Research for Marketing Decisions

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Week - 05

Lecture - 22

Measurement and Scaling: Levels of Measurement

Good afternoon everybody please be seated, so till yesterday or till Monday we covered the experiments right? so today we are going to get started with the descriptive research design in detail, and we will be taking up survey design, which is about the structured questionnaire and we will be discussing it more and more as we move on right? so, from here on for the next three sessions or two sessions we will be discussing details of how to make a survey right we will discuss details of how to write the questions how to make the questions cover the topics on which you want the answers to, and how to take the measurement on various variables and so on. So that all we will be doing from this session onwards for the next two sessions right?. So we are going to get started with the fundamentals of questions, survey and so on. Now the basic thing about survey is measurement. In survey you put up a question to measure something, right? When you are giving a survey, in survey there are questions.

The questions are meant to measure something. Let's say there is a question about age. So brackets are given, right? So the basic thing about survey is measurement. So what is measurement?

As you understand. What is your understanding of measurement? What is measurement? Somebody says quantifying. Quantifying what?

Extent to which something exists. Extent to which something exists. So this extent is quantitative? Anybody else? Some are not quantitative, some are quantitative.

We convert them to quantitative. So, are you saying that measurement is qualitative also? In survey, we are measuring the variables. What is measurement? Measurement is assigning numbers

or symbols, so which means qualitative also, so which means measurement is assigning numbers or symbols to characteristic of an object not the object you do not measure the object you measure a characteristic of an object, so for a customer you measure their perception, attitude, age, gender. Gender is a qualitative variable. So what is measurement? Measurement is assigning numbers or symbols to characteristic of an object. And there are certain rules of measurement.

What could be those rules? So, we know that measurement is now assigning numbers or symbols to characteristic of objects, not the object themselves we measure the characteristic of something characteristic of an object, and we can assign both numbers and symbols, so which means measurement is not only quantitative, it is it can be qualitative when with to gender we say male female we are assigning symbols we are not assigning numbers but still we are measuring. We are in a way distinguishing one gender from the other. Right? Now what could be the rules of measurement?

Common units. Okay. So if you look at the screen, there has to be one-to-one correspondence between the extent of characteristic And the number assigned which means if I stand and you are looking at my height and Amitabh Bachchan stands with me. We should be assigned different number because the extent of our height is different.

So one of the rule is, one to one correspondence between the extent of characteristic and the number assigned. Two people with different weights should be given different numbers, so one-to-one correspondence, but two people with same weight, if we are measuring weight they can be assigned the same, so, but there has to be one-to-one correspondence between the extent of a characteristic and the number assigned. The other rule is that when you take the measurement the rules of measurement should be standardized and should be applied uniformly across time, space, and object or across time and across objects. I should not get into space because things would go different, so it should not be that for one person you are measuring a variable in a certain way, for the other in a different way, if you are measuring weight use the same machine rather than different machine which could be calibrated differently. The rules of measurement should be up should be standardized and should be applied uniformly across time and objects that is what is the measurement. Now if this is measurement which is me which means

assigning number or symbols to characteristic of object not object and the rules should be applied rules of measurement should be applied uniformly they should be standardized there has to be one-to-one correspondence between the extent of characteristic and the number assigned this is what is measurement. Now what is what is a scale? so this is measurement, the another concept is scale which is a basic concept in

survey. So in survey, we measure the variables, so we should understand what is measurement, now we should know what is a scale. we know a ruler a ruler is a continuum, right? likewise, a scale here is a continuum. So marks from 0 to 100, scale 0 to 100 is a continuum upon which the measured objects on their characteristics can be located which means if after the course for each one of you I according to the marks obtained if I locate you on from 0 to 100 continuum what is that that 0 to 100 continuum of marks is a scale. So we know measurement, we know scale scale is a continuum from lower extreme to higher extreme upon which the measured objects can be located. Right? So these two concepts are clear?

Measurement and scale. Then comes scaling. Scaling is the process using which we locate measured objects on the continuum. Which means there is a continuum. If it is height, scale of height, we generally put like this.

Let's assume this is the height scale. And the rules of measuring height we know. The process of locating objects on that characteristic measured on that particular scale, that is called scaling. Now, for something like height and weight, you would not be able to see the difference between scaling and scale. right? But scaling is more about using what procedures we use to locate people on the continuum, for example, we are going to read something about a not about the comparative scaling. In comparative scaling we compare two objects or let's say there are five objects we compare them based upon let's say, customers

preference, something is more preferred, something is moderately preferred, something is least preferred. One way to ask preference is directly ask what do you prefer? The other way is you compare in pairs, you compare 2 by 2 in pairs and then locate them on what is more preferred, what is least preferred. So that's why scaling also there are different procedures. That is why we say scaling is a process

by which the measured objects can be located on the continuum. If it is difficult to understand what is scaling, just understand measurement and scale that is good enough now all the all these scales all the concepts that we talk about through the entire course of

marketing in this entire course all the concepts can be measured through four different characteristics. So, which means all the concepts that exist all the scales that exist in this marketing course or even in any other course in this universe all these concepts that exist can be measured and they can be measured with the help of four characteristics, and that we are going to see what are the four characteristic that using them we can actually measure any particular concept in this universe The first concept is called description. Second is called order.

