

# Assessing the Statistical Competency among University level Postgraduates

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**Abstract:** The present study was carried out to determine the level of statistical competency among post graduate students and identify the strength and weakness in dimensions of statistical competency aspects of the post graduate students. The study is quantitative in nature. The descriptive survey method was utilized in this study. A sample of 80 post graduates was selected using simple random sampling technique. The current study adapted a standardised ‘Statistical Competency test’ constructed by Govil, Qasem and Gupta to measure the statistical competency of post graduates. To analyse the data both descriptive and inferential statistical techniques were used. Findings indicated that the respondents had a below average levels in overall statistical competency. The post graduate students have strong statistical competence in the dimensions of understanding of basic statistical concepts, followed by interpretation of descriptive statistics. More than 50 % of post graduate students have poor understanding in the measuring and interpreting coefficient of correlation, use of various parametric methods and use of various non-parametric methods. On the other hand 81% of students are weak in explaining the results and 61% of post graduate students are weak in selecting the appropriate statistical methods and weak in explaining the results.

**Keywords:** Statistics, Competency, Post graduate students, Central University, State University

## Introduction

Scientific research nourishes the world, enhances progress in all aspects of societal life, facilitates continuous learning and increases the wealth of knowledge. It acts as a tool to understand the problems systematically and work efficiently to resolve the issues and create awareness by disproving the lies or supporting the truths. Research is conducted by both professionals and

non-professionals to equip them with the knowledge and skills required to survive their lives. In the academic world, an individual conducting research showcases the researcher’s passion, in-depth love, curiosity, and knowledge in the specific subject areas. Professional research competencies is evidenced by the researcher ability to demonstrate knowledge in identifying researchable problem, developing research questions and research hypotheses, reviewing relevant literature, matching purpose, design and methods, applying appropriate statistical techniques, interpreting results and finally, effectively communicating the research findings (Mahmud & Zainol, 2008) to the world. Advancements of science are based on theory building and theory testing. If the collected data are not analysed properly and do not provide a meaningful construction then valuable theories building become invaluable. Statistics plays a pivotal role to provide accurate, reliable evidence to understand in which phenomena the theory works best.

According to the figures compiled by All India Survey of Higher Education (AISHE) by the HRD Ministry report(2018-19) “the total enrolment in higher education has been estimated to be 37.4 million, at undergraduate level the highest number (35.9%) of students are enrolled in Arts/Humanities/Social Sciences courses followed by Science (16.5%), Engineering and Technology(13.5%) and Commerce (14.1%). About 79.8% of the students are enrolled in undergraduate level programmes. Post Graduate level maximum students are enrolled in the Social Science stream. Only 1, 69,170 students are enrolled in Ph.D. that is less than 0.5% of the total student enrolment and maximum numbers of students are enrolled in Science stream”. It is understandable from the above facts throughout India too few post graduates are registering for Ph.D. programmes. As rightly

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remarked by Pushkar (2018) without sufficient emerging researchers, India's research capabilities will remain deficient and hurt the competitiveness of Indian universities in global university rankings. Without providing sufficient competency in statistics and research methodology in the post graduate level production of quality research and excellence in research competency in Ph.D. programmes and research excellence will remain only as a dream.

The programmes at postgraduate level are often designed to provide participants with advanced academic and/or professional knowledge, skills and competencies, leading to a second degree or equivalent qualification in higher education and the programmes at this level are theoretically based, but may have a substantial research component (Indian Standard Classification of Education report, 2014). From this it is understood for the successful completion of the post graduate programmes one of the criteria or requisite is to conduct the original research in their related discipline and submit the dissertation. Al-Habashneh & Najjar (2017) remarked "it is known to be the main resource for the scientific research for they contain additions to the specialised additional knowledge".

To conduct the scientific research, researchers have to frame the fundamental assumptions, research questions and answer them by adopting the proper scientific methodology. For proving the research objectives of the study researcher has to examine the methods, choose the data carefully and equip their skills to interpret the results from the findings of the data. Keeping the need in view and to equip the student's statistical potential stakeholders included a paper on statistics in post graduate programmes. With the help of this statistics course students would have acquired adequate statistical knowledge, skill and competencies. Having the statistical literacy students will be able to answer their research questions efficiently by managing the data set, use the various appropriate statistical tests, reach conclusive findings, interpret and explain the results and report them.

