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Review of Sampling Techniques for Education

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ABSTRACT

This paper offers a thorough explanation of the procedure for aspiring authors to learn more about data-gathering techniques and the application of sampling strategies in completing papers for publication in a range of academic fields. The sections describe the data-gathering methods used & sampling techniques to clarify those differences. Both probability sampling and non-probability sampling are employed in statistics. The advantage of probability sampling ensures the sample will be represented in the population. Simple random, systematic, stratified, and cluster sampling are some of the different types of probability sampling techniques. Non-probability sampling chooses the sample based on individual judgment. Non-probability sampling technique is considered the best because it includes all subjects' representation of the entire population. Convenience sampling, sequential sampling, quota sampling, judgmental sampling, and snowball sampling are just a few examples of non-probability sampling. The differences between non-probability sampling techniques and probability sampling approaches are examined.

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1. INTRODUCTION

The core goal of data collection techniques includes both secondary and primary data gathering that is focused on the kinds of qualitative and quantitative data discussed in the previous section. The systems for collecting data have been developed and the basic data-collecting techniques are the main sources. Field observations, interviews, and casual chats are examples of qualitative sources whereas survey questions and interview topics are examples of quantitative data sources (Peshkin, 2000). The details of the data's main source acquisition are provided in the following sections. Secondary data gathering techniques are data that was gathered by a party other than the user (Smith, 2008).

This data source provides information about the current state-of-the-art method (Hsu, 2015). The supplemental data sources may include both internal and external information sources and cover a wide range of topics.

2. METHODS

This paper is a literature survey, taking data from internet sources especially articles from international journals. Data were obtained, collected, and summarized to build this paper.

3. RESULTS AND DISCUSSION

3.1. Sampling

Sampling is the process of employing a portion of a population to represent the entire population in survey research. There are some instances where data sampling techniques help in clarifying (Afifah *et al.,* 2022). The sampling employs a smaller number of people with representative traits to represent the entire large scale with more realistic costs and timelines. You must choose who will be included in your sample list and how to pick those who will best reflect the entire population. Sampling is a method that you might use to determine how to approach things. Sampling methodology is a statistical approach used by researchers in acquiring data and examining the population. Numerous sampling methods can be used and they can be split into two categories. All of these sampling techniques may aim for difficult-to-reach groups (Wahab *et al.,* 2023).

Sampling vastly expands the opportunities for research because it enables you to study larger target populations with the same resources as you would for smaller ones. Using sampling can help make your research less constrained by costs, delays, and complexity associated with various population sizes. To obtain pertinent data from the population many sampling approaches are available in statistics such as Probability Sampling and Non-probability Sampling.

3.2. Probability sampling

Probability sampling also referred to as random sampling is a type of sample selection where randomization is used rather than deliberate choice. The probability sampling method makes use of a random selection process. In this method, each eligible person has a chance to choose a sample from the entire sample space. The advantage of probability sampling ensures the sample will be representative of the population. The various forms of probability sampling techniques include simple random, systematic, stratified, and clustered. A detailed discussion of the various probability sampling techniques is illustrated with examples as follows:

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(i) Simple Random Sampling. Every member of the population has an equal probability of being chosen for the sample when using simple random sampling. It resembles drawing a name out of a hat in several ways. By making the population anonymous, each object or person in the population is a number and then selecting those numbers at random simple random sampling can be carried out. Simple random sampling eliminates any bias risks from the sampling process and is quick, easy, and inexpensive to use. It also provides the researcher with no means of control which increases the likelihood that unrepresentative groupings will be chosen at random. Every item in the population has an equal and likely probability of being chosen for the sample when using a straightforward random sampling procedure. This method is referred to as the "Method of chance Selection" since the decision to select an item is entirely based on chance. It is referred to as "Representative Sampling" because of the size of the sample and the random selection of the item. For instance, let's say we wish to choose 200 kids at random from a school. We can give each student in the database of school a number between 1 and 500 and use a random number generator to choose a sample of 200 numbers (Agustina and Nandiyanto, 2021). The benefits of using this method are simplicity and impartiality. Although it is straightforward to carry out, simple random sampling isn't employed very frequently due to the subgroup of the bigger group being drawn at random from the large population, any traces of bias are eliminated (Mohamad and Masek, 2021). The outcome might be reasonably dependable because it is much less complicated. When conducting larger populations, it takes little to no specialized understanding. The inherent shortcomings of a simple random sample include the time required to compile the entire list of a particular community. Difficulty gaining access to population-wide lists. impose protracted retrieval procedures that may hinder a researcher's capacity to gather the most precise data on the complete population set. It causes implicit bias, which leads to a skewed study.

