Management of Utilizing Data Analysis and Hypothesis Testing in Improving the Quality of Research Reports

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Abstract

Data analysis and mathematical techniques play a central role in quantitative data processing. Quantitative researchers estimate (strength) the strength of the relationship of variables, and test hypotheses statistically. Unlike the case with qualitative research. Although qualitative researchers might test a hypothesis in the analysis process, they do not estimate or test hypotheses about the relationship of variables statistically. Through tests or statistical tests can be used as the main means for interpreting the results of research data. It is through this statistical test that we as researchers can compare which data groups and what can be used to determine probabilities or possibilities that distinguish between groups based on an opportunity. Thus, it can provide evidence to determine the validity of a hypothesis or conclusion. In this study, we will discuss the preparation of data for analysis such as editing data, coding, categorizing, and entering data. As well as discussing the differences in data analysis for descriptive statistics and inferential statistics, differences in data analysis for parametric and non-parametric statistics in research, explanations of multivariate data analysis procedures, and also forms of research hypotheses.

Keywords: *Data analysis, Quantitative research, Qualitative research, Hypothesis*

1. Introduction

Data analysis and mathematical techniques play a central role in relation to quantitative data processing management. Quantitative researchers describe the characteristics of the sample in proportion, percent, or mean (standard) and standard deviation (standard deviation). Quantitative researchers estimate (strength) the relationship between variables, and test hypotheses statistically (Murti, 2010)[1]. Although qualitative researchers might test a hypothesis, they do not estimate or test hypotheses about the relationship of variables statistically[2]. Another striking difference is that quantitative methods analyze data after all data has been collected. If necessary, the analyst is made blind so that objective analysis, maintained distance, is not affected by the research hypothesis. On the other hand, qualitative methods carry out data management analysis from the beginning to the end of the study[3]. Data analysis in qualitative research is part of management research design, part of literature review, part of theory formation, part of data collection, part of sorting data, archiving and reading data, and part of writing research results[4].

For this purpose, qualitative researchers use a diary or laptop, so that the results of observations, interviews, and other findings can be immediately analyzed in accordance with the context at which observations or interviews were conducted. Qualitative analysis technique itself is a method that emphasizes more on aspects of deep understanding of a problem than seeing problems for research in generalization[5]. This research method prefers to use the aspect of deep understanding (in depth analysis), which is to examine the problem in case of percasus because qualitative methodology believes that the nature of a problem one will be

different from the nature of other problems. The purpose of this methodology is not a generalization but contains management in-depth understanding of a problem. Qualitative research serves to provide substantive categories and qualitative research hypotheses. In fact, it is recommended that qualitative research go back to the field to discuss and do the matching of research findings with participants to improve the interpretative validity of research in accordance with the hermeneutic paradigm[6].

2. Research Methods

In this study used a literature study method, also known as the literature review method, which is done by searching for and gathering theories in the form of scientific material from previous studies that are relevant to this study. The following is a list of literature reviews used in this study:

