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Review

The philosophy behind sampling in educational research

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The article lays emphasis on incorporating sampling techniques in a research work in order to save money and other resources. In many cases, a researcher is unable to cover the whole population of interest in which case, a sample that is part of the population is taken. When a researcher uses only part of a given population, we refer to the study as a sample survey and in the case where a researcher uses the whole population in a given research; we say that researcher is carrying out a 'census' or mass survey. The purpose of this article is to guide researchers understand the philosophy behind sampling in educational research.

Keywords: Philosophy, Sampling, Educational research, Population.

INTRODUCTION

In many cases, the researcher is unable to cover the whole population of interest, in which case a sample that is part of the population is taken (Harper, 1988, p. 22; Moser and Kalton, 1979 pp. 54 – 56). In this article, we deal with the issue of the research population, target population, accessible population and types of sampling.

Research Population

Every researcher will have a 'population' or 'universe' that is the totality of respondents/ objects/ products/ specimens of interest. For example to some body doing research known as auditing (i.e. an auditor), the books of account for a given time period, could constitute a population. For a medical researcher, the bacteria on a given wound could be the population of interest (Harper, 1988 pp. 21 – 22 and Kalton 1979, pp. 53 – 54). When a researcher uses the whole population in a given research, we say the researcher is carrying out a 'census' or 'mass survey'. Amin (2003, pp. 12 – 13) distinguishes between a target population and sampled/ accessible population.

Target Population

The target population is the population to which the researcher ultimately wants to generalize results. For example, Uganda has about 30 universities. A researcher may wish to examine the level of computer literacy among staff in those universities. Then the target population will be all the universities in Uganda.

The sampled/ accessible population

Practically however, due to time, cost and other

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constraints, the researcher may find it more convenient to carry out the study in one university (e.g. Bugema University) and thus pick the research sample from that university. That university becomes the sampled (accessible population). As to why in many researches, the investigator/ researcher is forced to sample, we outline some of the reasons. Researchers usually sample;

(i) In order to save money and other resources; Kakinda Mbaaga (1990, p.8) argues, and rightly so, that if a researcher who has a population of size say N = 8000 respondents, and selects a sample size say n = 800, the researcher will use about a tenth of the money and other resources such as labour on the research as opposed to ten times that figure if a census involving all the N = 8000 respondents were carried out (Hawkins, 1987, p. 366: Harper, 1988 p. 23).

(ii) In order to save time; Similarly, the researcher cited in (i) above, would take only about a tenth of the time on the sample research, as opposed to ten times that duration in case of a census. (Tull & Hawkins, 1987); Mbaaga (1990) add that in the case of census, more so in the case of a demographic census, the results take long to come out, and indeed in many cases, the results came out when they are already at least partly out dated.

(iii) Some population are too scattered to study in their entirety; For example if coca-cola were to carry out a market research involving a census of all its customers, then that research would encompass the whole world!! Such a population will be too scattered to study in its entirety. A reasonable market researcher will then think of sampling (Morden, 1993, p. 29).

(iv) Other populations are infinite and ever-growing; Researchers on animate (or living) things (e.g. human beings, plants, bacteria etc) have to cope with the fact that their respective populations are infinite and/ or ever growing. Thus it is impossible to have the population of interest in its entirety (Ball, 1991, p. 101). In such a fix sampling is the logical thing to resort to.

(v) Some researches are destructive; Some researches involve the destruction of the materials/ objects/ respondents/ specimens of interest. Quality control (or reliability) research on match boxes, bulbs, vehicle tyres, bottled drinks, and so on, is in this category of destructive research. In such researches therefore, if a census of all products/ respondents is undertaken, nothing will be left for sale/ consumption (Ball, 1991, p. 101, Tull & Hawkins, 1987 p. 368).

(vi) Sample survey findings may be of higher quality than census findings; Given that sample research has reduced coverage/ scope (in terms of number of respondents, geographical area,etc), it may allow better quality researchers, more concerted research effort, better quality equipment and so on, than a census. The end result may obviously be better quality research findings in the case of a sample survey than a census (Bailey, 1987 pp. 83 – 84; Kakinda Mbaaga, 1990 p. 8; Harper, 1988 p. 23; Tull, & Hawkins, 1987 pp. 367 – 368).