According to Rumsey (2002) "Statistical competence" refers to the basic knowledge that underlies statistical reasoning and thinking, and "statistical citizenship" refers to the ultimate goal of developing the ability to function as an educated

person in today's age of information. It involves understanding and using the basic language and tools of statistics: knowing what statistical terms mean, understanding the use of statistical symbols, and recognizing and being able to interpret representations of data. It involves the following components:

1. Data awareness,
2. An understanding of certain basic statistical concepts and terminology,
3. Knowledge of the basics of collecting data and generating descriptive statistics,
4. Basic interpretation skills (the ability to describe what the results mean in the context of the problem),
5. Basic communication skills (being able to explain the results to someone else).

Most countries widely recognised the importance of statistical competencies in enhancing student's lives, so they included statistics as a part of the mathematics curriculum in the school stages. It is understood that the causes for postgraduate statistical anxiety, specifically social science, is because, once they have moved away from school they have no opportunity to work with numbers and improve their computation skills for so long and continue their learning in the different dimensions. Students entering in social science and education disciplines often do not have a strong mathematics background and often dislike anything "mathematical". The threats of working with numbers cause anxiety among the students in statistics. This produces a negative attitude among postgraduates towards statistics.

A good researcher is supposed to have enough knowledge in research methodology and statistical competence to contribute to the real world. But post graduates face many challenges and anxiety while using statistical knowledge. Recognising the post graduates lack of statistical competency and statistical anxiety made researchers conduct a study of this nature. This study sought to determine the level of statistical competency and identify the strength and weakness in dimensions of statistical competency among post graduate students.

Many studies have been conducted to explore the attitude towards statistics and use of statistical techniques in the medical field. Studies to assess the level of statistical competency among post graduate

students are very limited. Few studies are given below: Parveen et al. (2015) found the level of statistical competency of post-graduate students was below than average level and they performed most effectively in the dimension ‘basic understating of statistical concept’ but were very poor in ‘using non-parametric statistics. Qasem et al. (2015) found that the level of statistical competency of Yemen post graduate students was significantly higher than their counterparts of India. Qasem (2012) found that there was a lack of statistical competencies among post graduate students. Mahmud and Zainol(2008) found that students with little background in statistics had difficulty in identifying the relevant and appropriate statistical tools for their study. Godino et al. (2007) found the future teachers show conceptual and procedural competence, but they lack interpretive and application skills. Baloglu (2003) found that older students have more positive attitudes towards usefulness of statistics but they also tended to have higher levels of statistical anxiety. Praveen et al.(2015) revealed that participants were lacking in statistical competencies and were having misconceptions regarding statistical topics. Obrial & Lapinid (2020) found students showed very low levels of statistical understanding and performance. Padmavathy(2020) found female postgraduates studying in central university from science stream with age group above 21 and less than 23 showed more competence in all dimensions and statistical methods than their counterparts. The previous studies helped the researcher to understand the nature of studies conducted in this area. On the basis of the research gaps identified, the researcher formulated following research questions for investigation

- Do postgraduate students in universities differ in the levels of overall statistical competency and its dimensions?
- What is the level of difference in the overall statistical competency and its dimensions among postgraduate students in the universities?
- What are the strong and weak dimensions in statistical competency among the post graduate students studying in state and central universities?

### Materials and Methods

In this current study a descriptive survey method was adopted to collect the data. The study is quantitative in nature. All the social science post graduates

studying in different universities of India were considered as the population of the study. A sample of 80 postgraduate students from two universities among the huge population with age group of 21-25 years was selected using simple random sampling technique out of which 40 are from state university and 40 are from central university. The study is confined to the social science postgraduate students studying in different types of university. The current study adapted a standardised ‘Statistical competency test’ constructed by Govil, Qasem and Gupta (2015) to measure the statistical competency of post graduates. The research instrument consisted of 60 multiple choice items comprising seven dimensions. The tool validity was determined by ‘content validity, discrimination validity and construct validity and has high reliability coefficient of 0.89. The obtained data was tabulated and analyzed with the help of SPSS 22. To analyse the data both descriptive and inferential statistical techniques were used.

### Results

The hypotheses raised for the study were tested and the results were presented below

Research Question 1: Do postgraduate students in the universities differ in the levels of overall statistical competency and its dimensions?