1. Research conducted by Anisak Intan Eka Prani, Parno and Arif Hidayat in 2018 entitled "Critical Thinking Skills in Inquiry Bounded Lab: Quantitative and Qualitative Analysis". In their research, they discussed the development of critical thinking skills that needed an active and conducive environmental support and were able to facilitate students to develop management thinking conceptually through scientific work. In this study, one alternative learning strategy is called Bounded Inquiry which can be used to develop students' critical thinking skills which include reasoning skills, testing hypotheses, analyzing arguments, analyzing possibilities and uncertainties, and making decision skills and solving complex problems. In addition, it was explained that the alternative Bounded Inquiry Lab can also facilitate students to have the skills to test hypotheses through activities to determine variables, determine relationships between variables, make hypotheses and scientific procedures. Based on the results of this study, it can be concluded that Bounded Inquiry Lab can be used as an alternative learning strategy to improve students' critical thinking management skills, especially in static fluid learning material[7].
2. Research conducted by Adji Sigit Sutedjo and Anwar Prabu Mangkunegara in 2018 entitled "The Effect of Competence and Work Motivation on Employee Performance at PT. Inti Kebun Sejahtera ". In their research, they discussed whether there was an influence of competency on the performance of bulk employees, whether there was an influence on the work motivation of bulk employee performance and whether there was a joint influence between competency and work motivation on the performance of bulk employees at PT. IKSJ. The purpose of this study is to find out how much influence competency has on the performance of bulk employees, how much influence work motivation has on the performance of bulk employees and how much influence jointly between competency and work motivation on the performance of bulk employees, so the results of this study are expected to provide benefits for the company, both top management, managers, employees, and all parties involved in the decision-making process and used as material for comparison or guidance in this case include competence and work motivation and the development of science, especially in the field of human resource management, especially regarding competence and work motivation on performance[8].
3. The research conducted by Abdul Majid in 2018 entitled "Application of Coaching to Improve the Competence of Principals in Academic Supervision at the Banjarmasin City Education Department-guided Middle School". The purpose of the study was to determine whether the competence of principals in academic supervision would increase through coaching in junior high schools assisted by the Banjarmasin City Education Office. The data analysis technique used in this study is quantitative data and qualitative data. The results of this study indicate an increase in the competency of principals in academic supervision, namely planning, implementation, evaluation, and follow-up on each principal[9].
4. Research conducted by I Made Agus Putrayasa and Made Dana Saputra in 2018 entitled "Budgeting and Analysis of Sales Budgets". The purpose of this study was to find out the budgeting approach and to determine the cause of the variance between the actual sales and sales budgets on the CV. This type of research uses quantitative data analysis and qualitative descriptive data analysis. In this study it was concluded that the company used a top down approach in the budgeting process. The types of data used in this study are quantitative data and qualitative data. Quantitative data in this study is a sales budget report on and realization

on CV. While the qualitative data in this study is the organizational structure and duties with related parties in CV Sumberjaya. The analysis technique used in this study is quantitative analysis and descriptive qualitative analysis. The quantitative analysis used in this study is the analysis of the difference in the sales budget by finding the difference between the budget that has been set and the realization in 2016 on CV Sumberjaya. While the qualitative analysis in this study is a description of the explanations of the results of the research obtained so that later it can be used to analyze budgeting carried out on CV[10].

5. Research conducted by Adam Prasetyo Wibowo in 2018 entitled "Quantitative and Qualitative SWOT Integration to Arrange Strategic Planning in the Field of Education (Case Study in Ex-Department of Surakarta Language and Arts FKIP Education)". In this study using quantitative and qualitative methods. The sample is determined by purpose sampling technique. Data collection uses questionnaire techniques, interviews, and documentation. And Data Analysis used is Flow Model[11].

3. Result and Analysis

A. Prepare Data for Analysis

Tests or statistical tests are the main means for interpreting the management of the results of research data. Through statistical tests, we as researchers can compare groups of data which are then used to determine probabilities or most likely opportunities that distinguish between groups are based on an opportunity. Thus, it can provide evidence to determine the validity of a hypothesis or conclusion[12].

Statistical tests to make conclusions based on decisions accepted or rejected hypotheses are called inferential statistics. In addition to statistical tests to determine conclusions, we can use statistics to describe a group of data or circumstances (for example, the average score) called descriptive statistics. For example, we want to compare learning achievement in social science subjects from 2 (two) groups of subjects who received different treatments, namely 1 (one) experimental group and 1 (one) control group (Sugiyono, 2010)[13]. After collecting through questionnaires, interviews, observations, or through secondary sources, then the data needs to be edited. Blank responses, if any, must be handled in a certain way, data encoded, and categorization schemes need to be compiled. Data will then be inputted and some management software programs will be used to analyze it[14].