(ii) Systematic Sampling. Systematic sampling also known as systematic clustering is a sort of probability sampling technique in which sample participants from a broader population are chosen using a predetermined, periodic interval but a random beginning point. The population size is multiplied by the required sample size to determine the interval which is known as the sampling interval. According to the rule, the Nth object or person is chosen even though the picks are made at random, the researcher can alter the interval at which they are chosen by ensuring that no selections are unintentionally grouped. After a predetermined sample interval, the items are chosen at random from the target population and then the other ways are chosen. To compute it, the required population size is by the total population size. Consider the following scenario: 300 students' names are arranged in a school in reverse alphabetical order. For example, 15 students were randomly selected while the 15th participant will be chosen at random from the sorted list starting with number 5. We might conclude by presenting a sample of a few students. With few resources, systematic sampling's advantages are relatively simple to plan, carry out, evaluate, and comprehend. It gives researchers a certain amount of control and rigor to fit particular requirements. Systematic sampling eliminates clustered selection. The drawbacks of systematic sampling presuppose that the population's size can be approximatively determined. It shows a naturally occurring level of unpredictability along the selected metric because researchers might be able to design their systems to maximize the likelihood of reaching a specified result rather

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than letting the random data create a representative answer, there is a higher risk of data manipulation.

(iii) Stratified Sampling. Random selection is used in stratified sampling within predetermined groupings. Knowing information about the target population helps researchers stratify it (subdivide it) in a way that makes sense for the research. It raises the issue of how to stratify a population which increases the possibility of bias. To finish the sampling process, a stratified sampling approach divides the entire population into smaller groups. A few features of the population are used to establish the tiny group. The statisticians choose the sample by drawing at random from the smaller groups created by the population division. For instance, there are three bags (A, B, and C) containing various eggs. There are 50 eggs in bag A, 100 eggs in bag B, and 200 eggs in bag C. We must randomly select a sample of eggs from each bag. Let's say there are 20 eggs in bag C, 10 eggs in bag B and 5 eggs in bag A. The benefit of stratified sampling is that it allows you to get reasonably accurate estimates for all subgroups connected to your research subject. The accuracy increases the statistical power of your analysis to identify group differences. The population is divided, which lowers survey expenses and streamlines data collecting. It aids in maintaining the full range of the population's diversity inside the sample. The drawback of these datasets is the complexity of their analysis. Any relatively similar strata will be unsuccessful if researchers cannot develop appropriate strata.

(iv) Clustered Sampling. Cluster sampling is a probability sampling technique in which you divide a population into clusters and then choose a random subset of these clusters as your sample. Researchers analyzed a sample that consists of multiple sample parameters such as demographics, background, or other attributes. Instead of selecting the entire population, cluster sampling allows the researchers to collect data by bifurcating the data into small, more productive groups. Cluster sampling chooses individuals from the target population at random. Simple random sampling is used in this method to sample the cluster of the population. The advantage was that the sampling procedure needed fewer resources. Therefore, administrative and travel costs are typically less expensive. The feasibility of the sample is increased when the complete population is divided into homogeneous groups. Cluster sampling has drawbacks since it might lead to biases in representing the full population and drawing conclusions about the entire population. Compared to samples created using other sampling methods, the cluster approach is more susceptible to sampling error.