Third is called distance. Fourth is called origin. So which means all the scales in this universe, they can be understood with the help of these four characteristics, some scales would have only one characteristics, other would have more. What is the characteristic of description? so let's say, I put this particular scale this is roll number one, roll number two, roll number three, roll number four, now each of this each of these points on this continuum or in this scale has a description as a label which does not mean anything more than that.

It is a description which I can use to identify who is this row number 1, row number 2, row number 3, row number 4. But it doesn't mean anything more. It is used to identify somebody like your name, zip code, name of cities. So they all are having the characteristic of description.

Gender, male, female. It is a categorical variable which means there are two categories. But again this has only characteristic of description. Male and female. We are not, there is nothing more than that.

You can identify two genders. There is no high, there is no low. So those scales that have the only that have the characteristic of description only they are called nominal scales. Now the second one so, if I after this particular course, I put that rank one in terms of the score in this class.

Or let's say after this program we say using CGPA rank 1, rank 2, rank 3. So when we rank the individuals on a particular characteristic. So there is a characteristic of order. Order means who is, who came first, who came second, who came third, who came fourth. Let us say if there is a race happening.

You would see in most of the races. They give three prizes. And there is a ribbon. The first person. And you also note down who is the second.

Who is the third one. So you give them prizes. 1, 2, 3. The standing, the position in the race 1, 2, 3 that is if you are measuring position in a race.

Position number 1, 2, 3. There is an order. First person finished first in less time than second, than third, so, there is an order, but in this case, when you are saying this person came first in the race, this person came second ,this person came third you do not know the difference the difference between whether rank 1 and rank 2, the difference was same or different you do not look at the you do not look at the, you just look at the order.

You do not look at the difference whether it is equal between rank 1 and rank 2, rank 2 and rank 3. There are concepts that you can measure through order saying that let us say ice cream, let us say your likeability towards vanilla flavor ice cream. You would say your preference for a vanilla flavor ice cream somebody would say most most prefer, moderately prefer, less preferred, so I don't know the difference between strongly so, but I know there is an order strong is more than moderate is that all these concepts that can be measured in a way that you obtain an order they are called ordinal concepts or ordinal scales and ordinal scales would have the characteristic of description also, so rank 1 when you say rank 1 it is a description the label is given some label is given you can identify and you can also know that rank 1 is before the rank 2, so they are called ordinal scales. Now the third one is distance in this case,

The distance between two points also in addition to having a description and order, you also know the distance between two different points, scale points. Temperature, 36 degree Celsius, 37, 38, 39, 40, 41. You know the difference between two consecutive points as you move across, it remains same. When the distance is same or it is known. It becomes an interval scale.

And it has the characteristic of order as well as description. 36 degree Celsius it is a label description characteristic. In order you know that 36 degree Celsius is cooler than 37. So there is an order. And you also know how much cooler it is than 37.

1 unit 1 degree Celsius. Right? So all those scales that have the characteristic of distance would also have the characteristic of order and description. They are called interval scales. Temperature, 0 degree Celsius.

At 0 degree Celsius what would happen? Is there no temperature? There is temperature. So which means? The scales that are interval they do not have a true origin.

Which means true origin means they do not have a true 0. At 0 value of their characteristic, it does not mean the characteristic goes away, it does not exist. So when we come to the next scale origin. They are the concepts that have the true origin like height. There is 0 height means 0.

That characteristic of that person or that person itself is not there right. Mark 0 is possible. Height 0 is not possible, right? So all those concepts that have a true origin, they are, they would have the characteristic of income. Have the characteristic of, somebody has an income of 10 lakh rupees per annum, right?

So 10 lakh is a description. This label, you can identify 10 lakh description. Order, it is more than or less than some number units also you know 10 lakh is 1 lakh less than 11 lakh. 11 lakh is 1 lakh less than 12 lakh. Unit also you know, and there is a true origin also, zero salary means or something right? so, those scales are called ratio scales. Ratio scales would have all the other characteristics, so why I am teaching you this because if we try to measure a characteristic of an object at a higher level of measurement, higher level of measurement means ratio or interval, you have to try to measure variables or characteristics of an object on the higher levels of measurement rather than lower level of measurement, because the higher the level of measurement the more this statistical techniques you could use to derive some inferences about your hypothesis or research questions. Interval and ratio interval and ratio you will have numbers, so you can do data analysis, description the numbers do not mean anything, they represent just to either they will be categorical or order there is order, but you do not know so the higher level of measurement would help you in doing further analysis.

