Makurdi Journal of Communication Research (MJCR)

(Vol. 1 No. 2 July - December 2010)
ISSN: 2141-050X

www.makurdijournal.wordpress.com

The Rationale Underlying Test of Hypothesis in Research

Mercy Tartsea-Anshase †
and
Ioryue Sylvester Iorkase

Abstract

Hypothesis is an informed intelligent guess or rather a proposition which is aimed at solving an identified problem. It can also be explained as an assumption whose validity is to be tested and established. It can also be considered as a conjectural statement regarding the relationship of two or more variables. Empirical evidence and previous knowledge are compared on the basis of compatibility using this tool. Therefore, the formulation of hypothesis and its subsequent test is very essential in any systematic research as it serves as a guide in the quest for solution to a given problem. Formulation of hypothesis however has to be comprehensive enough to cover every aspect of the problem under investigation as it provides a framework for drawing conclusion. This paper looks at the rationale for the test of hypothesis, the extent of it's usage, the processes involved, factors to be considered in the choice of statistical test. The study however concludes that the use of hypothesis is vital to research but students shy away from it due to fear, lack of knowledge and so on. Students and teachers are therefore urged to put in more efforts to it towards improving the trend.

† *Mercy Tartsea-Anshase lectures in the Department of Mass Communication, University of Mkar, Mkar. She can be reached by mobile phone (08052716748).*

Introduction

Science does not admit anything as valid knowledge until a satisfactory test of its validity has been completed. At the outset, may be, we should clarify our terminology. The term hypothesis is somewhat confusing unless one understands that it has two different meanings in research literature. The first meaning relates to a research hypothesis; the second relates to a statistical hypothesis.

Leedy and Ormrod (2001:270) state that, a "research hypothesis" exists because the research problem or the sub-problems issuing from it arouse curiosity in the researcher's mind; this arousal in turn leads to a tentative guess about how to resolve the problem situation. Therefore, the research hypothesis is a reasonable conjecture, an educated guess. Its purpose is a practical one as it provides a temporary objective, an operational target, a logical framework that guides researchers as they collect and analyze data. As earlier stated, research hypothesis is imperative especially in sciences, behavioral sciences and social sciences, as it guides an activity to a logical conclusion. But it has been observed overtime that most students who embark on research works shy away from this even when their topics require such. This has remained a source of concern overtime and especially to external examiners. This situation has prompted a number of questions as to the role of project supervisors and students alike in changing this trend.

This write-up however, focuses on the use of hypothesis in research works. Specific reference is made to post-graduate students of the Benue State University, Makurdi.

Statement of Problem

The hypothesis is in a very real sense the core of the study. It guides the researcher in planning the course of the inquiry, in choosing the kinds of data needed in deciding the proper statistical treatment and in examining the results of the study. Since they are the major organizing factors of any study, this work therefore, seeks to examine the extent to which hypothesis is put to use in carrying out research activities.

Objectives of the Study

Since it is held that hypothesis is a starting point for studies to solve research problems, the prime objectives of this study are:

i. To examine the processes involved in testing a hypothesis
ii. To assess the factors for choice of statistical tests and or techniques in testing hypothesis
iii. To find out the importance of testing hypothesis in a research activity
iv. To find out the extent to which hypothesis is used in research works

Research Questions

This study seeks to address the following questions:

i. What is the rationale for testing hypothesis in a research activity?
ii. What are the processes involved in testing a hypothesis in a research work?
iii. What factors determine the choice of statistical test or techniques in testing hypothesis?
iv. To what extent has hypothesis been used in research works?

Method

The methodology adopted for the study was the survey. The primary and secondary sources of data collection were used. For primary source, copies of questionnaire were administered on respondents and information concerning the topic elicited. As for secondary source, library materials were used.

Testing Hypothesis

The phrase "testing hypothesis" is however an entirely different thing. Here, the word hypothesis refers to a " statistical hypothesis", usually null hypothesis. A null hypothesis, often symbolized by the H_o postulates that any result observed is the result of chance alone, Leedy and Ormrod (2001:270).

Wimmer and D\ominick (1998:258) also agree that the null hypothesis (also called the "hypothesis of no difference") assert that the statistical differences or relationships being analyzed are due to chance or random error. This means that differences or relationships arising from a null hypothesis occur by chance or error.

The null hypothesis (H_o) is the logical alternative to the research hypothesis (H_1). For example, in a study to evaluate total quality management in broadcasting: A study of Radio Benue, the null hypothesis could be: "There is no relationship between radio stations and total quality management. Its logical alternative will be: " There is a relationship between radio stations and total quality management". The null hypothesis is said to be always present and plays a vital role in the rationale underlying hypothesis testing.

