

Evaluation of Statistical Tools used by Educational Researchers and Evaluators in Data Analysis of Journal Article Publications

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Abstract

The study investigated the statistical tools used by educational researchers in data analysis of journal article publications. It determined the prevalent and appropriateness of statistical tools for researches conducted. The study surveyed journal publications of Educational Research and Evaluation by Nigerian Association of Educational Researchers and Evaluators (NAERE) now known and addressed as Association of Educational Researchers and Evaluators of Nigeria (ASSEREN) and Journals of Curriculum Studies by Curriculum Organization of Nigeria (CON) from 2007 to 2015 in different volumes and numbers. Fifty- five articles in Journal of Educational Research and Evaluation and 15 articles in Journal of Curriculum Studies were sampled. The sample comprised 70 Journal article publications. The publications were evaluated according to type of statistical tools used for data analysis to assess the most prevalent statistical tool in data analysis of journal published articles and the appropriateness of such tools to address the research interest. Frequency counts and percentages were used to analyze the data. The findings revealed that the statistical tool used by researchers in journal article publications in NAERE and CON are Descriptive statistics, T-test, Multiple Regression, Analysis of Variance (ANOVA), Z-test, Correlation, Analysis of Covariance (ANCOVA), Chi-square, Improvement Index (INI), Factor analysis, Kendalla Tau and Multiple Regression Analysis (MANOVA). The findings also revealed that the most prevalent statistics used for data analysis in journal publications of NAERE and CON is the descriptive statistics. It was recommended that researchers should also go for more in-depth research that could give room for inferential statistics applications whose results could also inform policy formulation.

Keywords: Evaluation, Statistical Tools, Educational Researchers, Data Analysis, Journal Article, Publications

Introduction

Research is a scientific approach employed to find the solution to problems. The term research in general usage according to Govil, Quasem and Gupta (2015) refers to a search for knowledge. Hansen (2009) defined research as a creative work undertaken on a systematic basis in order to increase knowledge, including knowledge of man, culture and society and the use of this

knowledge to devise new application. It is also defined as the creation of new knowledge or the use of existing knowledge in a new and creative way so as to generate new concepts, methodologies and understanding. According to Erukoha, Emeh and Umoinyang (1995), it is the strategy adopted by scientists to answer questions raised about the world and the processes going on in it. Research seeks to discover the truth about the world. It is goal-oriented, systematic and logical (Umoinyang, 2015).

Research is not confined to science and technology alone, there are vast areas of research in other disciplines such as Humanities, Arts, Social Sciences and Education. Educational research is the systematic application of scientific methods in solving educational problems. It uses both conceptions of social reality and the statistical methods that are considered appropriate for exploring it (Govil, Quasem & Gupta 2015). Educational research refers to the variety of methods in which individuals evaluate different aspects of education including students learning, teaching methods, teacher training and classroom dynamics. Educational research seeks to find relationship among educational variables as a whole, to explain behavioural changes in education, to predict and control the activity of educational system. Since the goal of education is to change learners' behaviour with respect to some stated objective, Umoinyang (2015) noted that educational research provides answers to many of the problems encountered by educators in their attempt to change behaviour. Educational researchers have come to the consensus that educational research must be conducted in a rigorous and systematic way. One of the approaches adopted by educational researchers before embarking on research is to delineate the problem of the study. This is followed by the research questions and formulation of the hypothesis. The hypotheses formulated have to be tested empirically so that their explanations have a firm basis (Cohen, Manion & Morrison, 2005). Data collected for the study need to be arranged and rearranged by breaking them down into constituent parts to enable the research extract new meaning from them. The techniques whereby the researcher exploring manipulates available data/information to expose latent information which would enable a summary description of the subject studied to be made is referred to as data analysis (Nwana, 1982).

Analysis according to Erukoha, Emeh & Umoinyang (1995) is the categorizing, ordering, manipulating and summarizing of data to obtain answers to the research questions and result of hypothesis testing. Analysis of data reduces data to intelligible and interpretable form so that the relations of research problems can be studied and tested (Umoinyang, 2015). Data analysis is enhanced by statistical tools. The statistical tools are technically very essential in the realm of the research. They help in analyzing the data and to draw out conclusions more clearly, precisely and more accurately (Rajasekar, Philominathanet, & Chinnathambi, (2013). Thus, statistic is a rule in scientific research and without the proper application of these rules and procedures for exploration data; it would be difficult to draw valid and reliable conclusions. Statistic is the science and practice of developing human knowledge through the use of empirical data expressed in quantitative form. Statistics is a main tool integrated and accompanied in research in the field of humanities and in any life matter (Abu- Hashem, 2004). This discipline is based on sound theories and is a branch of applied mathematics. Within statistical theory, randomness and

uncertainty are modeled by probability theory. In other words, a researcher can make suitable decisions on research in terms of rejecting or not rejecting the proposed hypotheses using statistical tools. Being able to use statistics in research, the required processes and skills for each kind of research is necessary for every researcher so that correct conclusion may be drawn.

