



Teaching Basic Terms in Statistics through Storytelling and Linkages

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Abstract: There are various methods of imparting knowledge to students in a way they will quickly understand what is being passed across to them. Such methods include the introduction of teaching aids like film shows, related materials to the lesson and so on. It is very rare to use storytelling method in teaching statistics. This research work, therefore, aims at using the story of a man, his son, and donkey to introduce students in Urban and Regional Planning and Teacher Education departments to some basic terms in statistics. The methodology employed in this paper is using every event and comment passed to explain some statistical terms (content analysis). Findings revealed that a large number of students in the pure science and engineering departments find it difficult to understand some basic terms in statistics as it reflects in their final project writing and results in statistics courses. This could be majorly attached to the ways they were taught. It was recommended that these basic statistical terms should be taught using every possible means to enable students to understand them and be able to apply them in their project and other reports writing.

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1. Introduction:

In the olden days in Africa, stories were used to explain issues in such a way that the listeners would understand and be able to draw facts from the stories. In the Holy Bible, Nathan the prophet used a parable to reveal the mind of God to David. In the same vein, storytelling could also be used in statistics to explain some basic concepts as it works in other areas of life. Experience has revealed that some of the students that are not in the science or engineering departments often find it difficult to cope when it comes to statistics-based courses that are compulsory for them to pass and which are used most especially in their projects writing. What matters, in this case, is for the students to understand some basic statistical terms and apply them in whatever reports they want to write.

Stern et al. (2000) opined that statistics is a branch of mathematics designed to allow people to accomplish two goals. These two goals are: to accurately describe data and trends in data and secondly to make predictions on future behavior based on current data. The first goal is simply called descriptive statistics and any method or formula which yields some number which tells you about a set of data is referred to as descriptive statistics. Predictive statistics that is the second goal involves using

statistics generated from the sample in order to make predictions; this is also often called inferential statistics (Stern et al., 2000)). Inferential statistics takes data collected from relatively small groups of a population and uses inductive reasoning to make generalizations, inferences and predictions about a wider population (Olatubara, 2005; Isotalo, 2001; Easttom, n,d). Statistics is the methodology which scientists and mathematicians have developed for interpreting and drawing conclusions from collected data (Isotalo, 2001; Moore, 2003). This course is very important to every aspect of life and reports writing and this is the reason students should understand it and be able to apply it in the two aspects. Lauretta (2018) posited that;

Statistics have become an important part of everyday life. We are confronted by them in newspapers and magazines, on television and in general conversations. We encounter them when we discuss the cost of living, unemployment, medical breakthroughs, weather predictions, sports, politics and the state lottery. Although we are not always aware of it, each of us is an informal statistician. We are constantly gathering, organizing and analyzing information and using this data to make judgments and decisions that will affect our actions.



In the same view, Isotalo (2001) argued the reasons one needs statistics include the fact that it provides methods for;

1. Design: Planning and carrying out research studies.
2. Description: Summarizing and exploring data.
3. Inference: Making predictions and generalizing about phenomena represented by the data.

There are certain basic terms frequently used in statistics that should be understood if good project methodology is to be written. It is in this regard that this paper aims at exploring how students understanding of the basic terms in statistics could be improved using the story of a man, his son and their donkey as narrated by one of the Nigerian Artists (Ebenezer Obey) decades ago. The objective is to innovatively define for proper understanding some basic terms used in statistics. The elementary concepts defined may be incorporated into general mathematics classes.

2. The Story of a Man, his Son, and his Donkey:

Ebenezer Obey started the narration of the story by telling his listeners that donkeys and horses in the olden day were like present-day vehicles that people rode for traveling. He went further by narrating how a man and his son embarked on a journey on a donkey. This man and his son were traveling from an untold origin to an unspecified destination. All authors know was that they had to pass through some settlements before they could reach their destination.

As they were going, the father sat on the donkey while the son was trekking beside him. When they got to a settlement on their way, some of the people there asked this man “why are you on the donkey and your son is trekking, you wicked and selfish father?” In trying to satisfy them, the man came down from the donkey, put his son on donkey and started trekking beside the donkey. When they got to another settlement still on their way, the inhabitants told the man “so, you are as foolish as this, your son is on the donkey and you are trekking?” To please these people, the man and his son then sat on the donkey and proceeded. As they got to the third settlement, the inhabitants still challenged them “You are so wicked. You and your son are riding on one donkey. You don’t even have mercy on the animal. Do you want to kill the donkey?” Then, this man in order to satisfy everybody left the donkey to be going without anyone sitting on it. Both the man and his son were trekking. On getting to the fourth settlement, the inhabitants still criticized the man calling him a..., you and your son are trekking while the donkey is going empty. Clueless people, that don’t know how to ride a donkey!” Then, this man realized how practically impossible it was for him to please human beings. He, therefore, concluded that “there is no way one could satisfy or please human beings”. This story is relevant as Statistics in practice is applied successfully to study many happenings including reactions, attitudes, and events.