In hypothesis testing, or significance testing, the researcher either rejects or accepts the null hypothesis. That is, if H_o is accepted, it is assumed that H_1 is rejected and vice versa.

To determine the statistical significance of a research study, Wimmer and Dominick (1998:258) emphasize that, the researcher must set a probability level, or significance level, against which the null hypothesis is tested. If the results of the study indicate a probability lower than this level, the researcher can reject the null hypothesis. If the outcome is the other way round, the researcher must support the null hypothesis.

Attesting to this, Leedy and Ormrod (2001:270) specify one common cut off as 1-in-20 probability; that any result that would occur by chance only 5% of the time probably is not due to chance but instead to another, systematic factor that is influencing the data. They say other researchers use a more rigorous 1-in-100 criterion. That is, the observed result would occur by chance only one time in 100.

The authors further explain that the probability which researchers use as their cut off point, whether 05, .01, or some other figure, is the significance level, or alpha (α). A result that, based on this criterion, we deem not to be due to chance is called *statistically significant.* That is to say that, when a result is due to something other than chance, then the null hypothesis is rejected. Invariably, you look to an alternative hypothesis as being more probable.

Patten (1997:93) corroborates this stance by saying, an alternative way to say that we have rejected the null hypothesis is to state that the difference is statistically significant. Thus, if we state that a difference is statistically significant at the 0.5 level (meaning .05 or less), it is equivalent to stating that the null hypothesis has been rejected at that level.

Error

Testing for statistical significance involves what is, referred to as error. It goes with all steps in the research process. Wimmer and Dominick (1998:258) state that there are two types of error particularly relevant to hypothesis testing viz: Type I error and type II error.

Type I error is the rejection of a null hypothesis that should be accepted while Type II error is the acceptance of a null hypothesis that should be rejected. The probability of making a Type I error is equal to the established level of significance and is therefore under the direct control of the researcher. That is, to reduce the probability of Type I error, the researcher can simply set the level of significance closer to zero.

Type II error, often signified by the symbol β, is a bit more difficult to conceptualize. The researcher does not have direct control over Type II error; instead, Type II error is controlled, though indirectly, by the design of the experiment. In addition, the level of Type II error is inversely proportional to the level of Type I error. That is, as Type I error decreases, Type II error increases, and vice versa. The potential magnitude of Type II error depends in part on the probability level and in part on which of the possible alternative hypothesis actually is true.

Power

Another issue about testing hypothesis is the concept of power. It is intimately related to Type I and II errors. Power refers to the probability of rejecting the null hypothesis when it is true, Wimmer and Dominick (1998:258) . In other words, power indicates the probability that a statistical test of a null hypothesis will result in the conclusion that the phenomenon under study actually exists.

Wimmer and Dominick (1998) further state that statistical power is a function of three parameters: probability level, sample size and effects size. The probability level is under the direct control of the researcher and predetermines the probability of committing a Type I error. Sample size refers to the number of subjects used in an experiment. The effects size on the other hand is the degree to which the null hypothesis is rejected. This can be stated either in general terms (such as any non-zero value) or in exact terms (such as .40). That is, when a null hypothesis is false, it is false to some degree; a researcher can say the null hypothesis is false and leave it at that, or they can specify exactly how false it is. The larger the effects size, the greater the degree to which the phenomenon under study is present. The effects size is referred to as the most difficult concept.

The authors also opine that researchers seldom know the exact value of the effects size. When such precision is lacking, researchers can use one of the following three alternatives;

1. Estimate the effects size based on knowledge in the area of investigation or indications from previous studies in the area, or simply state the size as "small", "medium", or "large".
2. Assume an effects size of "medium"
3. Select a series of effects sizes and experiment

When the probability level, sample size and effects size are known, researchers can then consult power tables to determine the level of power in their study.

Another issue in testing hypothesis is that of choice of statistical test. To this end, Emaikwu (2008, p. 188) points out certain factors to be considered in the choice of statistical test as follows:

The nature of the research questions and the research hypotheses: The ways in which the research questions and the research hypotheses are framed determine the type of statistics to use in analyzing the data. For instance, if the research questions are framed in such a way that they are aimed at finding the *relationship* between the variables under investigation, then we use correlation statistical techniques. But if the intent is to show if *differences* exist among variables, then inferential statistics either parametric or non-parametric is used.

