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Integrating Technology to Improve Research Competencies through SPSS Practical Training

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Abstract: The aim of this study was to investigate the effectiveness of SPSS practical training to improve the research competencies of the students and academic staff of "Fan S. Noli" University. The population consists of 42 participants in the training sessions that were conducted during the development of the "Technology and data analysis in scientific research: Applications in SPSS, R and EViews" project, implemented in "Fan. S. Noli" University. The instrument used was a pretest and posttest questionnaire that was distributed among staff and students taking part in the training. The questionnaire's aim was to grasp the perceptions of participants related to data entry, descriptive statistics, testing hypothesis, regression analysis, correlation analysis, and categorical data analysis. Subsequently, the data gathered was compared using the Wilcoxon Signed Rank Test. The results indicated a statistically significant difference in all the fields mentioned above, thus confirming that participants performed better after the training than before.

Keywords: SPSS, Training, Research competencies, Technology

Introduction

Several researchers in recent years have shown a strong commitment to using a variety of software applications in their research activities such as writing research papers, theses, and performing analytical tasks of any kind. Understanding this, scientists worldwide employ IBM SPSS (Statistical Package for the Social Sciences) as one of the most popular statistical analysis programs. SPSS is of the most widely used tools for statistical analysis in the social sciences, education, health, agriculture, business fields etc.

While theoretical knowledge is essential in research, it is through practical training with tools like SPSS that students and researchers truly develop the competencies required to conduct meaningful and reliable research. SPSS has undergone a number of modifications since its founding around fifty years ago according to the demands

of social science scholars due to the necessity for precision and accurate data representation in quantitative data analysis.

In a scientific research, data analysis is the most essential part of the research that makes the result of the study more effective. It involves collecting, presenting, transforming, cleaning and modeling data in order to discover information that is important in supporting the researcher's results. Therefore, to say that data analysis is important for a scientific research is an understatement, when in fact no research can survive without data analysis. Nowadays, where information is everything, mastering statistical computer tools for data processing has become a necessity for researchers, their students or experienced researchers. In their studies, Rahman and Muktadir (2021), Masuadi et al. (2021), Curtis and Nunez (2022) conclude that SPSS (Statistical Packages for Social Sciences) is the most widely used statistical program in various fields for scientific research based on surveys, and its usage rate has been increasing (Okagbue et al., 2021).

According Jatnika, (2015) there is a significant increase in the cognitive aspects of learning Statistics after using SPSS as measured by Survey of Attitudes toward Statistics (SATS). Regarding Šebjan and Tominc (2014) there is a positive relationship between perceived usefulness of statistics and perceived usefulness of SPSS, perceived ease of use of SPSS, and attitude towards using the SPSS. Results, at Karanu and Omollo (2023) and Kimani et al. (2017) researches among graduated and post graduate students revealed that the level of knowledge significantly increased after the practical training of SPSS. Correspondingly, the research of Kimani and Simba (2017) titled: Effect of Practical SPSS Training on Students' Research Competence; A Survey of Jomo Kenyatta University of Agriculture and Technology Mombasa Campus Postgraduate Students revealed that most of the participant had low knowledge in data entry, descriptive statistics, regression and correlation analysis, parametric and non-parametric analysis, and also the increase of the level of knowledge after the training session. Recommending the frequent organization of such trainings. At Mathews and Musonda (2016) findings revealed that SPSS may be an effective tool for teaching hypothesis testing to students at Colleges and Universities asserting that the use of SPSS had a positive impact on students' performance in hypothesis testing. Moreover, students' attitude towards learning statistics through technology was improved and no gender disparities were founded.

This study was conducted within the framework of an institutional research project whose main goal was to improve the ability to perform solid and trustworthy statistical analysis as an indispensable research skill in an era where data drives important decisions among academic, professional and policy-making spheres. Our focus was academic researchers, university staff and students especially master students of "Fan S. Noli" University that require acquiring additional training in software, such as SPSS, that helps in their studies and their diploma thesis research. Since today's research requires not just a solid theoretical grasp but also involves the capacity to use statistical tools in practice, developing research skills in statistical analysis is crucial for professionals, researchers, educators and students who want to use evidence-based inquiry to make significant contributions to their disciplines.

Throughout the course of this project we observed that there is a paucity of research related to improving research competencies through SPSS practical training in the Albanian context. The present research seeks to fill this identified gap providing empirical insight on the role of SPSS practical training in enhancing research skills. To achieve this objective a three-day training session was organized at "Fan S. Noli University". The program was designed for academic staff and students and offered an integrated approach that combined small portions of statistical theory with practical applications in scientific research. At the end, a pre- and post-training assessments was used to measuring participants' self-reported knowledge levels across six key domains: data entry, descriptive statistics, hypothesis testing, correlation analysis, regression analysis, and categorical data analysis. The results of our training were promising and demonstrated the improvement of skills of the participants in using SPSS to perform presentation and statistical analysis of the data according to their study field.

