

Analysis of statistical applications in education research in the universities of Sindh, Pakistan

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Abstract: Universities are meant to create knowledge and archive for future well-being. Statistics being interpretational tool holds paramount importance to analyze data, however, the issues of its applications in the paradigm of educational research is less prevalent in social sciences as compared to sciences. The purpose of this study is to focus on all those factors related to statistic application, which hamper scholar of using this tool in their educational research in Sindh province of Pakistan. Stratified random sampling design was applied to highlight this issue and study was conducted on a population of 320 M.Phil. and Ph.D. students, 120 were taken as sample comprising 57% of female and 43% male. Data was collected through a self-made Likert three-point categorical questionnaire (agree, disagree, undecided). MS Excel sheet was used to analyze and interpret data. Among the major findings of our study includes student either don't have or have very low level previous knowledge as well as no expertise of statistics application and concept. Inclusion of statistics tool in the course work is recommended along with proper training of the supervisory staff in the domain of fairly advance level statistics.

Key words: *Education; Research; Statistic; Sample probability*

1. Introduction

The word "Research" means a systematic and careful analysis of something or some process to institute facts generally known as laws or principles. According to Harris and his team [1] scientific methods consist of systematic observation, classification and interpretation of data i.e., a sequence of process in which nearly all are engage is called as research. Statistic is the main scientific discipline dealing with such issues both in social sciences and in sciences. Obviously all research, one way or the other produces quantitative numerical data and statistics being body of mathematical techniques is capable to select, organize, analyze and interpret the same. Moreover, statistical methods serve to describe analysis in efficient manner with significant impact of produced results. Statistical applications substantiate understanding of complicated data, by making it simple and logical [2]. Statistics knowledge and applications are helpful in collecting samples as well as subsequent analysis and explanations. Therefore, statistics is a dire need for researchers with regards to their study composing of collecting, analyzing and interpreting data. In fact, it has established itself as a distinctive entity required essentially for qualitative studies and help professional performing their task effectively. Statistical techniques are largely employed to find out valid results and to predict the future values of a phenomenon, as well as for solution of various

difficult problems related to education and beyond education. A connection between students' success in studies and statistics has been confirmed by many studies [3].

Unfortunately, as statistical processing requires mathematical background, it is an area that is often approached with discomfort and anxiety. Having no proper understanding and approach of the subject, research students are more shy and phobic towards statistical courses and thus remain handicapped which leads to their poor performances [4-6]. Published data reveals that negative attitude towards a particular course explains significant variation in learning of students and hence influence the future selection of advance course in concern area of learning [7]. Roberts and Bilderback in 1980 compiled a study showing that majority of the student who take statistics course are scared and anxious. Latter on other educators found same kind of finding in university student [8]. Other studies such as student negative attitude towards Statistics, value and usefulness of statistics, interpretation of statistics, as well as fear and anxiety testing of statistics have been compiled [6, 9-10]. Murtonen & Lehtiner, in 2003 pointed out that usually student of research possesses minimum level understanding and concept of statistics and are helpless when deal in practical research [7]. Onwuebuze and Wilson pointed out that lack of understanding statistics leads to anxiety and stress when involved in research [8]. Anxiety and stress, being the leading cause of lack of conceptualization and could lead to failure in the subject of statistical application as

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pointed out by Gal and Ginsburg [11]. Research studies pointed out that statistical issue among students of universities are rampant [12-14]. Issues might be due to many factors as Zeidner in 1991 reported that lack of previous knowledge in Mathematics and a poor concept of self-efficacy lead to in-appropriate subject command [6]. Garfield and Ahlgren stated that insufficiency in Mathematics abilities and theoretical analysis are the main factors in conceptualization of statistical knowledge and skills [15].

Usually statistics has been taught as a theoretical subject in most of the universities in Pakistan and in particular in Sindh, without focusing on its application. Statistics education is the key to better the learning of many discipline that's why it is an emerging field possessing unique importance. Lacking basic expertise in statistics, causes may issue with regard to sampling, analysis and interpretation of findings properly. The basic motive for this study was to examine the factors that causes stress and failure in research students in education at M.Phil. and Ph.D. programs, in the Sindh province in Pakistan. This endeavor investigated, analyze these issues and plausible recommendations are made based on the findings. These identified factors in connection to statistical technique capabilities may have theoretical and practical implications [16]. This study was designed particularly to know the factor which leads to statistics phobia in educational research at the university level in the province of Sindh Pakistan and to recommends proper solutions. The major objective of this study was to verify the domains of statistical issues in the research learners and educators in the universities of Sindh.

2. Methodology

2.1 Sample

The population of the study comprised of all students of M.Phil. and Ph.D. programs enrolled in Education Departments at the university level in the Sindh province. Stratified random sampling was adopted and a total of 120 students; 56% female and 45% male were involved in this study. Sample is presented in Table 1.

The students were also asked to show their socioeconomic background and education of their parents through close option questions. More than 90% student showed that their socioeconomic status and level of parents' education was average. In terms of the Grade Point Average 80% student showed GPA of 3-3.5, 10% indicated more than 3.5 and remaining 10% indicated less than 3.0.