The number of groups of variables under investigation: This determines the type of statistics to be used in analyzing data. If the number of groups of variables is two for instance, and we want to establish if there is a significant difference between the two groups being compared, the t-test technique is used. But if there are three groups of the variables, *the analysis of variance* (ANOVA) is put to use.

The sample size: This also determines the type of statistics one is to use. For sample sizes that are not large but very small in each sample, researchers have to use non-parametric statistics in place of parametric statistics. Non-parametric statistics is used to treat data which are simply classificatory and used with data which are only discreet in nature. Non-parametric statistics are generally less powerful since they require larger samples in order to yield the same level of significance.

The nature of the sample: If data are got from correlated sample, (then it becomes necessary to use a *repeated measure statistical* technique to analyze the data otherwise the conclusion gotten from such analysis will not be reliable.

Test of assumptions: Some tests are put to use based on some assumptions regarding the shape of the distribution from which the data have been taken. Such tests are parametric tests like t-test, F-ratio – and Z-test. Emaikwu emphasizes that statisticians are increasingly demanding that the researchers demonstrate the fulfillment of these assumptions before a particular significance test is used.

Some of the alternative valid statistical tests which might be used to reach decision about hypothesis include: Turkey method, scheffe method, Turkey/Krammer method, canonical analysis, path analysis, factor analysis, Neumann Keul method, and others like t-test, Z-test, ANOVA, etc. All these are parametric statistical techniques.

Those techniques which fall under non-parametric statistics are: McNemar test of change, chi-square test, Binomial test, the median test, one sample runs test, the sign test, Wilcoxon matched pair test, the Mann-Whitney-V-test, Kruskal Wallis ANOVA, Kolmogorov-Smirnov-one sample test, fisher exact probability test, Cochran-Q-concordance, Friedman two-way ANOVA by ranks.

Data Presentation and Interpretation

Table V: Rationale for Hypothesis

Question	Response	Frequency	Percentage
Why do we test hypothesis?	To guide the inquiry.	30	27.3
	Helps to resolve the problem situation	10	9.1
	Provides an operational target.	10	9.1
	All of the above.	60	54.5
Total		110	100%

Table V dwells on the rationale for testing hypothesis. The results indicate that 30(27.2%) respondents said hypothesis guides an enquiry, 10(9.1%) respondents said it helps to resolve the problem situation, 10(9.1%) respondents said it provides an operational target for the enquiry while, 60(54.5%) respondents who are the majority went for all the options. This shows that all options serve as reasons for embarking on hypothesis testing.

Table VI: Use of Hypothesis

Question	Response	Frequency	Percentage
Have you ever use/test hypothesis in your work?	Yes	30	27.3
	No	80	72.7
Total		110	100%

Table VI enquires about the use of hypothesis. 80(72.7%) respondents said they have never tested hypothesis before while, 30(27.2%) agreed that they have used hypothesis in their work. This is a clear indication of the fact that not so many people understand the importance of testing hypothesis in research activities.

Table VII: Reason for saying 'No.'

Question	Response	Frequency	Percentage
If no to the above question, why?	No sound maths or statistics base.	20	25
	Lack of knowledge of test tools.	10	12.5
	Hypothesis testing is waived in various departments.	20	25
	Scared of calculations	30	37.5
Total		80	100%

Table VII seeks to find out the reason for non-usage of hypothesis. 20 (25%) respondents said it is due to lack of a sound foundation of mathematics. 10 (12.5%) respondents said lack of knowledge of the test tools is the problem. 20 (25%) respondents blamed their departments for waiving it while 30 (37.5%) respondents who were the majority attributed their non-usage of hypothesis to the scary nature of calculations. All these are reasons why students do not go for hypothesis in their work.

Table VIII: Worthiness of Test

Question	Response	Frequency	Percentage
Was the test worth the while?	Yes	30	100
	No	-	-
Total		30	100%

Table VIII seeks to know whether those who actually tested hypothesis found value in it. The results show that all 30(100%) respondents who indicated that they tested hypothesis arrived at logical conclusions. This means that hypothesis is important in research.

Table IX: Processes Involved

Question	Response	Frequency	Percentage
Processes involved	Setting probability/significance level	20	18.2
	Error-type I & II	20	18.2
	Power, sample size and effects size	15	13.6
	All of the above.	55	50
Total		110	100%

Table IX seeks to know the processes involved in the testing. 20 (18.2%) respondents went for setting probability/significance level, 20 (18.2%) other respondents went for error-type I & II. About 15 (13.6%) respondents said power, sample size and effects size while 55 (50%) who are majority respondents went for all the options. This means that all processes are involved in the test of hypothesis.

