considered as a variable while different children are considered as cases. There are some characteristics that are quantitative and can be measured directly such as height, weight, age, temperature, Blood Pressure, etc. These characteristics will yield some numerical figures which can be directly manipulated. On the other hand there are some qualities that cannot be quantified numerically such as gender, color, etc. These qualities are rather categorical and can be classified into categories rather than measurements.

Apart from these two types of variables psychological problems contain a third type of variables called latent variables. Latent variables are the quantities which cannot be measured directly but we can index them from other related characteristics. Personality traits such as behavior, perception, individual differences, and cognitive abilities are latent variables that can be indexed from other variables using Likert Scale.

Example

Let us consider a hypothetical example to explain the difference between Likert type and Likert scale as well as its analysis phase. Suppose a researcher wishes to analyze the impact of talk shows on the general public, and design a questionnaire containing the Likert type items. The first four questions are asked from the respondents concerning their depression regarding current affairs. The nest three questions are asked that can be used to index the impact of print and electronic media.

Following is an example of the questionnaire

Table 1: Example of Questionnaire

Impact of talk shows on anxiety level of the general public						
S. No	Questions	Strongly Agree	Agree	Neutral	Disagree	**Strongly Disagree**
1	People hesitate to visit crowd due to blasting					
2	People do not believe in government announcements					
3	People feel reluctant in going out for shopping due to high inflation					
4	People discuss the current situation with their friends and relatives					
5	Most of our population have access to cable and satellite channels					
6	Most of the people listen talk shows and news in their spare timings					
7	**Most of the people recognize the famous talk shows anchors**					

The respondents of the survey were asked to tick the appropriate box regarding their perception whether they are agreeing to the statement or not.

Analysis of Likert type item

Each individual Item included in the survey is a Likert type item that represents a separate variable. For graphical representation of these items simple Bar charts are constructed where the height of the bars (y-axis) represents frequency of each category. Category axis (x-axis) comprises the perceptions of respondents regarding each question.

Table 2 demonstrates the frequency distribution of each Likert type item; whereas Figure 1 exhibits its Bar graphs.

Table 2: Frequency Distribution

Options	Item 1	Item 2	Item 3	Item 4	Item 5	Item 6	Item 7
Strongly Agree	48	44	44	48	36	28	72
Agree	20	60	32	52	32	56	32
Neutral	48	28	52	32	24	44	32
Disagree	48	40	44	24	52	36	52
Strongly Disagree	36	28	28	44	56	36	12

Table 3 presents modes and quartile deviation in each case as their descriptive statistics. In order to assess relationship between different items Kendal's Tau b statistics is used for variables measured on ordinal scale.

Table 3: Mode and Quartile Deviation for each Item

	Item 1	Item 2	Item 3	Item 4	Item 5	Item 6	Item 7
N	200	200	200	200	200	200	200
Mode	1[a]	2	3	2	5	2	1
Quartile Deviation							

Table 4 demonstrates the Kendal's tau b result, which shows the association between Item 1 with that of Item 5, 6, and 7 respectively.

Table 4: Kendall's Tau between Item 1 And Item 5, Item6, Item 7

			Item 5	Item 6	Item 7
Kendall's tau_b	Item1	Correlation Coefficient	.040	-.145*	-.010
		Sig. (2-tailed)	.487	.011	.857
		N	200	200	200