(1). Editing Data

Data must be edited, especially if it relates to responses to open ended questions in interviews or questionnaires, or unstructured observations. In other words, information that may be hastily recorded by the interviewer (interviewer), observer or researcher must be clearly described so that all data can be systematically encoded[15]. Many data editing processes that process management are automatically carried out in the case of computer-assisted telephone interviews (computer assisted telephone interview CATI) and electronically distributed questionnaires, even when respondents are answering questions.

(2). Handling Blank Responses

Not all respondents answered items in the questionnaire. The answer may be left blank (blank response) because the respondent does not understand the question, does not know the answer, does not want to answer, or is simply not interested in answering all questions. In the latter situation the respondent is likely to leave many items empty. There are 5 (five) ways that are used to handle empty responses, which include:

- 1 (one) way to handle the blank response for an interval scale item with a middle value is to give the middle value in scale in response to that item.
- Another way is to let the computer ignore the blank response when the analysis is done.
- Give the value item out the response from all who respond to the item.
- Giving these items the average response from respondents specifically on all other questions that measure these variables.
- To handle it is to give an empty response to a random number in the range of that scale.

It should also be remembered that SPSS uses linear interpolation management from adjacent points as well as linear trends to replace lost data. As we have seen, there are several ways that can be done to handle empty responses, but the general approach is to give the middle number in scale as a value or ignore the item during the analysis process[16]. Computers can be programmed to handle lost and unknown responses in the way we want. The best way to handle lost data is to improve the validity of research, especially if the large sample size is to ignore cases where data is related to certain missing analyzes.

(3). Encode

The next step is coding the response. If the respondent's response cannot be directly entered into the computer system manually, then it might be better at the first time to use coding instruments to transcribe the questionnaire data and then enter data[17]. This method, in contrast to tracing each questionnaire for each item or item, avoids confusion, especially if there are many questions and a large number of questionnaires.

(4). Categorization

At this point it is useful to create a scheme to categorize variables, so that some items that measure a management concept can all be grouped together. The response to several questions that are arranged negatively also needs to be reversed so that all answers are in the same direction[18]. Remember that related to questions that are arranged negatively, the response is 7 (seven) on a scale of 7 (seven) points, with 7 (seven) showing very agree, really means very disagreeing which is actually 1 (one) on a 7 scale (seven) point.

(5). Enter Data

If the questionnaire data is not collected on the scanner answer sheet, which can be directly entered into the computer as a data archive, the raw data must be manually typed into the computer. Raw data can be entered with any software program. For example SPSS data editor, which looks like a spreadsheet, which can enter, edit, and view data files. Each editor line represents a case and each column represents a variable[19]. All missing values will appear as points in cells. It is possible to add, or delete values easily after the data is entered.

(6). Main Objectives of Data Analysis

In our data analysis we have 3 (three) objectives, including (1) getting a feeling for the data (feel for the data), testing the quality of the data (goodness of data), and testing the research hypothesis. Feelings of the data will give an initial idea of how well the scale is made, how well the coding and management of data entry is carried out onwards. Suppose that a 7 (seven) scale item is incorrectly coded or entered as 8 (eight), it will appear as the maximum value in descriptive statistics and errors can be corrected. (2) testing the accuracy of data management, can be done by entering data for factor analysis, obtaining Cronbach alpha or reliability of split two measurements and so on. (3) hypothesis testing is achieved by selecting the appropriate software program menu, to test each hypothesis using the relevant statistical test management.

In quantitative research, analysis is an activity after data from all respondents or other data sources are collected. Activities in data analysis management include grouping data based on variables from all respondents, presenting data for each variable under study, performing calculations to answer formulas, and performing calculations to test hypotheses that have been proposed. For studies that do not formulate hypotheses, the final step is not carried out[20]. There are 2 (two) types of statistics used for data analysis in the study, namely descriptive statistics and inferential statistics. Inferential statistics include parametric statistics and nonparametric statistics.