The mastering of statistical tools is of greatest importance for the development of research, accurate data analysis and interpretation of results. Several researchers have carried out survey in educational research in order to evaluate which statistical tool professionals must be acquainted with in order to be able to understand and develop research in their area. There are many surveys on statistical techniques analysis used in studies published by educational and psychological journals. For example, Edgington (1974) reviewed seven journals of the American Psychological Association each year from 1948 to 1972. His result showed that the percentage using ANOVA increased steadily from 1948 to 1972. However, the percentages using t-test and correlation declined. The percentage employing chi-square and factor analysis were about the same throughout the period. Wilson (1980) surveyed American Educational Research Journal (AERJ) between 1969 and 1978. He discovered that approximately 41% of the statistical techniques analyses were biostatistics (such as correlation, multiple regression, discriminant analysis, multivariate analysis of variance). Approximately 34% were agricultural statistics (such as ANOVA/ANCOVA).

In comparing the statistical procedures used in articles published in the Journal of Educational Research (JER), 1970 and 1980, with the exception of descriptive statistics, West, Carmody and Stallings (1983), found more multivariate statistics were used in 1980. The most frequently used statistics in 1970 were correlation, ANOVA, t-test, chi-square, multiple regression, and non-parametric statistics. The most frequently used statistics in 1980 were ANOVA, multivariate, multiple regression and t-test. Goodwin and Goodwin (1985) surveyed statistical techniques used in the Journal of Educational Psychology (JEP) and American Educational Research Journal (AERJ) between 1979 and 1983. The most commonly used statistics in AERJ were ANOVA/ANCOVA, 17%, correlation 12%, descriptive statistics 10%, chi-square/non-parametric statistics 7%, multiple-comparison 6% and t-test 5%. Statistics most frequently used in JEP were ANOVA/ANCOVA 26%, correlation 17%, multiple-comparison 13%, t-test 8% and regression 8%). Elmore and Woehlke (1988) reviewed AERJ, Review of Educational Research (RER) and Educational Researcher (ER) between 1978 and 1987. They discovered that the most frequently used statistics were ANOVA/ANCOVA, descriptive statistics, multiple correlation/regression, bivariate correlation, multivariate and non-parametric statistics. Later they extended their survey to include 1978 to 1998 (Elmore and Woehlke, 1998). The extension changed the ranking of the most frequently used statistics to descriptive statistics, ANOVA/ANCOVA, correlation/regression, qualitative techniques, bivariate correlation and multivariate. The discrepancies between Goodwin and Goodwin (1985b) and Elmore and Woehlke (1988, 1998) were due to the different nature of the articles published in ER (consisting more of interpretative and philosophical articles) and RER consisting mostly of reviews of research). The rankings were almost identical when only the articles in AERJ were considered.

There are various statistical tools used in data analysis. These tools are grouped into parametric statistical tools and non-parametric statistical tools.

The parametric statistical tools include: frequency distribution, Graphs, Measures of Central Tendency and Dispersion, Measures of Relations: Pearson Product Moment Correlation Analysis, Spearman Rank Order Correlation Analysis; Analysis of Difference: Independent t-test, Dependent t-test, Population t-test, Analysis of variance (ANOVA), Profile analysis, Multivariate analysis, Multiple regression, multiple discriminant analysis, Multivariate analysis of variance (MANOVA), Multivariate analysis of covariance (MANCOVA), Analysis of covariance (ANCOVA) and Canonical correlation amongst others. Some non-parametric statistical tools include wilcon, Fred, chi-square, spearman rho, Kendall tau etc. Each of these statistical tools has the aim of extracting from the available data new information of a numerical nature which was not apparently there before (Umoinyang, 2015).

Statement of the problem

Researchers are expected to study their research situation properly and select the most appropriate tool to use for data analysis if the findings of the research are to be dependable. However, most statistical tools used in data analysis are not appropriate for addressing the research interest. It is on the basis of this background that this study was designed to evaluate the statistical tools used by educational researchers in Journal article publications, with the aim of determining the appropriateness of the tools to the research interest addressed.