3. Methodology:

The methodology employed by the authors is content analysis. The content analysis presents data as expressions that are meant to be interpreted. By this, the contents of the story and every event were interpreted and linked to some basic statistical terms to make the students understand them the more. Data used were sourced through the secondary means. This involved using some scholars’ work to explain each event.

However, names of the four settlements passed by the owner of the donkey were not mentioned in the story. The assumption made is that the first settlement should bear A, second settlement B, third settlement C and the fourth settlement should bear D in all the analysis presented in this paper.

Excerpts from The Story That Explain the Basic Terms in Statistics:

3.1. Statement of the Research Problem and Research Question:

A research problem is a gap to be filled or an unanswered question to be resolved. It could still be viewed as a statement of what one hopes or wants to achieve at the completion of the research. Therefore, statement of the problem declares that truly there is a problem that requires a solution based on facts from the relevant literature reviewed and manifestations of the problem.

The research question or questions direct the researcher on how to go about solving it. SAS Institute Inc. (2003) advised that it is good practice to revise and refine the research question several times to ensure that one is very clear, about what he really wants to know.

It could be deduced from the story that as the man was trying to solve a problem a new one emerged. The research problem in this story is that there are some challenges or problems that could be solved without creating another one. This man’s problem was how to satisfy everybody or be free from people’s comments. The research question is, therefore, how could human beings be satisfied or how could a problem be solved without creating a new one?

3.2. Hypothesis Formulation:

Isotalo (2001) opined that the common aim in many studies is to check whether the data agree with certain predictions. A hypothesis is a statement about the predicted relationships among events or variables (SAS Institute Inc., 2003). The statement by the owner of the donkey is “there is no way one could satisfy human beings” This is a tentative statement for the issue at stake, which may be used as a basis for further findings or investigations. Therefore, to state his hypothesis, there should be an issue or a statement that requires further investigation. Stern et al. (2000) presented the null hypothesis (H_0) as a representation of a theory that has been put forward,



usually as a basis for argument. The null hypothesis is usually simpler than the alternative hypothesis and is given special consideration. Thus, the conclusion is given in terms of the null hypothesis. Authors either “Reject H_0 in favor of H_1 ” or “Do not reject H_0 ”

Thus, the man’s null hypothesis and the alternative one are presented thus:

H_0 : One cannot satisfy human beings

H_1 : One can satisfy human beings

Therefore, in researches, there should be at least a tentative statement to be tested to secure validation or rejection as the donkey man did.

3.3. Population, Sample, Variable, and Data:

3.3.1 Population:

Figure 1 presents the whole circle as a population. Therefore, a population is a complete set of items that are being studied. It includes all members of the set. This might be a set of items that have homogeneous characteristics. Examples of a population are all male students, all motorcycles, and all distinction students in the college and so on. For the man in question, his population was everybody in settlements A, B, C, and D he has to pass, out of where he picked his samples.

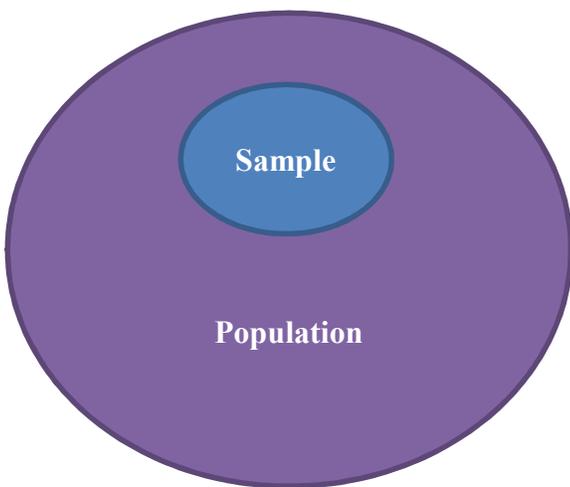


Figure 1. Pictorial Presentation of Population and Sample

3.3.2 Sample:

Stern et al. (2000) defined a sample as a relatively small group of items selected from a population. A sample is the representation of the whole as the sub-circle in Figure 1 revealed. The Authors placed the condition that a sample has to be proportionate with the total or population and called a random sample if every member of the population has an equal chance of being selected. It was concluded by them that by studying the sample it is hoped to draw valid conclusions (inferences) about the population. One has to ask himself these two questions; is the sample size you selected large enough and is the sample truly representative of the population you are attempting to measure.