**Table 1:** Descriptive statistics for different level of Statistical Competency among Postgraduate students in universities

Statistical Competency (N=80)	Mean	S.D	Percentage			
			Weak	Below Average	Average	Above Average
Understanding the Basic concepts	7.98	1.66	0	22.5	31.25	46.25
Interpretation of Descriptive Statistics	6.00	1.47	0	38.75	18.75	42.5
Measuring and interpreting Coefficient of Correlation	4.31	1.28	0	30	53.75	16.25
Use of various Parametric Methods	3.04	0.89	0	32.5	36.25	31.25
Use of various Non-Parametric Methods	2.54	0.72	0	60	26.25	13.75
Explaining the results given by statistical programs as SAS, SPSS etc.	1.50	0.90	48.75	47.5	3.75	0
Selecting the appropriate Statistical Methods	2.20	0.83	43.75	35	21.25	0
Overall Statistical Competency	27.44	3.547	0	66.25	30	3.75

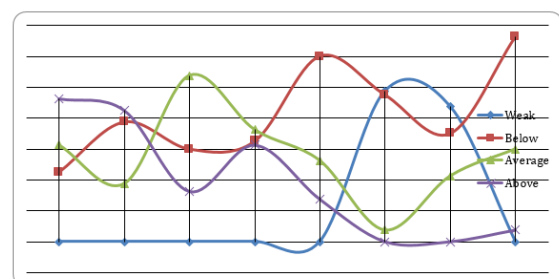


Figure 1: Level of Statistical Competency among Postgraduate students in universities

As apparent from Table 1 and Figure 1, it is found that 66.25% of the postgraduate students fall in below average category and 30% fall under average level in overall statistical competency 3.75 % of the post graduate students reported above average level in statistical competency. However, more than half percentage (66.25%) of the postgraduate students falls in below average levels in overall statistical competency. However, the post graduate students overall statistical competency is below average.

Considering the dimensions many students' falls in the above average category for the understanding the basic concepts, interpretation of descriptive statistics; and post graduates falls in the average category for measuring and interpreting coefficient of correlation , use of various parametric; Regards in the dimension 'Use of various Non-Parametric Methods' postgraduates' falls in the below average category and for the dimension 'explaining the results given by statistical programs as SAS, SPSS etc .and selecting the appropriate statistical methods' post graduates showed the weak statistical skills.

**Research Question 2:** What are the strong and weak dimensions in statistical competency among the post graduate students studying in state and central university?

**Table 2:** Descriptive statistics showing the strongest and weakest aspect of Statistical Competency and its dimensions among post graduate students

Statistical Competency		Post graduates Percentage of Achievement						
		State University (N=40)		Central University (N=40)		Overall (N=80)		
		Achieved %	Error %	Achieved %	Error %	Achieved %	Error %	Rank
Dimensions	Understanding the Basic concepts	58	41	66	34	62	38	I
	Interpretation of Descriptive Statistics	54	46	56	44	55	45	II
	Measuring and interpreting Coefficient of Correlation	42	58	42	58	42	58	V
	Use of various Parametric Methods	41	59	46	54	44	56	III
	Use of various Non-Parametric Methods	40	60	46	54	43	57	IV
	Explaining the results given by statistical programs as SAS, SPSS etc.	15	85	23	77	19	81	VII
	Selecting the appropriate Statistical Methods	37	63	41	59	39	61	VI
Overall Statistical Competency		46	54	47	53	47	53	

As apparent from Table 3, that

The first dimension "Understanding of basic statistical concepts' encompasses 13 items to examine the post graduate students' understanding of descriptive and inferential statistics, levels of

measurement and variables and hypothesis. An average post graduate student is able to score 8 marks out of 13 with standard deviation 1.96. This result reveals that 58 % post graduate students studying in state university and 66 % in central university achieved competency in this dimension, while 41% postgraduate students studying in state university and 34% in central University lack in this dimension.

The second dimension "Interpretation of Descriptive Statistics' encompasses 11 items to examine the post graduate students' understanding of calculation and interpretation of descriptive statistical methods. An average post graduate student is able to score 6 marks out of 11 with standard deviation 1.5. This result reveals that 54% post graduate students studying in state University and 56% in central University achieved competency in this dimension while 46% postgraduate students studying in state University and 44% in central University lack in this dimension.