Research Questions

1. What are the statistical tools used in selected journal article publications?
2. Which of these statistical tools are prevalent in data analysis of journal published articles?
3. What is the appropriateness of the tools used to the research interest?

Method

The study used a survey research type to investigate the statistical tools used by educational researchers in data analysis of journal article publications. The study surveyed journal publications of Educational Research and Evaluation by Nigerian Association of Educational Researchers and Evaluators (NAERE) now ASEREN and Journals of Curriculum Studies by Curriculum Organization of Nigeria (CON) from 2007 to 2015 in different volumes and numbers. Fifty five Journal article publications of Educational Research and Evaluation by Nigerian Association of Educational Researchers and Evaluators (NAERE) now ASSEREN and 15 Journal article publications of Curriculum Studies by Curriculum Organization of Nigeria (CON) were sampled purposively with focus of the empirical studies that could have employed statistical analysis of one type or the other. The sample was made up of a total of 70 publications from the two Journals of interest to the study. The publications were evaluated according to type of statistical tools used for data analysis with the utmost aim of identifying the most prevalent statistical tool in data analysis of journal published articles and the appropriateness of such tools to address the research interest. Frequency counts and percentages were used to analyze the data.

Results and Findings

Results and findings were presented according to the research questions raised earlier

Table 1: Frequency counts and percentages of Statistical tools used in data analysis of published articles in Nigerian Journal of Curriculum Studies (CON) 2007 to 2015

	2007		2008		2009		2010		2011		2012		2013		2014		2015		Total	
	F	%	F	%	F	%	F	%	F	%	F	%	F	%	F	%	F	%	F	%
Descriptive	7	3.8	34	18.4	14	7.6	13	7.0	20	10.8	13	7.0	10	5.4	12	6.5	13	7.0	136	73.5
T-test	1	0.5	6	3.2	4	2.2	3	1.6	3	1.6	0	0.0	2	1.1	1	0.5	4	2.2	24	13.0
Regression	1	0.5																	1	0.5
ANOVA	1	0.5						1	0.5										2	1.1
Z-test			1	0.5					1	0.5	1	0.5		1	0.5		0.0	4	2.2	
Correlation			2	1.1	1	0.5											1	0.5	4	2.2
ANCOVA			2	1.1							1	0.5					0.0	3	1.6	
Improvement index (INI)								1	0.5										1	0.5
Chi Square Score							2	1.1			1	0.5	3	1.6			2	1.1	8	4.3
Z-score																	1	0.5	1	0.5
Factor Analysis																	1	0.5	1	0.5
Total	10	5.4	45	24.3	19	10.3	18	9.7	26	14.1	16	8.6	15	8.1	14	7.6	22	11.9	185	100.0

The result of the analysis as presented in table 1 showed that there are 10 statistical tools used in selected articles published in Nigeria Journal of Curriculum Studies. These are: Descriptive statistics (mean, standard deviation, frequency and percentages), T-test, Multiple Regression, Analysis of Variance (ANOVA), Z-test, Correlation, Analysis of Covariance (ANCOVA), Chi-square, Improvement Index (INI) and Factor analysis.

Table 2: Frequency counts and percentages of Statistical tools used in data analysis of published articles in Nigerian Journal of Educational Research and Evaluation (NAERE) 2007 to 2015

	2007		2008		2009		2010		2011		2012		2013		2014		2015		Total	
	F	%	F	%	F	%	F	%	F	%	F	%	F	%	F	%	F	%	F	%
Descriptive	14	6.5	25	11.6	15	7.0	16	7.4	19	8.8	13	6.0	14	6.5	17	7.9	22	10.2	155	72.1
T-test	3	1.4	3	1.4	2	0.9	2	0.9	2	0.9			1	0.5	1	0.5	2	0.9	16	7.4
Regression	1	0.5	1	0.5		0.0	1	0.5					1	0.5			4	1.9	8	3.7
ANOVA	2	0.9	1	0.5	2	0.9			1	0.5			1	0.5	1	0.5	3	1.4	11	5.1
Z-test			1	0.5	1	0.5	3	1.4							1	0.5	1	0.5	7	3.3
Correlation	1	0.5	2	0.9							2	0.9					3	1.4	8	3.7
ANCOVA													1	0.5					1	0.5
Chi Square Score			2	0.9		0.0	1	0.5	2	0.9	3	1.4	1	0.5			1	0.5	10	4.7
Kendall's Tau			1	0.5															1	0.5
MANOVA																	1	0.5	1	0.5
Need Gap Analysis (NGA)																	1	0.5	1	0.5
Total	21	9.8	32	14.9	20	9.3	23	10.7	24	11.2	18	8.4	19	8.8	20	9.3	38	17.7	215	100.0