3.3. Non-probability sampling

Non-probability sampling refers to the purposeful selection of objects or subjects for the sample by the researcher by their objectives or expertise. In contrast to random selection, non-probability sampling chooses the sample based on individual judgment. Not every member of the population will be given the chance to participate in the research under this methodology.

There are many other non-probability sampling techniques, such as convenience sampling, sequential sampling, quota sampling, judgmental sampling, and snowball sampling. Non-probability sampling types are as follows:

(i) Convenience Sampling. Convenience sampling involves selecting a sample from a group of people who are simple to get in touch with. The terms grab sampling and availability sampling are also used to describe this method of sampling. Convenience sampling methods are selected from the population directly because they are conveniently

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available for the researcher. The samples are easy to select and the researcher did not choose a sample that outlines the entire population. This method of data collection is practical. The sample does not accurately reflect all participants depending on their availability and accessibility.

Although a large amount of bias might be introduced if it is conducted early or as a first step. The advantages of convenience sampling are that is cheap, efficient, and simple to implement. It is useful as an intervention to correct dissatisfaction. It offers a way to receive specific feedback from an individual's demographic profile than generalizing. It is a lot easier to analyze the info instead of worrying about participant selection and interviews. It allows the completion of multiple studies simultaneously since one participant can provide data on multiple subjects in just a few minutes. The disadvantage of convenience sampling is that the sample lacks clear generalizability. It doesn't provide a representative result. It is easier to provide false data if the researcher determines the exclusion of that data will adversely influence the results. it can lead to decision-making circumstances that lead people and organizations in the wrong direction. It is challenging to replicate the results.

(ii) Consecutive Sampling. Consecutive sampling is described as a non-probability sampling strategy where samples are chosen at the researcher's convenience, similar to convenience sampling but with a small difference. Consecutive sampling is similar to convenience sampling with a small difference. The researcher selects an individual or a group of persons for sampling. The researcher then does additional research for some time, analyzes the findings, and, if necessary, switches to a different group. It provides a way for researchers to improve the representativeness of their samples in the target population. The advantage of consecutive sampling is quick and easy to carry out.

The researcher selects individuals consecutively until they reach the number required for the study. It allows researchers to choose their sample to improve the reliability and validity of individuals. The researcher has many options when it comes to sampling size and sampling schedule. To produce definitive results, the sample plan must be based on the nature of the research. Minor changes and adjustments can be made right at the beginning of the research to avoid considering research bias. The disadvantage of consecutive sampling is that selection of participants is not random, people in that setting must also be representative of the desired population. It is uncommon to identify potential participants because doing so could skew the results.

(iii) Quota Sampling. Quota sampling is a non-probability sampling technique where researchers compile a convenience sample of participants who accurately reflect the population. Researchers select these people based on particular characteristics while the final subset will only be chosen based on the researcher's familiarity with the group. By designating which individuals or groups should be recruited for a survey by particular groupings, the strategy seeks to achieve a dispersion over the target population. For instance, your quota can call for a specific proportion of men and women. As an alternative, you might want your samples to fall within a particular age range, income range, or ethnic group. Bias may be introduced during the selection process; for instance, volunteer bias may skew the sample in favor of those with spare time and an interest in participating. Creating individuals with similar characteristics or traits relevant to the research will ensure participants in the study belong to only one group. One specific city is being studied to determine the percentage of subgroups in quota sampling. When choosing the sample size, at the very least, pick 100–200 people from

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each sampling category. The research group's volunteers determine how accurate the study is.

The advantages of quota sampling are quite easy to conduct and administer as compared to other similar research sampling methods. It is suitable for research where the researcher has a time limit to conduct the study. It saves a lot of time for the researcher. It can be used for research with a limited budget. Quota sampling helps in an easy comparison of two groups of research. Quota sampling is beneficial in scenarios where researchers have specific criteria to conduct research. The disadvantage of quota sampling does not allow a random selection of participants. It increases the risk of being biased as a researcher in approach. It lacks randomness in the selection of participants as it is affected by many factors.