The third dimension, "Measuring and interpreting Coefficient of Correlation" encompasses 10 items to examine the post graduate students' knowledge of selecting the appropriate correlation method and their ability to interpret the results An average post graduate student is able to score 4 marks out of 10 with standard deviation 1.4. This result reveals that 42 % post graduate students studying in both state and central achieved competency in this dimension while 58% postgraduate students studying in state and central university lacked in this dimension.

The fourth dimension "Use of various Parametric Methods' ' encompasses 7 items to examine the post graduate students' basic understanding and application of parametric methods. An average post graduate student is able to score 3 marks out of 7 with standard deviation 0.9. This result reveals that 41 % post graduate students studying in state university and 46 % in central university achieved competency in this dimension while 59% postgraduate students studying in state university and 54% in central university lack in this dimension.

The fifth dimension "Use of various non-parametric Methods' ' encompasses 5 items to examine the post graduate students' knowledge about the use of non parametric methods. An average post graduate student is able to score 2.5 marks out of 5 with standard deviation 0.8. This result reveals that 40%

postgraduate students studying in state university and 46 % in central university achieved competency in this dimension while 60 % postgraduate students studying in state university and 54 % in central university lack in this dimension.

The sixth dimension “Explaining the results given by statistical programs as SAS, SPSS etc.” encompasses 8 items to examine the post graduate students knowledge about statistical programs and explaining the results. An average post graduate student is able to score 1.5 marks out of 8 with standard deviation 0.9. This result reveals that 15 % post graduate students studying in state university and 23% in central university achieved competency in this dimension while 85% postgraduate students studying in state university and 77% in central university lack in this dimension.

The seventh dimension “Selecting the appropriate Statistical Methods' ' encompasses 6 items to examine the post graduate students ability to select the statistical methods. An average post graduate student is able to score 2 marks out of 6 with standard deviation 1.08. This result reveals that 37% post graduate students studying in state University and 41 % in central university achieved competency in this dimension while 63 % postgraduate students studying in state university and 59% in central university lack in this dimension.

More than 50 % of post graduate students have poor understanding in the measuring and interpreting coefficient of correlation, use of various parametric methods and use of various non-parametric methods. On the other hand 81% of students are weak in explaining the results given by statistical programs such as SAS, SPSS etc. and 61% of post graduate students are weak in selecting the appropriate statistical methods.

Hence, comparing the achieved scores revealed the post graduate students studying in state and central university have strong knowledge in the dimension of understanding the basic concepts, followed by interpretation of descriptive statistics, use of various parametric and non parametric methods; measuring and interpreting coefficient of correlation and weak in explaining the results given by statistical programs as SAS, SPSS etc .and selecting the appropriate statistical methods.

## Discussions

Research is essential core component of post graduate studies and prerequisite pathway to conduct a original, unique and novel discoveries. These researches require conducting in the scientific way using a systematic process for the contribution and welfare of the society. From the above analysis the findings of the study can be summarized as here: the current study found that more than half of the postgraduate students fall in below average levels in overall statistical competency. However, the post graduate students overall statistical competency is below average. This findings consonance with the findings of Parveen et al.(2015),Qasem et al. (2015), Obrial & Lapinid (2020) and Padmavathy(2020). The post graduate students have strong statistical competence in the dimensions of understanding of basic statistical concepts followed by interpretation of descriptive statistics, use of various parametric and non parametric methods; measuring and interpreting coefficient of correlation and weak in selecting the appropriate statistical methods, Explaining the results given by statistical programs as SAS, SPSS etc. Researcher wants to highlight that the samples have very less knowledge measuring and interpreting coefficient of correlation and weak in selecting the appropriate statistical methods, explaining the results given by statistical programs as SAS, SPSS etc. This is very dangerous situation for the research, researcher and research community. The researcher recommends all the statistics professors, stalk holders to diagnose their students statistical competencies in the beginning of their courses, plan the class delivery according to the students capacity, promote data awareness using relevant context and stress the importance of statistical reasoning and thinking skills since these post graduates are future researchers, research scientist and professors of Universities.

## Conclusions

In conclusion the findings of the study indicated that post graduate students overall statistical competency is below average level. This situation alarms the dangerous sign and calls all the stakeholders and requires immediate attention. The inability of the researcher to answer the research problems by adopting proper data collecting, analysis using appropriate statistical tools, giving an adequate result, misleading interpretation of result findings and recommendation not only lead the researcher's trustworthiness, it also harms the research society and negatively impacts real world development. Among other things, all the stakeholders of the

research community should come forward to enhance the higher order thinking skills, higher level interest in statistical competency and sensitize the importance of statistical literacy.