(7). Data Reduction

The design of the analysis is a variety of research data management analysis tools so that the research problem formulation can be solved, the research hypothesis can be proven or

tested, and finally the goal can be achieved. According to Sangadji (2010) data reduction is defined as management of the selection process, focusing on simplification, abstracting, and transformation of rough data that emerges from field notes[21]. Data reduction continues throughout the study. Even before the data is actually collected. The anticipation of a reduction has already been seen when the researcher decides on the regional conceptual framework, research problems, and the approach to collecting the data chosen.

During the data collection, management of data reduction took place in the form of summarizing, coding, searching for themes, creating clusters, making partitions, writing memos, and so on. Data reduction continues after field research until the final report is compiled[22]. In this data reduction management process, researchers can make choices about the data they want to encode, which ones are discarded, which ones are summaries, and stories that are developing. Data reduction is a form of analysis that sharpens, classifies, directs, discards unnecessary, and organizes data in such a way that final conclusions can be drawn and verified.

B. Descriptive and Inferential Statistics

Descriptive statistics are statistics used to analyze data management by describing or describing data that has been collected as it is without intending to make conclusions that apply to the general or generalizations. Research conducted on the population (without sampling) will clearly use descriptive statistics in the analysis. But if the research is conducted on the sample, the analysis can use descriptive and inferential statistics. Descriptive statistics can be used if researchers only want to describe sample data, and do not want to make conclusions that apply to the population in which the sample was taken[23]. But if the researcher wants to make conclusions that apply to the population, then the analysis technique used is inferential statistics. Included in descriptive statistics include the presentation of data management through tables, graphs, pie charts, pictograms, mode calculations, median, mean (measurement of central tendency), decile calculations, percentiles, data distribution calculations through average calculations and standard deviations, and percentage calculation. Just keep in mind that in correlation analysis, regression, or comparing two or more averages it does not need to be tested for significance. So technically it can be seen that in descriptive statistics there is no significance test, there is no level of error, because the researcher does not intend to make generalizations, so there are no generalizations[24].

Inferential statistics (often also called inductive statistics or probability statistics) are statistical techniques used to analyze sample data and the results are applied to the population. This statistic is also called probability statistics because the conclusions that are applied to the population based on the management of the sample data are probability. A conclusion from the sample data that will be applied to the population has the opportunity for errors and truths expressed in percentage terms. If the chance of error is 5%, then the confidence level is 95%, if the chance of error is 1% then the level of trust is 99%. Can be given an example for example from the results of correlation analysis found a correlation coefficient of 0.54 and for significance of 5%. That means the variable relationship of 0.54 can apply to 95 of the 100 samples taken from a population. Another example, for example, in a different test analysis found a significance of 1%. This means that based on that it applies to 99 out of 100 samples taken from the population. So significance is the ability to be generalized with certain errors. There is a significant relationship which means that the relationship can be generalized. There are significant differences, meaning the relationship can be generalized.

C. Parametric and Non Parametric Statistics

In inferential statistics there are parametric and non-parametric statistics. Parametric statistics are used to test population parameters through statistics, or test population size through sample data (the statistical meaning here is data obtained from samples). Population parameters include: averages with notation, standard deviation, and variance. In statistics, testing parameters through statistics (sample data) is called the statistical hypothesis test. Therefore research that hypothesizes statistics is research that uses samples. In the statistics of the hypothesis tested is the null hypothesis, because there is no desired difference between

population parameters and statistics (data obtained from the sample). Only in reality parameter values are rarely known. Non-parametric statistics do not test population parameters, but test distribution [25]. The use of parametric and non-parametric statistics depends on the assumptions and types of data to be analyzed. Parametric statistics require many assumptions to be fulfilled, the main assumption is that the data to be analyzed must be normally distributed. Furthermore, in the use of one of the tests requires that the data of two or more groups tested must be homogeneous, in the regression the linearity assumption must be fulfilled.