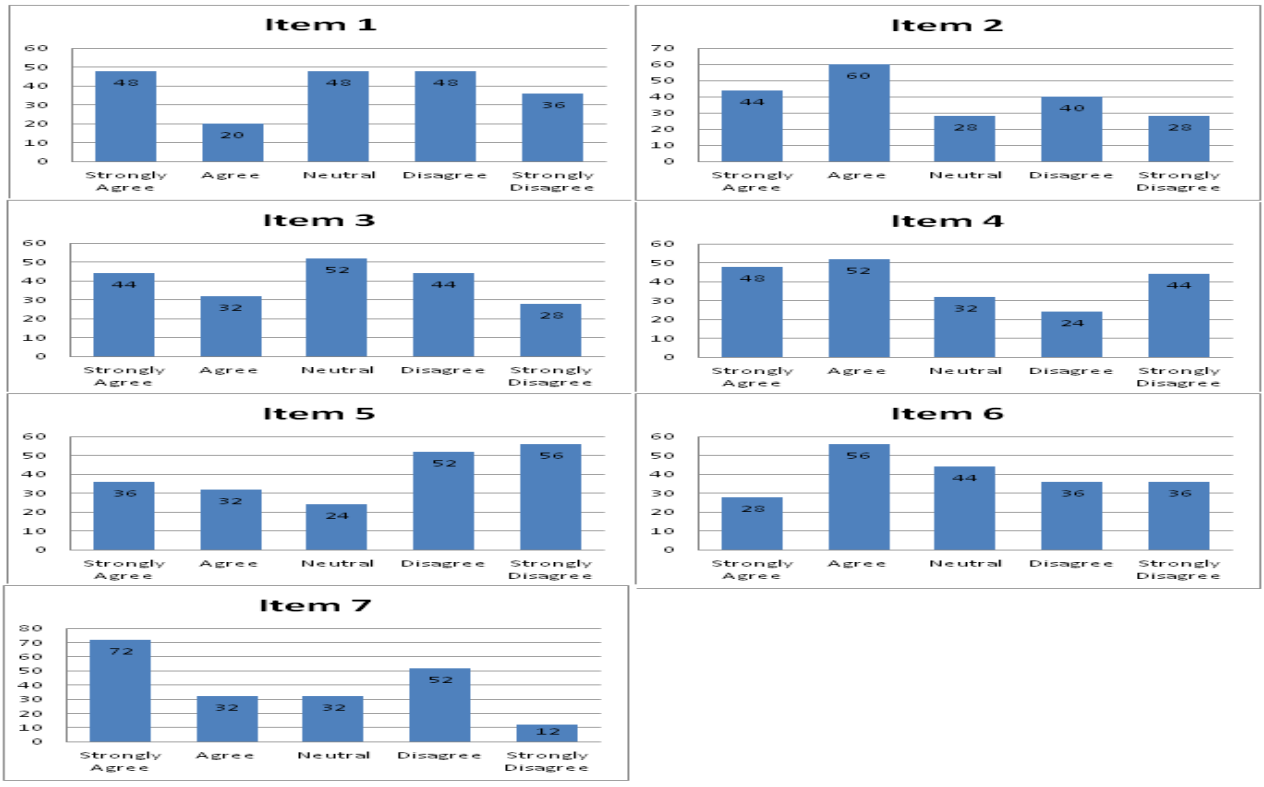

Figure 1: Bar Charts for individual items

Analysis of Likert Scale item

In likert scale some of the items in the questionnaire are summed together to get scoring on a single latent variable. In the above example items presented in question 1 to Question 4 are summed together to obtain the scoring on "Anxiety Level", while Questions 5 to 7 are added for "Media Role". Scores obtain as a result of additions is provided in Table 5 for both latent variables.

Table 5: Scores obtained as a result of sum

	SA	A	N	DA	SDA	total
Anxiety	46	41	40	39	34	200
Media Role	34	30	25	35	26	150

Now these scores are assumed to distribute on an interval scale and all parametric statistical tools can be applied for its analysis if the assumption of normality is satisfied. For testing the normality assumption of "Anxiety level" and "Media Role" Kolmogorov-Smirnov test is used and the result is provided in Table 6.

Table 6: One-Sample Kolmogorov-Smirnov Test

		anxiety	media
N		5	5
Normal Parameters[a,,b]	Mean	40.00	30.00
	Std. Deviation	4.301	4.528
Most Extreme Differences	Absolute	.208	.212
	Positive	.208	.212
	Negative	-.208	-.212
Kolmogorov-Smirnov Z		.465	.473
Asymp. Sig. (2-tailed)		.982	.979

The Table suggests that both variables approximately follow a normal random variable. For the graphical representation of both variables' histograms are constructed, which are given in Figure 2.