(iv) Purposive or Judgmental Sampling. Purposive sampling often referred to as authoritative or judgmental sampling is a type of non-probability sampling in which researchers use their judgment to select people from the public to take part in their surveys. Since the researcher's experience was essential in producing the sample, their knowledge is used to choose the samples. Participants in the sample are purposefully chosen by researchers based on their familiarity and grasp of the pertinent study topic. It is a quick and comparably easy way to compile a variety of results or responses to create a representative sample. There are several purposive sampling types that researchers can use such as heterogeneous variation, typical case sampling, critical case sampling, or total population.

The advantages of Purposive Sampling are the opportunity to create justification to generalize from the sample. A critical sample can be used in determining the value of an investigation while the sampling approach allows an in-depth analysis of the information. The flexibility of purposive sampling allows researchers to save time and money while they are collecting data. It helps researchers to develop insight as a key point in observing a strong perspective that represents the general public.

It helps researchers to identify the extreme perspectives that are present in each population group. Researchers achieve a lower margin of error using the purposive sampling approach because the information they collect comes straight from the source. The disadvantages of purposive sampling allow you to generalize from specific samples to a larger population group making statements about the validity or accuracy of your discoveries complex. It can provide roadblocks in the way of a final result. It may be challenging to defend the representative nature of a sample. When used on sizable populations, it may be ineffectual. It can be virtually impossible to determine if there is a sampling error in the present information (Shaturaev, 2022).

(v) Snowball Sampling. Snowball sampling is a non-probability sampling technique that involves enlisting new units as sample members from among the existing ones. It can be used to study people with particular traits who might be hard to find in other ways. The participation spreads like a snowball tumbling downhill across a network of connected people.

This approach can be useful if the researcher is unfamiliar with the target demographic and has difficulty reaching out to or accessing them. Snowball sampling has the benefit of being quick and simple to discover subjects because they originate from trustworthy sources. It is convenient and not expensive as compared to other methods. It helps in situations where they ask for a reference from people known to each other. The disadvantages of snowball sampling might only be able to reach out to a small group of people and may not be able to complete conclusive results.

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3.4. Probability sampling vs non-probability sampling methods

To separate the sampling techniques, the many differences between probability sampling and non-probability sample approaches have been investigated **(Table 1)**.

Table 1. Differences between probability sampling and non-probability sample

No	Probability Sampling Methods	Non-Probability Sampling Methods
1	The probability sampling methodology is based on the theory of selecting from a larger population	Non-probability sampling is chosen by the researcher based on their judgment rather than by random selection
2	Random sampling method	Non-random sampling method
3	The population is selected randomly	The population is selected illogically
4	They employed a conclusive study	The study is preliminary
5	It takes a while to gather the data	These are quick and simple techniques to gather data
6	The sample uses a process to secure the population's demographics	The depiction of the population's demographics is typically distorted because the sampling methodology is random
7	The selection criteria are defined by the research design before the market research study starts	The sample nor the criteria for selecting it are vague and rapid
8	This form of sampling is completely objective, the conclusions drawn are also objective and conclusive	The results of this form of sampling are completely biased, which makes the research speculative
9	There is a guiding hypothesis before the investigation and the goal of the probability sampling approach is to support that hypothesis	The non-probability sampling is developed after the research hypothesis is completely investigated

4. CONCLUSION

This essay offers a discussion on the need for high-quality educational research. It exemplifies how the assessment of the quality of educational research satisfies both the practical demands for relevance to modern social science and the epistemic standards for rigor measurement and statistical models. Probability concepts provide the framework for determining if apparent discrepancies in measures are likely a random occurrence given the underlying variability present in the real world.

5. AUTHORS' NOTE

The authors declare that there is no conflict of interest regarding the publication of this article. Authors confirmed that the paper was free of plagiarism.

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