2.2 Design of the study

Original version consisted of 30 items that were created on a Likert type three-point scale which was reduced to 16 after removal of inconsistent items and applied on a random sample of 120 research

students. Likert type scale 16 instruments numbers (In. No), covering various statements about the issue. Instrument numbers are presented in Table 2. The majority of the instruments designed to measure these factors, have been focused on statistics. The data was collected through a questionnaire administered to the students asking to opt for any of the three option (agree, disagree and undecided). Students were contacted once, therefore, it may also be considered as pilot study with cross-sectional design. Null hypothesis was defied and tested through statistic-test [17].

2.4 Statistical procedures

Statistical Application in Education (SAE) in the universities of Sindh was investigated through a self-administered 3-point Likert scale questionnaire. An initial pool of 30 items (instrument number) regarding SAE was constructed and examined preliminary, for reliability and internal consistency. Total score and the product-moment coefficient were calculated item wise and those items were removed whose coefficient was less than 0.50 or less associated and a total of 16 items remained. Coefficient of 0.50 was considered sufficiently high to assume a strong relationship. Finally, sixteen instruments (16 items) were developed to analyze SAE issue [20].

Data was collected and subjected to analysis through MS Excel sheet. Sample variance (S^2), standard deviation (S), χ^2 (chi square), Φ (association) and p-values (probability significance) were calculated. The null hypotheses (H_0) constructed was "there *is no major dissimilarity in views of M.Phil. and Ph.D. research students regarding application of statistics in educational research at the universities in Sind*" with respect of each item of the instrument, subsequent points view were collected. The data was discussed and explained in descriptive form. Significance level (α) of 0.05 was used with degree of freedom (df) of 2. Null hypothesis was tested statistically and these results were interpreted and recommendations were made based on these results. The values obtained were verified by applying following formulae [19-20].

$$\chi^2 = \sum \frac{(f_o - f_e)^2}{f_e} \quad (1)$$

Where, \sum = Sum, f_o = Observed frequency, f_e = Expected frequency

Level of significance $\alpha=0.05$

Degree of freedom (df) = 2

Equation for measuring association (ϕ)

$$\Phi^2 : \chi^2/n \quad (2)$$

Where, χ^2 = chi square, n = number of item (sample)

Equation for sample variance (S^2)

$$S^2 : \sum (x - \bar{x})^2 / n - 1 \quad (3)$$

Where, \sum = Sum, x = individual measurements, \bar{x} = mean of measurements, n = number of item (sample)

Equation for sample standard deviation (S)

$S: \sqrt{s}$

(4)

Table 1: Sample size and proportion

Gender	Public universities students	Private universities students	Total	Percentage
Male Students	30	20	50	42.7
Female Students	30	40	70	58.3
Total	60	60	120	100

Table 2: Instruments of the study questionnaire

Instrument. No	Statement
1	Statistics provides visual glance of the data through graphical representation
2	Present course of Statistics programs at M.Phil and Ph.D develop broad based mental development of learners
3	There is need to modify M.Phil and Ph.D Statistics courses
4	Teachers of Statistics are not trained according to the latest teaching strategies and techniques
5	Present statistical tools and techniques create interest among M.Phil. and Ph.D. students
6	Lack of basic knowledge causes problems in further understanding of the concept of statistics
7	Unawareness of statistical software creates problem for researcher
8	I can understand all statistical terms that I face in research
9	Analyzing the data through Statistics is easy
10	Statistics provides useful interpretations of data
11	Present course of Statistics at M.Phil and Ph.D programs do not fulfill future needs of research
12	Accuracy in the result depends largely upon the data collection
13	Homogeneous groups have been arranged and utilized easily through statistics
14	Standard deviation is used for "spread" between two groups
15	Statistics reduces a mass of figures into a simple understandable form.
16	Use of statistics in my study make me nervous

2.3 Null and alternate hypothesis

A null hypothesis (H_0) was defined for this study as "there is no major dissimilarity in views of M.Phil. and Ph.D. research students regarding application of statistics in educational research at the universities in Sind with respect of each item of the instrument". The frequency for three option categories would be $f_1=f_2=f_3$. An alternate hypothesis (H_a) would means "there is a major dissimilarity in view of student regarding application of statistics in the concerned domain". The frequency for three option categories would be $f_1 \neq f_2 \neq f_3$ [18].

3. Results and discussion

In order to documents the reliability of the SAE measurement and its internal consistency, fourteen (14) items were deleted from original version of instruments. The remaining 16 item on the scale accounted for more than 70% of the total variance and a coefficient of more than 0.8500 was obtained which is satisfactory [21]. Details of the responses and data are listed in the in Table 3. IN-6 "Lack of basic knowledge causes problem in understanding concept of statistics" produced sample variance of 46.8 with standard deviation of 4.0. P-value is highly significant at 0.05 level. Sample variance of 21.8 is shown by IN-4 which is about the training and technique of teacher in statistics. Student strongly suggested teacher training in this domain. IN-2 exhibited about 16.0 sample variance which states "statistic course at present research level do not