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Conflict of interests

The author declares no conflict of interest

### References

- Al-Habashneh, M.H., & Najjar, N.J. (2017). Constructing a Criterion Referenced Test to Measure the Research and Statistical Competencies of Graduate Students at the Jordanian Government Universities. *Journal of Education and Practice*, 8(2), 67-81. <https://eric.ed.gov/?id=EJ1131564>
- Baloglu, M., (2003). Individual differences in Statistics anxiety among college students. *Personality and Individual Differences*. 34(5), 855-865. [https://psycnet.apa.org/doi/10.1016/S0191-8869\(02\)00076-4](https://psycnet.apa.org/doi/10.1016/S0191-8869(02)00076-4)
- Godino, J.D., Roa., & Wilhelmi, M.R. (2007). Assessing the Statistical Competencies of Primary School Students Teachers. 56<sup>th</sup> Conference on Statistical Education. Lisbon, Portugal. [https://iase-web.org/Conference\\_Proceedings.php?p=ISI\\_56\\_2007](https://iase-web.org/Conference_Proceedings.php?p=ISI_56_2007)
- India Survey of Higher Education (AISHE) by the HRD Ministry report, (2018-19). Department of Higher Education, Ministry of Human Resource Development, Government of India, New Delhi. <https://ruralindiaonline.org/en/library/resource/all-india-survey-on-higher-education-2018-19/>
- Indian Standard Classification of Education Report. (2014). Department of Higher Education, Ministry of Human Resource Development, Government of India, New Delhi. <https://www.education.gov.in/en/indian-standard-classification-education-2014>
- Mahmud, Z. A. (2008). Examining Postgraduate students Perceived Competency in Statistical Data Analysis and their Attitudes Towards Statistics. *International Journal of Education and Information Technologies*, 2(1), 79-83. <https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&ved=2ahUKEwiIuLbn2NHxAhX8>
- Obrial, J T. and Minie Rose Caramoan Lapinid (2020). The Use of Statistical Investigation in Assessing Students' Performance in Statistics. *Action Research and Innovation in Science Education*, 2020, 3(2), 47-54.
- Padmavathy, R.D. (2020). Examining Postgraduate Students Competencies in Various Dimensions of Statistical Methods. *International Journal of Management*, 13(10), 2312-2323.
- Parveen, S., Govil, P. & Gupta, S. (2015). Efficiency in statistical methods among post-graduate students of Social Sciences. *International Journal of Research in Economics and Social Sciences*. 5(12)1-10. [https://www.academia.edu/20412140/Efficiency\\_in\\_statistical\\_methods\\_among\\_post\\_graduate\\_students\\_of\\_Social\\_Sciences](https://www.academia.edu/20412140/Efficiency_in_statistical_methods_among_post_graduate_students_of_Social_Sciences)
- Pushkar, S. (2018). Fraction of PhD students has been mostly constant, and low, in last decade. *Science The Wire*. <https://science.thewire.in/education/india-phd-student-aishe-2018-report-higher-education/>
- Qasem, M.A., Abdulrahman, A.N., & Punita, G. (2012). Constructing a criterion – referenced Test for measuring the Statistical Competencies of post graduate students in Educational Colleges in Yemini Universities. M.A. Thesis, Yemen King Saud University. <https://eric.ed.gov/?id=ED538980>
- Qasem, M.A., Govil, P., & Gupta, S.A. (2014). Statistical Competency Test (Manual). Agra Psychological Corporation, Agra. [https://www.scirp.org/\(S\(351jmbntvnsjt1aadkpozje/reference/ReferencesPapers.aspx?ReferenceID=1409744](https://www.scirp.org/(S(351jmbntvnsjt1aadkpozje/reference/ReferencesPapers.aspx?ReferenceID=1409744)
- Qasem, N., Govil, P., & Gupta, S. A. (2015). Comparative Study of the levels of Statistical Competency among Post-graduate students of the University of Yemen and India. *Open Journal of Social Sciences*, 3(2), 130 - 137. <https://m.scirp.org/papers/54054>
- Rumsey, D.J. (2002). Statistical Literacy as a Goal for Introductory Statistics Courses. *Journal of Statistics Education*, 10(3), 1-12. <https://doi.org/10.1080/10691898.2002.11910678>