So, this is one example nominal ordinal interval ratio. So, interval another example of interval scale is let's say, I write I like Pepsi and from 1 to 5, where 1 represents strongly disagree, 5 represents strongly agree. There are 1, 2, 3, 4, 5. Let us say 3 is neutral. 5 is strongly agree, 1 is strongly disagree. What is this scale?

Likert scale we did not still study. But what is this scale in terms of nominal, ordinal, interval, distance or the origin? So, let me write 5 is strongly agree. Strongly agree is just agree. Neutral, this is disagree and this is strongly disagree.

Now we definitely know it is not a ratio scale because there is no true origin. Is it? Let me try it instead of saying 1, 2, 3, 4, 5, I put 0, 1, 2, 3, 4. I can do that so, which means Likert scales I can also write instead of 0, I can I can write it minus 1, 0, 1, 2, 3 although this scale is the what is the concept I am measuring how much one like Pepsi?

This is the concept I am measuring. And measurement I am taking on these scale continuum 1 to 5. 5 means I strongly like, and 1 means I strongly dislike. Let us see. If I don't write these numbers, then what would this scale become?

Ordinal, right? Because we do not know how much strongly agrees more than agree, and we do not know. We can say that somebody who likes, who strongly agree means somebody strongly likes it. Agree, likes it but not strongly. We know the order.

It becomes ordinal, right? Suppose I write one, two, three, four, five, it is still ordinal but l am forcing it to become interval so that we can have number some number related to that characteristic, this is what we do in marketing, we try to force interval scales into ratio, and that is acceptable. So we do that ah so that we are in a position to use many statistical techniques. This is a truly ordinal scale, but when we are asking the survey questions, we also put 1, 2, 3, 4, 5.

One is we give an indication that there is a difference of one unit, but they are not truly interval. But we force them to be interval and let us say somebody put 3, we will enter a score of 3 against that particular variable. Somebody gave 4, 5, so we will have a list of scores. And interval scales, as you know, there is no true origin. I can have it starting from minus 1, you know, minus 1, 0, 1.

I can have minus 100 also. It's just that the distance I need to keep the same. These are all examples of nominal scale. You already understood this, so let me quickly move further. Now, if you look at the kind of descriptive and inferential statistics that you could use for different scales for nominal, you could use in descriptive statistics, and these are the inferential you would be able to use.

For the ordinal, you would be able to use the ones for nominal as well as in addition to them this. So, as you move higher you can perform the lower order the test meant for the lower level of measurement scales as well as their level of measurement, so when you go to interval you can do this as well as the above two and this is the highest level of measurement ratio, so we generally try to see whether we can measure the variables on ratio if not on interval, if not then an ordinal, last one is nominal. There are certain variables that you cannot measure in any other way let's say, nominal gender you have to measure in a nominal way, there, but there are other variables that you could measure that you have the choice whether you would want to measure in a nominal way or the ordinal or interval or ratio. So, whenever you have a choice measure the variables or the

characteristic of an object on a higher level of measurement, try to write the level of measurement for all these variables. The first one is what?

Nominal. Nominal, okay. What is the second one? Age. Age, if you directly ask what is your age, then it becomes ratio.

But as I told you, do not ask women about their age and men about their income. Yes, age here, as it is written now, is ratio. But we will learn in the next session that how to ask age-related, income-related questions. We should not directly ask because people will lie or leave it. The next one, where you have lived most of your life?

Nominal. Score on last exam? Was that measurement on interval scale? The next one, species of fish caught? Nominal.

The next one, eye color? Nominal, right. Six one, course, evaluation scale, poor, acceptable and good. Ordinal, very good. Eye color we have done.

Country of birth. Nominal, very good. Course of study at the undergraduate level. Nominal. Tenth one, a researcher asks participants to put ten photographs of faces in order from most to least attractive.

Ordinal, okay. But if you try, you can force fit for the measurement interval when you put 1, 2, 3, 4, 5. That's a different case. Eleventh one, a psychologist measures the attachment style of children. Attachment style secure or insecure?

Nominal. Twelfth one, a researcher asks five-year-olds what their favorite flavors of ice cream are. Okay, we'll move to the next one. A psychologist counts the number of items out of 20 that students can remember from a memory test. A psychologist counts the number of items out of 20 that students can remember from a memory test.

You can remember, but there is a true zero, right? One could also not remember anything. Yes. It is a true zero, so it will become a ratio scale, right? I am telling it is a ratio scale.

Yes, true zero. See, what is it is counting? The counting the memory power in terms of the number of items one could remember out of 20 somebody who doesn't remember anything like me

what would happen? Zero. The next one. A researcher measures how quickly participants can run 50 meters. Time is the ratio.

Time is interval. Time is interval. There is some time in zero time. Is it? Time is ratio.

There is a true zero. A researcher measures how quickly participants can learn. There is a true origin in time or not? Temperature, there is no true origin. At 0 degree Celsius, we feel cold, right?

At 0, when you measure time, how many hours you completed, let us say, some race or some task, you count from 0 to, so there is a true origin in terms of time. So that is why that is a ratio scale.