Types of sampling

Random sampling

Ideally, the sampling method used in any research should be objective/ random/ scientific/ statistical/ unbiased, such objective sampling yields unbiased/ representative samples (samples representative of their parent populations) (Michois, 2000 pp. 56 – 57; Morden, 1993 p. 30; Harper, 1988 pp. 27 – 28; Moses & Kalton, 1979 pp. 79 – 80). Some three common objective sampling methods are (i) simple random sampling (srs); (ii) systematic random sampling (sys); (iii) stratified random sampling (srs);

Sample random sampling (srs)

This is the commonest sampling method among the random ones. It is simple in the sense that each member of the population of interest has an equal (or same) chance/ probability of appearing in the sample. A common example of simple random sampling is the lottery method or gold fish bow/ method (Kakinda Mbaaga, 1990, p. 6) if a researcher wants to have a simple random sampling of size n from a population of size N, then each member/ element of the population has a chance/ probability/ likelihood, n/N, of appearing in the sample. Thus ratio n/N, is known as the 'sampling function' used by the sampler.

Some advantages of using simple random sampling

The major advantages of simple random sampling are that it is (a) simple to understand and (b) simple to use.

Some disadvantages of using simple random sampling

However simple random sampling has shortcomings, such as;

(a) Simple random sampling is only applicable if the population of interest is of a small size Kakinda Mbaaga, (1990), else the lottery (or gold fish bowl) method will be tedious.

(b) Simple random sampling requires a sampling frame, that is a list (or map) of names or any other identification characteristics (e.g. numbers) for all the members of the population; else identification of those members on lotteries used will be difficult (Harper, 1988; bailey, 1987 and Tull & Hawkins 1987)

Systematic random sampling (sys)

Systematic random sampling or interval random sampling is used in several instances such as (a) if an auditor decides to check every 10th voucher in the voucher book; such an auditor is said to be doing systematic or interval sampling; (b) if a quality controller in an industry decides to test (for quality) every 50th item/ product that comes off the production line; such sampling is clearly systematic/ interval sampling. The interval between any two sampled items in a systematic or interval sample is referred to as the sampling interval used by the samples.

How is a systematic random sample chosen from a population of a specified size? We shall use an example to illustrate how such systematic random sampling proceeds;

Example I

Supposed I have a list (or sampling frame) of N = 100 students in a given class, and I want to select from that list of systematic sample of size n = 30. How I proceed?

Solution

Step (i) determines the required sampling interval, k; Here use is made of the ratio of the population size to the required size as an approximation of the sampling interview; thus:

$k = {}^{N}/_{n}$

100/

choose every 3rd (third) student on the list.

Step (ii) I choose the random start; From among the first k elements on the sampling frame" I choose the called random start using say simple random sampling. Suppose in our case, the random start' turns out to be the 2nd (second) student on the list.

Step (iii) Hence I select the whole systematic sample; Hence our systematic random sample will involve the random start (in our case the second student on the list) and every 3rd student that is 2nd, the 5th the 8th the 11th and so on till the sample size of n = 30 is attained.

Some advantages of using systematic random sampling

Proponents of systematic random sampling claim that the method spreads the sample evenly/ systematically across the sampling frame, or in the case of a production line, across the time the production line is in operation.

The sample is therefore expected to be representative of the population (Kakinda Mbaaga, 1990, p 13.).

Some disadvantages of using systemic random sampling

However, systematic random sampling has problem too as noted by Kakinda –Mbaaga (1990, p. 13) the major problem being that there may be a characteristic of the items in the sampling frame (or on say a production line) which occurs periodically with the same interval as the sampling interval used. This defeat is known as 'periodicity' in the sampling frame. This periodicity will obviously bias the systemic random sample towards the particular periodic characteristic. Kakinda-Mbaaga (1900 p. 13) therefore advises that a given sampling frame should be checked to make sure there no "periodicity".

Stratified random sampling (sys)

Stratified random sampling is used when the population of interest is not uniform or homogenous; that is when the population of interest is heterogeneous; by this we mean that the population can be subdivided into sub-populations/ layers/ strata, using some relevant stratification variables such as age group(s), ethnic group(s), gender(s), marital status and so on.