Obviously, the larger the sample size the better Using proper sampling techniques will give your statistical analysis credibility (Stern et al., 2000). Examples include a particular number from a class, ascertain number of lecturers out of all the lecturers etc. The donkey man took his samples from every settlement he passed and people made a comment. Therefore, those that made the comment were his samples and their comments were recorded for their settlements. The representativeness of the man’s samples could not be ascertained because the quantity was not mentioned in the story. Students should know that their samples number is equal to the total questionnaires they will administer and make inference on.

3.3.3 Variable:

According to Isotalo (2001), a variable is any characteristic that varies from one individual member of the population to another. Variables could be classified as dependent and independent variables as presented by Figure 1. This tries to answer, “How does one affect the other?” question. The dependent variables rely on other variables’ measures or observations. Therefore, it could not stand alone nor has a meaningful definition except connecting to the independent one. A variable might be an event or opinion as in the case under examination (The donkey man’s experiences). The dependent variable in the story is human satisfaction while comments from the four settlements stand as the independent variable. This was so because the comments from settlements A, B, C, and D determine whether one can satisfy human beings or not.

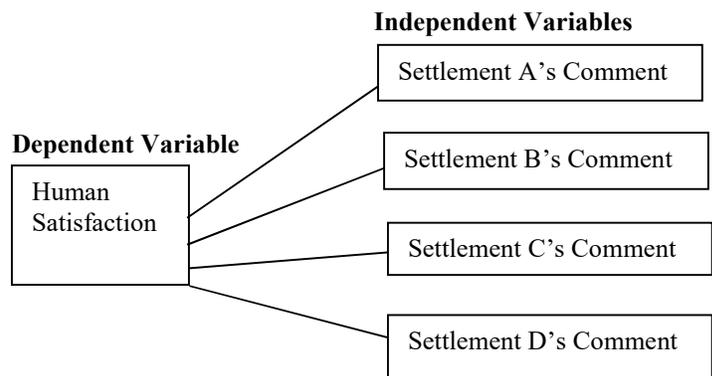


Figure 2. Dependent and Independent Variable

3.3.4. Data:

Data are numbers or measurements that are collected. Data may include numbers of individuals that make up the census of a city, ages of pupils in a certain class, temperatures in a town during a given period. Data can be defined as a collection of scores obtained when a subject’s characteristics and/or performance are assessed (SAS Institute Inc., 2003). The data collected by the owner of the donkey centered on whether or not one can satisfy



everybody at a particular time and place. Moreover, the owner of the donkey used cross-sectional approach to collect his data because the information was collected on a set of cases at a point in time. The story did not state that the man traced the first cases at a predetermined interval for the next interview (longitudinal approach). It could be deduced that as he was going, he was taking the snapshot of the cases.

3.3.4.1. The Source of Data:

There are 2 sources of data in research. These include the primary and the secondary sources. The secondary source files data that have already been collected, processed and presented in particular terms that could be useful to a large number of interested users. The secondary data could be sourced from the libraries, government gazette, statistical records, maps and so on.

The primary data are data collected through fieldwork. The various sources of the primary data include; direct personal observation, focus group discussion, in-depth/key informant Interview and questionnaire administration.

The owner of the donkey collected his data through fieldwork and direct contact with the samples, which is a primary source of data. He passed through settlements A, B, C and D and collected data about their opinion through direct personal observation. Observation could be participatory (direct), systematic (indirect) or mechanical. Therefore, it is possible for one to touch, ear, see, smell and so on in order to observe (the use of the senses) in primary data collection.

3.3.4.2. Sampling Technique:

There are 2 broad classes of sampling techniques. These are probability and non-probability techniques (Yate, 1949). The probability techniques include; simple random sampling, systematic sampling, stratified sampling, cluster sampling and so on. The non-probability techniques include accidental sampling, Quota sampling, and purposive sampling.

The said Owner of the donkey used the non-probability sampling technique in selecting his samples. The particular method was purposive sampling. In using the purposive sampling, there is usually no basis or guide. One simply reaches out and takes the cases that are available to obtain the broadest range of information and perspectives on the subject of study, continue the process until the sample reaches a designated size. In other words, deliberate selection of participants whom you suspect might hold views related to your topic of study. For example, data collection on students of a certain level. One may approach any quarter that has the needed information about the students at hand. There is usually no known way of evaluating the level of biases involved. The Owner of the donkey passed the first settlement, the inhabitants that were willing to react, passed their comments. He grabbed

their comments and continued his journey until he got to the last stage he exhausted everything in his capacity to meet the challenges. Then, he concluded, "There is no way one could satisfy human beings".

3.3.4.3. Judging the Merit of the Data Collected by the Owner of the Donkey and how they were used:

The cost of collecting the data he used, the time spent and the representativeness of the used data could not be quantified and the practicability of the used method of data collection stands to militate against the validity of the man's conclusion. The accuracy of his observations could also be questioned because the researcher relied on a single measure of data collection (ears).