Non-parametric statistics do not require many assumptions to be fulfilled, for example the data to be analyzed does not have to be normally distributed. Therefore nonparametric statistics are often called "distribution free" (free distribution). Parametric statistics have more power than nonparametric statistics, if the underlying assumptions can be fulfilled. The use of both statistics also depends on the type of data management analyzed. Parametric statistics are mostly used to analyze data intervals and ratios, while nonparametric statistics are mostly used to analyze nominal, ordinal data. So to test hypotheses in quantitative research using statistics, two main things must be considered, namely the type of data and the form of the hypothesis proposed. In quantitative research, the hypothesis is drawn from the theoretical study that comes from literature review as a temporary answer to the research problem [26].

D. Multivariate Data Analysis Procedure

In general there are 2 (two) statistical methods in multivariate data analysis, namely (1) interdependent methods (interdependence method) and (2) dependent methods (dependence methods).

(1) Interdependent Method (Interdependence Method)

In the interdependent method, there are no variables or a number of variables that predict or explain other variables. In this case there are no independent variables or dependent variables. This method aims to determine the arrangement of all variables studied. An example of this statistical method is factor analysis, cluster analysis, multidimensional scaling.

(2) Dependence Method

The dependent method in multivariate analysis is a statistical method used to describe one or more dependent variables based on a number of independent variables. Statistical methods included in the group include multiple regression, analysis of variance, analysis of covariance, conjoint analysis, multiple discriminant analysis, multivariate analysis of variance, cannonical correlation, linear probability model.

E. Definition of Hypothesis

Based on the theories put forward, it can then be used to compile a management framework. With management this framework can then be used to form hypotheses. The hypothesis is a temporary answer to the formulation of the problem or sub-problem proposed by the researcher, which is described from the theoretical or theoretical basis and still has to be tested for its truth. Because of its transient nature, it is necessary to prove the truth through collected empirical data or scientific research. The hypothesis will be declared accepted or rejected. The research hypothesis must be formulated in positive sentences. Hypotheses should not be formulated in question sentences, whole sentences, suggested sentences, or expected sentences. The hypothesis is a temporary answer to the research question. Thus there is a link between the formulation of the problem with the hypothesis, because the formulation of the problem is a research question. This question must be answered in the hypothesis. The answers to hypotheses are based on theory and empiricism, which have been studied in previous theoretical studies. The hypothesis formulation diagram can be seen as follows:

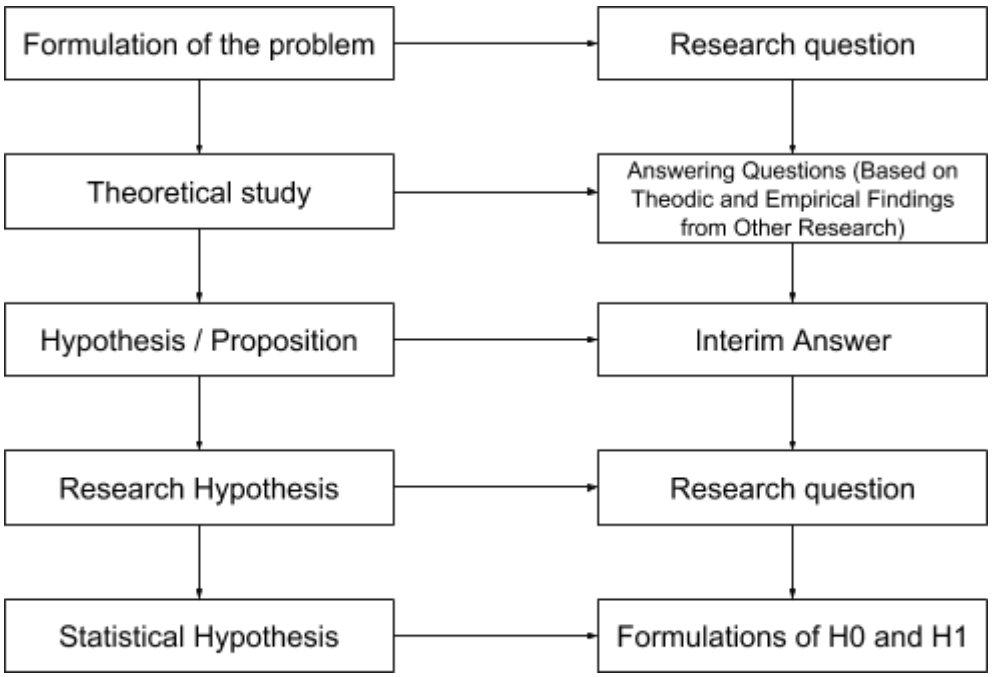

Figure 1. Hypothesis Formulation

Theoretical studies used as the basis for the preparation of hypotheses can be observed and measured in the real world. So, the theory must be translated into a form that can be observed and measured through the operationalization management process, namely changing the abstractness of a theory into an empirical phenomenon or in the form of propositions that can be observed or measured. Propositions that can be measured or observed are propositions that state relationships between variables. Propositions like this are called hypotheses. Hypotheses connect theory to reality so that through hypotheses theory testing and data collection are carried out.

F. Forms of Hypothesis

The research hypotheses are closely related to the formulation of research problems. When viewed from the level of exploration, the formulation of the research problem is three, namely (1) descriptive problem formulation (independent variable), (2) comparative or comparison and (3) association or relationship. Therefore, there are three forms of hypothesis, namely: descriptive, comparative, and associative hypotheses.

In the comparative hypothesis, it is divided into 2 (two) types, namely comparative for testing two samples and more than two samples. The descriptive hypothesis is a temporary answer to the formulation of the descriptive problem. Whereas the associative hypothesis is a temporary answer to associative or relationship problems. The following are examples of statistical hypotheses (only available if based on sample data) as follows:

1. Employee morale at PT X is 75 percent of the ideal criteria set.
2. Employee morale at PT X is at least 60 percent of the ideal criteria set (at least that means big or equal to).
3. The work spirit of employees at PT X is at most 60 percent of the ideal criteria set (at most it means smaller or equal to).

In reality, only one hypothesis is proposed, and which hypothesis is chosen depends on the theory and preliminary observations made on the object. The alternative hypotheses are:

1. Employee morale at PT X is not equal to 75 percent.
2. Employee morale at PT X is 75 percent smaller.
3. Employee morale at PT X is 75 percent greater.

4. Conclusion

Data analysis and mathematical techniques play a central role in quantitative data management processing. Quantitative researchers describe the characteristics of the sample in proportion, percent or mean (standard) and standard deviation (standard deviation). Quantitative researchers make estimates (estimates) about the strength of the relationship of variables, and test the hypothesis statistically. Qualitative researchers do not describe the characteristics of the sample in proportion, percent, or mean except in certain circumstances it can be calculated the number of occurrences of certain categories, when qualitative researchers carry out data analysis called Content Analysis.

Although qualitative researchers might test a hypothesis, they do not estimate or test hypotheses about the relationship of variables statistically. Another striking difference is that quantitative methods analyze data after all data has been collected. If necessary, the analyst is blinded so that the results of the analysis are objective, maintained at a distance, not affected by the research hypothesis. On the other hand, qualitative methods manage data analysis from the beginning to the end of the study. Data analysis in qualitative research is part of research design, part of literature review, part of theory formation, part of data collection, part of sorting data, archiving and reading data, and part of writing research results.

The descriptive hypothesis to be tested with parametric statistics is an estimate of the value in one sample (unit sample), compared to the standard, while the descriptive hypothesis that will be tested with non-parametric statistics is an estimate of whether there is a significant difference between groups in one sample. The comparative hypothesis is the presumption of whether there are significant differences in the values of two or more groups. Associative hypothesis, is the presumption of the presence or absence of a significant relationship between two or more variables. There are 3 (three) types of hypothesis testing, namely, two-party test, right-hand side, and left-hand side. Which type of test to use depends on the sound of the hypothetical sentence itself.

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