How does stratified random sampling proceed?

We shall use an example to illustrate how stratified random sampling proceeds:

Example

A problem has arisen in a class of 40 males and 15 females. The Dean of students wants to interview 10 as a sample from this class in order to assess the said problem.

Help the Dean select these 10 using gender as your stratification variable

Solution

The dean has a population of size N = 55 divided into strata of sizes, Nm = 40 for males and Mf = 15 for females. Using the so called proportional allocation method, simple random samples are chosen from the representative two strata in the proportion each stratum bears to the population as a whole, that is;

Since in the population of size 55 there are 40 males, then in the sample of size 10, there should be 10/55 x 40 = 7.3 (7 males)

Similarly

Since in a population of size 55 there are 15 females, then in the sample of size 10, there should be 10/55 x 15 = 2.7 (3 females).

Some advantages of stratified random sampling

The main advantage of stratified random sampling is that it guards against bias as far as the stratification variable is concerned.

Stratified random sampling is administratively convenient in that;

(a) Different research assistants can be set to correct data from different strata

(b) Different sampling frames can be used in different strata

(c) Different methods of data correction can be used in different strata

Non-random/ biased/ non-scientific/ non-statistical sampling

To face facts, few researchers select their samples randomly; instead they use such non sampling methods as;

Convenience/ accidental sampling

Here the researcher chooses the closest (persons) or respondents in order to save time, money and so on (Bailey, 1987, p. 93). The researcher conveniently chooses those that are by accident/ nearest.

Quota sampling/ non-random stratified sampling

Quota sampling ensures that certain number of sampling units from different categories with specific characteristics is represented in the sample (Amin, 2003). Here for example a market researcher is told to go and ensure that as many as 60% of the respondents are male (i.e. to ensure a quota of 60% males) as many as 40% of the respondents are female (i.e. to ensure a quota of 40% females any how! (Bailey, 1987, p. 93).

Purposive/ fundamental sampling

In this case the researcher uses own judgment about which respondents to choose depending on the purpose of the study (Bailey, 1987 pp. 94 – 95).

Snowball/ network sampling

This is useful in researches where it is extremely hard to assemble all the respondents at ago (e.g. if you are studying street ladies). What is done is to start with one or a few respondents (e.g. one street lady) who will later bring others. These others will also later bring in others. The term 'snowball' stems from the analogy of a snowball which belongs small but becomes larger and larger as it rolls downhill (Bailey, 1987, p. 85).

Adequacy of the sample size; how large a sample should a researcher pick?

When a researcher is compelled by circumstances beyond control to resort to studying any example of the target population, the researcher will have to answer the question, "how larger should my sample be?" Or "what proportion of the entire population should my sample constitute?" There is no fixed and inviolate rule regarding sample size. No fixed number and no fixed percentage is ideal. Rather it is the circumstances of the study situation that dictates what number or what percentage of the population should be studied. (Owolabi, 2003, p. 4).

Nevertheless, Owolabi (2003; pp. 4 – 5) goes on to suggest four principles of sample size determination;

The larger the sample becomes, the more representative of the population it becomes and so, the more reliable and valid the results based on it will become. By this principle the investigator should go for higher sample percentages.

The larger the sample, the more expensive the data correction becomes. Whatever technique you are adopting (interview, self-administered questionnaires, observation, measurement and documentary study) you will have to cover distances, spend/ purchase equipments and consumer items. By this principle the researcher who has the problem of raising funds is advised to select lower sample percentages so that the researcher can finance the collection of quality data.

A well selected random sample, albeit small can yield results whose amount of errors can be reliably estimated through statistical techniques. By this principle; the researcher should exercise a great deal of patience in planning and selecting representative samples as well as in the choice of data collection instruments.

Some issues exhibit wide degree of variability in the population while others exhibit a rather limited degree of variability. Where the phenomenon is known to be quite variable, a higher percentage of the population should be included in the sample where opinions will not appear to vary much (e.g. on an issue such as whether primary education should be tuition free if the government can afford it) a low sample percentage drawn from the population will give reliable and valid results.

When the four principles are taken together the researcher can determine what sample size is desirable, and will be able to defend such a decision (Owolabi, 2003, pp. 4 – 5).

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