Table X: Choice of statistical test.

Question	Response	Frequency	Percentage
What determines the choice of statistical test?	Finding relationships/offences existing between variables.	30	27.3
	Number of groups under investigation	10	9.1
	Test of assumptions	10	9.1
	All of the above	60	54.5
Total		110	100%

Table X seeks to find out the determinants for choice of statistical test tools. Results show that 30 (27.3%) respondents said finding relationships/differences existing between variables is a determining factor. 10 (9.1%) respondents went for the number of groups under investigation. Another 10 (9.1%) respondents said test of assumptions determines the choice of test tools while 60 (54.5%) who are majority went for all options. This indicates that all options determine the choice of statistical tests.

Table XI: Improvement

Question	Response	Frequency	Percentage
Strategies for improvement.	By acquiring a very sound knowledge of maths/statistics right from the basics..	40	36.3
	Teachers should encourage the learning of maths through bench-marking of excellence.	20	18.2
	Lecturers concerned should teach research techniques/statistics property.	20	18.2
	Students should develop/sustain interest in research studies.	30	27.3
Total		110	100%

Table XI finally seeks to know how this trend can be improved upon. A total of 40 (36.3%) respondents advised that acquisition of a very sound knowledge of maths right from time is the way out. 20 (18.1%) said teachers should encourage interest in maths by rewarding those who excel so that others can also develop interest. Another 20 (18.1%) respondents advised that lecturers rested with the responsibility of teaching research techniques should do so with all seriousness and properly too. A total of 30 (27.2%) respondents urged students to develop and sustain keen interest in research studies. This shows that all responses are equally important in the quest for improvement in hypothesis testing.

Summary

The purpose of this study is to find out to what extent students put to use hypothesis in research activities. Results indicate that most students understand what hypothesis means. On the rationale for testing hypothesis, majority of respondents proved that test of hypothesis is imperative as it serves as a guide to an enquiry. Concerning the actual use of hypothesis, very few respondents affirmed that they have used hypothesis. As to why majority did not use hypothesis, they blamed it on lack of a sound maths base, lack of knowledge of statistical test tools, ignorance on the part of their departments and fear of calculations. On the importance of hypothesis, those who actually tested it affirmed that it led them to logical conclusions. As for the processes involved in the endeavour, majority of respondents accepted all the options provided: setting probability/significance level, error-type I & II; power, sample size and effects size. Majority of respondents averred that determinants for the choice of statistical tests include: finding relationships and differences existing between variables, the number of groups under investigation and test of assumptions. Finally, respondents pointed out acquisition of a very sound knowledge of mathematics and statistics right from the basics. Teachers are to encourage interest in maths through recognition and rewarding excellence so that others can also develop interest. Students on their part should develop and also sustain interest in research studies.

Conclusion

Based on the findings, this study concludes that the extent to which hypothesis is put to use in research activities is very low as only 27.2% accepted ever using hypothesis. Even though most respondents attested to the importance of testing hypothesis as it takes the work to a logical conclusion, they lack the adequate knowledge to properly go into the test. As a result of lack of knowledge of statistics, the test tools and fear of calculations, students shy away from hypothesis testing.

Recommendations

Students should first and foremost identify a research problem. Appropriate hypothesis can then be formulated which is an assumption specifying some form of relationship between the variables of interest. By so doing, statistical decisions could be arrived at by choosing appropriate statistical tests as a wrong choice of technique more often than not leads to wrong results.

Teachers should find ways of encouraging learning and interest in mathematics such as rewarding those who excel so that the rest who do not have interest can also develop same. This will prepare them for future challenges like the one in focus.

Lecturers vested with the responsibility of teaching research methods and techniques should do that properly and with all seriousness so that students can understand and also put to practice in their project work.

Finally, students should on their part develop and sustain interest in the learning of mathematics and research studies so that they can carryout their research endeavour properly.

References

Emaikwu, S. O. (2008) *Fundamentals of Educational Research Methods and Statistics*. Kaduna: Deray Prints.

Leedy, P. D. and Omrod, J. E. (2001) *Practical Research: Planning and Design*. New Jersey: Merrill Prentice Hall.

Patten, M. L. (1997) *Understanding Research Methods: An Overview of the essentials*. Los Angeles: Pyrezak Publishing.

Wimmer, R. D. and Dominick, J. R. (1998) *Mass Media Research: An Introduction*, 6th ed. California: Wadsworth.