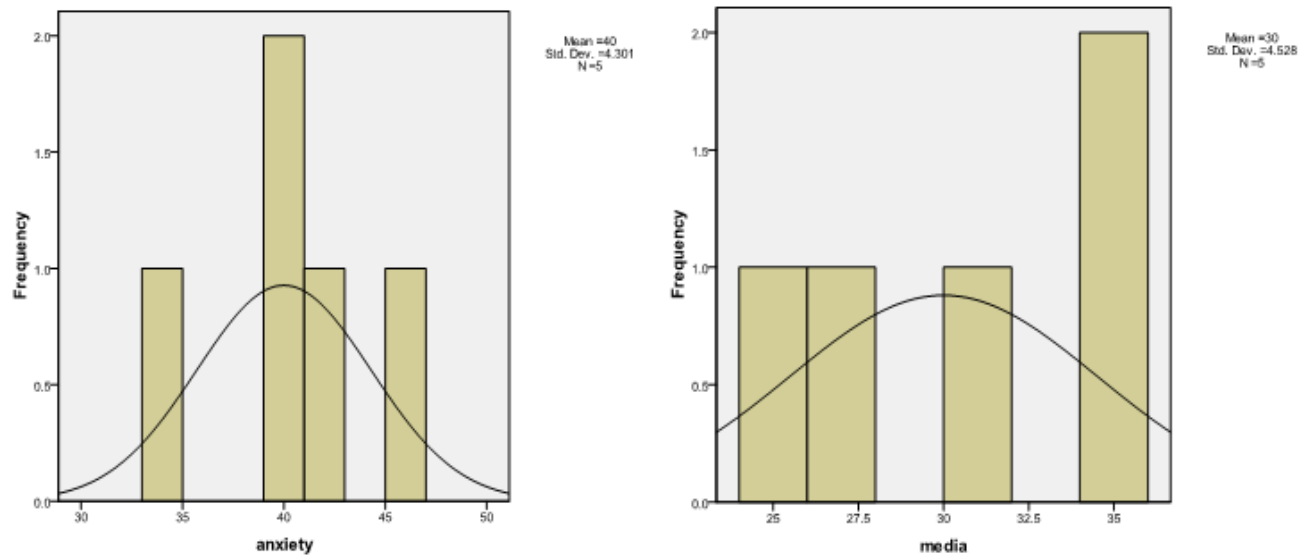

Figure 2: Histograms of Anxiety Level and Media Role

One sample t test is used to test the respective hypothesis that the average "Anxiety Level" has a zero score and "Media Role" has no effect on the general public. Table 7 demonstrates the t value is 20.79 and 14.81 for "Anxiety Level" and "Media Role" respectively with p value less than 0.01. The Pearson correlation coefficient is estimated for relation between the two variables,

Table 7: One sample t test

	Test Value = 0					
					95% Confidence Interval of the Difference	
	t	df	Sig. (2-tailed)	Mean Difference	Lower	Upper
anxiety	20.795	4	.000	40.000	34.66	45.34
media	14.816	4	.000	30.000	24.38	35.62

Table 8 shows that 0.852 with p value 0.002 indicating a significant relation between "Anxiety Level" and "Media Role".

Table 8: Correlation between Anxiety and Media

		media
anxiety	Pearson Correlation	.852
	Sig. (2-tailed)	.002
	N	5

Similarly, to investigate the dependence of "Anxiety Level" on "Media Role", simple least square regression line is fitted to the data set. Table 9 provides that the slop coefficient is 2.363 with p value less than 0.05. Hence the Media Role significantly increases the Anxiety level in public of Pakistan.

Table 9: Regression Model

Model		Unstandardized Coefficients	
		B	Std. Error
	(Constant)	24.268	13.844
	media	2.362	.457

Discussion

A number of ways are available for gathering information in medical sciences. But the most common technique used for information gathering on unobservable latent variable is Likert scale. Perception, personality traits, ability etc. are the phenomenon that cannot be quantify directly. Rather these variables can be observed by investigating the level of Agreement and Disagreement to certain questions called items. Likert scale, usually consist of five points, is a scale that measure this level of agreement or disagreement to items.

Statistical analysis and description of the variables is based on the nature of variables, and measurement scale used for scoring the trait. As already mentioned, that the Liker-Type items fall in the ordinal category, as the numbers assigned to options portrays a ranking and ordering amongst them. Although the extent of difference amongst them is not mentioned and a response

is greater by how much is not implied. Is such a situation Mode and Median is the suggested descriptive statistics for central tendency, while Range and Inter-Quartile Range for dispersion. Similarly for presentation purpose Bar chart, Dot plot, and frequencies can be recommended. Association can be measure through Kendal Tau B, Kendal Tau C, and χ^2 contingency table. Non-Parametric such as Wilcoxon signed rank test may be used for difference between Medians (Harry et al., 2012).

Likert-Scale measurements on the other hand, are calculated by adding various Likert-Type items to get a composite score. In this case the scale of measurements is considered to be interval for measuring a latent variable. Coding indicates the difference between categories, with an arbitrary zero point, and options are considered equidistant and symmetrical. Arithmetic mean is used as a measure of central tendency and variance as a measure of variability. Histogram can be used as a graph for representation purpose. If the assumption of normality satisfies, Analysis of Variance and t test can be used for comparison, otherwise Mann-Whitney and kruskal Wallis may be used. Regression analysis and correlation are the appropriate measure for investigation of relationship (Carifio et al., 2007).

Cochran Q, McNemar test and chi square can be used in nominal case, where neutral category is dropped and other are combined to form “Agree” and “Disagree” options.

Conclusion

Statistical analysis and description of the variables is based on the nature of variables, and measurement scale used for scoring the trait. Likert type items are assumed to distribute on the ordinal scale and all nonparametric procedures can be applied for its analysis purpose. Bar graph and pie chart can be used for its graphical representation, while median, mode and quartile deviation are suitable as a descriptive for it. Kendal’s tau b and tau c can be used for investigating the relation between items and wilcoxon test is appropriate for testing the median. On the other hand if these items are sum together to index a single latent variable is considered to distribute on interval scale. All parametric tests like student’s t test, ANOVA, regression, Pearson correlation coefficient, are appropriated techniques. Mean and variance can be used as a descriptive while histogram is suitable for its graphical representation.

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