The result of the analysis presented in table 2 showed that there are 10 statistical tools used in selected articles published in Nigeria Journal of Educational Research and Evaluation (NAERE). These are: Descriptive statistics, T-test, Multiple Regression, Analysis of Variance (ANOVA), Z-test, Correlation, Analysis of Covariance (ANCOVA), Chi-square, Kendall's Tau and Multiple Analysis of Variance (MANOVA). Tables 1 and 2 also provided answer to Research Question 2. Table 1 revealed that the most prevalent statistics used in selected articles in Journal of Curriculum Studies is descriptive statistics (mean, standard deviation, frequency and percentages) with frequency of 7(70%) in 2007, 34(75.56%) in 2008, 14(73.68%) in 2009, 13(72.22%) in 2010, 20(76.92%) in 2011, 13(81.25%) in 2012, 10(66.67%) in 2013, 12(85.72%) in 2014 and 13(59.08%) in 2015. This was followed by t-test with frequency of 6(13.34%) in 2008, 4(21.05%) in 2009, 3(16.67%) in 2010, 3(11.53%) in 2011 and 4(18.18%) in 2015. Table 2 also showed that the most prevalent statistics used in selected articles in Journal of Education Research and Evaluation is descriptive statistics with frequency of 14(66.67%) in

2007, 25(69.44%) in 2008, 15(75%) in 2009, 16(69.57%) in 2010, 19(79.17%) in 2011, 13(72.22%) in 2012, 14(73.70%) in 2013, 17(85%) in 2014 and 22(56.43%) in 2015. This was followed by t-test with frequencies of 3(14.26%) and 3(8.32) in 2007 and 2008 respectively. The most prevalent statistics after descriptive statistics and t-test are Z-test and chi-square score with frequencies of 3(13.3%) and 3(16.67%) in 2010 and 2012 respectively. The most prevalent statistic in 2015 after descriptive statistic is Multiple Regression with a frequency of 4(10.26).

Discussion of Findings

This study identified and tabulated statistical tools used in data analysis of selected articles published in Nigerian Journal of Education Research and Evaluation (NAERE, now ASEREN) and Nigerian Journal of Curriculum Studies (CON) from 2007 to 2015. It was revealed that 12 different statistical tools were used in 405 articles in which statistics were applied. Among these statistical tools, descriptive statistics which include mean, percentages, frequency distribution, and standard deviation constituted the most prevalent. T-test, Chi-Square Score, Z-test and Multiple Regression Analysis followed closely in that order. It can therefore be said that descriptive statistics are applied in most of the articles published in NAERE and CON. The reason for this could be that descriptive research can be valuable where large datasets in which the volume of information may obscure recognition of basic relationships. Countless pieces of data are collected each day about our education system, student's attendance, classroom participation, assessment results, grades, and disciplinary incidents, school's enrollment, curriculum, class schedules, staff characteristics, and facilities. Descriptive research can be used to distill these datasets into meaningful dimensions, inform and improve decision-making. Good descriptive analysis can improve understanding about important phenomena. This finding agrees with the findings of Govil, Qasem & Gupta (2015) who carried out a study on the statistical methods used in Ph.D. thesis of Social Science in Indian Universities and found that 90% of the study employed descriptive statistics. It is slightly different from the findings of Hsu (2005) who carried out a study on research methods and data analysis procedure used by educational researchers and found that 29% of the journal articles survey used descriptive statistics, 23% ANOVA/ANCOVA and 13% correlation. The prevalence in the used of descriptive statistics could be for obvious reasons; it is easy to employ and it is also easy to interpret. Descriptive statistic is comparatively easier and less rigorous in application. The study revealed that the statistical tools employed in data analysis of journal article publication were appropriate in terms of sample size, number of variables and designs of the study

Conclusion and Recommendations

Statistical tools are technically very essential in the realm of research. They help in analyzing the data and to draw out conclusions more clearly, precisely and accurately. The mastery of statistical tools is of greatest importance for the development of research, accurate data analysis and interpretation of results. The result of data analysis for this study showed that 10 different statistical tools were used in data analysis in selected articles published in NAERE and CON journals. It also revealed that the most prevalent statistical tool in the selected journal publications is the descriptive statistics. The potential of descriptive statistics to inform policy,

practice, and research is important, given the recent availability of large and complex datasets that are relevant for understanding education issues. Based on this, it was recommended that researchers should also go for more in-depth research that could give room for the use of inferential statistical tools

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