Therefore, if authors want to go by the way of judging the merit of the data used by the owner of the donkey, authors may reject his conclusion. Statistically, his conclusion should be tested to know its validity before authors can pass any judgment of rejection.

4. Testing of the Donkey Man's Stated Hypothesis:

The owner of the donkey's hypothesis is stated thus;

H_0 : One cannot satisfy human beings

H_1 : One can satisfy human beings

There should be a standard to measure the H_0 statement of the owner of the donkey. The three ways of testing hypothesis include:

- Having a view of the data. However, the donkey man had his data in expressed forms, collected through primary means. His data were not quantified therefore this method is not capable to test the conclusion of the donkey's owner.
- The subjective school of thought advocates the use of data plus a priori experience. This method comes up from the fact that in data collection, there are errors inherent in data collection method and this is why a priori experience should be used with the data collection. There was nothing like prior experience in the donkey man's story.
- One whereby the researcher set a standard. This school of thought argues that it is possible for everybody to arrive at the same result given the same data and process. Those in this school of thought acknowledge that 2 errors are likely to happen. These include:

Type I error – rejecting the hypothesis that is in fact correct.

Type II error – accepting hypothesis that is, in fact, untrue /incorrect.

The failure of the Donkey owner's stated hypothesis to fit in any of these three methods leads to the discussion of quantitative and qualitative analysis. This shall reveal the category into which this story falls. It is worthy to note that throughout the story the man in question just transforms data into findings without the application of any formula.



5. Qualitative and Quantitative Analysis

Fundamental concepts and aims in fields of study and determination of how evidence is defined, identified, and interpreted are defined by research paradigms (Given, 2008). He identified two main research paradigms or testing the studying reality that includes the positivist (typically quantitative) paradigm and the interpretive or naturalistic (typically qualitative) paradigm. Qualitative research is interpretive, exploratory, and broad-based, hypotheses formulation or testing is not used in this type of research (Given, 2008). In differentiating between qualitative and quantitative analysis, Morrill et al. (2000) as cited by Sage publication (n.d.) submitted that there are no variables and hypotheses in this qualitative analysis. Therefore, there is no need for testing any hypothesis in this Owner of the donkey's case. For better understanding, Sage publication (n.d.) summarized ways that qualitative data analysis differs from quantitative analysis. These include:

- A focus on meanings rather than on quantifiable phenomena.
- Collection of many data on a few cases rather than few data on many cases.
- Study in depth and detail, without predetermined categories or directions, rather than emphasis on analyses and categories determined in advance
- Conception of the researcher as an "instrument," rather than as the designer of objective instruments to measure particular variables
- Sensitivity to context rather than seeking universal generalizations
- Attention to the impact of the researcher's and others' values on the course of the analysis rather than presuming the possibility of value-free inquiry
- A goal of rich descriptions of the world rather than measurement of specific variables

Remark

Notwithstanding the fact that in qualitative analysis there are often no predefined measure or hypotheses to test any statement or submission, for teaching sake, one could still look into the Owner of the donkey's data and submission. All his samples made different expressions that are referred to as data. Therefore, viewing the collected data made the owner to submit that no one can satisfy human beings. That means the H_0 that says "you cannot satisfy human needs" can be accepted and H_1 that says "you can satisfy human needs" can be rejected based on the data at hand. In fact, the confidence level may be high as presented by the data (expression) collected. Therefore, if authors reject H_0 , authors are ending up committing type I error.

6. Conclusion

Teachers are expected to impart knowledge. They are saddled with the responsibility of ensuring that the

information they pass across to their students is properly communicated. Their task is however made difficult by the variation in attention and understanding levels of the students. This is because students learn and understand differently that require the teacher to look for ways of achieving his aim (making the students to understand what he is passing across).

Everything that deals even remotely with the collection, processing, interpretation, and presentation of data belongs to the domain of statistics, and so does the detailed planning of every event or activity. The story is a descriptive statistic because it only tried to describe the journey of a donkey owner and what happened on his way. Planning is a futuristic profession that seeks to make inferences using the previous and the present data to forecast. The owner of the donkey made his inference/conclusion about people's remarks based on his previous and present experiences. No one could say whether if he continued, the next group of people would not even complain about the way he treated his donkey. Therefore, most of the time making inferences about cases could not be made using descriptive statistics.

SAS Institute Inc. (2003) recommends that regardless of discipline, researchers need a common language to use when discussing their work most especially statistics with others. In addition, the understanding of these statistical concepts and ability to deploy them in report writing make one a good researcher. This paper has discussed in a qualitative and innovative way some basic concepts and terminologies of research that could be used in a project or technical report writing by students. It is therefore recommended that because of the importance of statistics to daily living and project/reports writing, every possible means of imparting it (statistics) to students should be employed by lecturers/ teachers as the case of the storytelling and linkages.

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