develop broad based learning" followed by 11.8 sample variance each of IN-11 and IN-10 which argues present statistical course do not fulfill future needs in research. Although, student understand that statistics provide useful interpretations of data as is evident from highly significant P- Values of IN-1 to 4, IN-8, and IN-16. All the sixteen instruments were significant at 0.05 level. Association of 0.54, 0.6, 0.54 and 0.74 was noted for IN-1, 2, 3 and 4 respectively which argues about the low standard statistics curriculum, low level command on statistics and low level teacher expertise on the subject. IN-6 which is significantly visible on the data table shows an association of 0.64, in addition pretty useful association was noted for IN-8 and IN-16 being 0.54 and 0.56 respectively. Student view to understand statistical terms were negatively voted as shown in Table 3 and it might be the reasons that a strong positive response was achieved for IN-16 which states "Use of statistics in my study make me nervous". On all the sixteen instruments the standard deviation ranged between 1.7-4.6 which granted low variation of opinion of student on a particular item while p-values of >0.000001 argues the distribution of sample away of the null point. The values of χ^2 , p-values, and S^2 for all the cases provide a valid logic to reject the null hypothesis and go for the alternative.

This study reveals that all the nineteen instruments were significantly related to statistics knowledge and application as a real issue in the faculty of education in Sindh universities. The current study based on the SAE measurement

indicated that students do understand the importance of statistics in their research but lack the basic concept and training to get them apply for fruitful, intended results. It is strongly recommended that teacher should be equipped with basic concept and application of statistics so that they may be able

to adopt special modifications to communicate about statistics skills in research, thereby fostering a deeper appreciation of this subject. This study provides distinctive profiles of students who find research problematic as is evident in IN-16 responses.

Table 3: Instrument responses and subsequent statistical interpretation

Instru- ment No	Expected value	Observed value			p-value	P < or > α (5×10^{-2})	obsX ²	Φ	S ²	S
		Agee	Disagree	Undecided						
1	40	70	30	20	2.5×10^{-8}	$P < \alpha$	35	0.54	11.8	3.4
2	40	75	30	15	2.6×10^{-11}	$P < \alpha$	49	0.6	16.3	4.0
3	40	10	50	60	2.5×10^{-8}	$P < \alpha$	35	0.54	11.8	3.4
4	40	80	30	10	7.6×10^{-15}	$P < \alpha$	65	0.74	21.8	4.6
5	40	55	30	35	1.2×10^{-2}	$P < \alpha$	9	0.27	2.9	1.7
6	40	20	80	20	9.3×10^{-14}	$P < \alpha$	50	0.64	46.8	4.1
7	40	20	40	60	4.5×10^{-5}	$P < \alpha$	20	0.41	6.72	2.6
8	40	35	75	10	2.1×10^{-12}	$P < \alpha$	54	0.66	18.1	4.2
9	40	45	60	15	1.9×10^{-6}	$P < \alpha$	26	0.46	8.8	2.9
10	40	60	50	10	2.5×10^{-8}	$P < \alpha$	35	0.54	11.8	3.4
11	40	60	25	35	2.9×10^{-4}	$P < \alpha$	16	0.36	5.4	2.3
12	40	35	30	55	1.2×10^{-2}	$P < \alpha$	9	0.27	2.9	1.7
13	40	50	45	25	1.2×10^{-2}	$P < \alpha$	9	0.27	2.9	1.7
14	40	35	30	55	1.2×10^{-2}	$P < \alpha$	9	0.27	2.9	1.7
15	40	55	50	15	6.9×10^{-6}	$P < \alpha$	24	0.44	8.0	2.8
16	40	65	45	10	3.8×10^{-9}	$P < \alpha$	39	0.56	13.0	3.6

The future needs and exploration of the relationships between research in education and statistics is an important area needs to be examined. The very prominent challenges that SAE in education faces, is the practical understanding and applications of statistics by teachers and subsequently by students. it was noted that curriculum as well as teacher were not equipped enough to make educational research in line with statistical application and it would be useful to note the overall process of teacher training in statistics on practical grounds. Teacher lacks basic skills and concept about this issue, therefore, teachers should be trained keeping in view the changes made in the curriculum. Basic foundation course in this subject may be helpful to accelerate advance level of learning of statistics. Need based training modules of Statistics may also be an alternative short term solution. Seminars for application of statistics in research may be arranged time to time. This is an effective way of not only letting students know the overall statistics features and applications but also generate acquaintance of day today trends in it. This helps student adapt themselves to the advancement in the field of statistics.

4. Conclusion

Previous skills and competencies of statistics are poor in almost all the research students. Student view about the curriculum need to be revised and should include statistic course complying to the needs of researchers. Hypothesis stands undisputed among the male and female scholars, owing to involvement in same learning procedure. From analyses, it was concluded that majority of students know the importance of statistics in their research

projects but cannot apply to the fruitful results and needs to be groomed on practical aspects of statistics. Due to mathematical background student feel nervous and anxious when deals with statistic and a basic training in this area is recommended. One of the major outputs of this research is that students are not satisfied with teaching strategies of statistics and supervisor training and education is the need of the hour in this regard.

Conflict of interest

All the authors declare that there is no conflict of interest.

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