Method

Data Collection Instrument and Participants

The participants of interest were students and staff from "F. S. Noli" University of Korca, Albania, which took part in a three-day SPSS practical training session. After the end of the training session all participants were given a questionnaire to fill out. The questionnaire was formulated based on the training program and on previous research studies. It had a total of seventeen closed questions, organized into three sections. The first section included four questions on the students' demographic and academic characteristics such as age, gender, job status,

and level of education. In the second section participants were asked if they use SPSS program and about their perceptions related their ability to perform entering the data, descriptive statistics, hypothesis test, correlation analysis, regression analysis, and categorical data analysis before the training. Additionally, in the third session participants were asked about their perceptions after the training sessions. The last two sections both use a 5- point Likert- Scale.

In total there were 42 participants (21% were male and 79% were female). The majority (45.2%) were between 20-30 years old, 26.2% between 31-40 years old 23.8% were between 41-50 years old, and 4.8% were over 50 years old. Regarding their level of education, most participants (31%) were Master of Science students, 14% were Professional Master students, 9% were Bachelor students, 7% Associate Professors, 29% were Ph.D. holders, and 10% were Ph.D. students. 54.8% of participants declared that they had rarely used SPSS for statistical analysis, 14.3% used it often, while 31% had never used SPSS before.

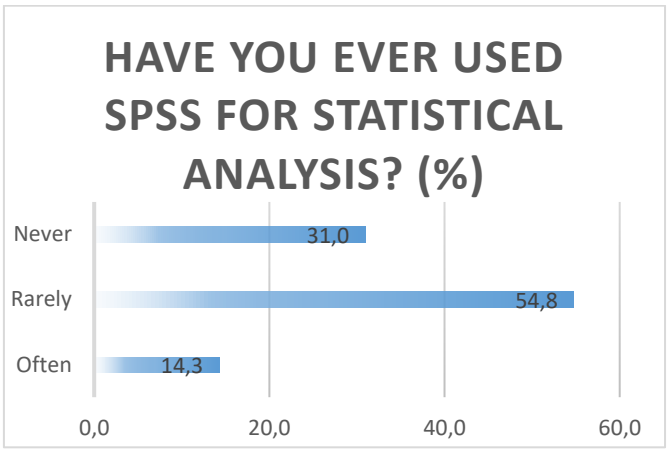

Figure 1. Distribution of respondents' experience with SPSS for statistical analysis

Statistical Analysis

Data analysis was conducted using the software IBM SPSS v. 20. Frequencies and percentages were used to describe changes in perceived knowledge before and after the training. In each domain, a marked improvement was observed, with substantial increases in the proportion of participants reporting very high knowledge levels and corresponding decreases in those reporting very low knowledge. To statistically assess these changes, the Wilcoxon Signed Rank Test was employed, as the data were paired and ordinal.

Results

In this section we present the results related to the sixth domains: data entry, descriptive statistics, testing hypothesis, regression analysis, correlation analysis, and categorical data analysis.

Data Entry on SPSS

Before the training sessions only 40.5 % of the participants revealed very high knowledge in data entry while 38.1% of them revealed very low knowledge. After the training sessions a notable improvement was seen in entering the data knowledge with 61.9% of participants declare very high knowledge and only 4.8% of them very low knowledge. The percentage of participants declaring very high knowledge increased dramatically from 40.5% to 61.9%. Meanwhile the percentage of participants declaring very low knowledge decreased from 38.1% to 4.8% indicating substantial improvement (Figure 2).

This shift of participants from very low knowledge to very high knowledge levels provide evidence of the effectiveness of the training sessions. Most notably, the increase in the performers from 40.5% to 61.9% shows a positive effect. A Wilcoxon Signed Rank Test was used to test whether the median of scores significantly changed (Table 1).

Figure 2. Comparison of participants' self-assessed ability to enter data before and after training

Table 1. Wilcoxon Signed Rank test for data entry before and after training

		N	Mean Rank	Sum of Ranks	Z	Asymp.Sig (2-tailed)
Entering the data After. – Entering the data Before.	Negative Ranks	1[a]	4.50	4.50	-4.102	.000
	Positive Ranks	22[b]	12.34	271.50		
	Ties	19[c]				
	Total	42				

a. Entering the data After. < Entering the data Before.
b. Entering the data After. > Entering the data Before.
c. Entering the data After. = Entering the data Before.

Participants' test results were compared before and after the training sessions. On average, participants performed better (Median = 5) after the training than before (Median = 3). A Wilcoxon Sign-Rank Test indicated that this improvement was statistically significant, Z=-4.102, p=.000<0.05.

Descriptive Statistics with SPSS

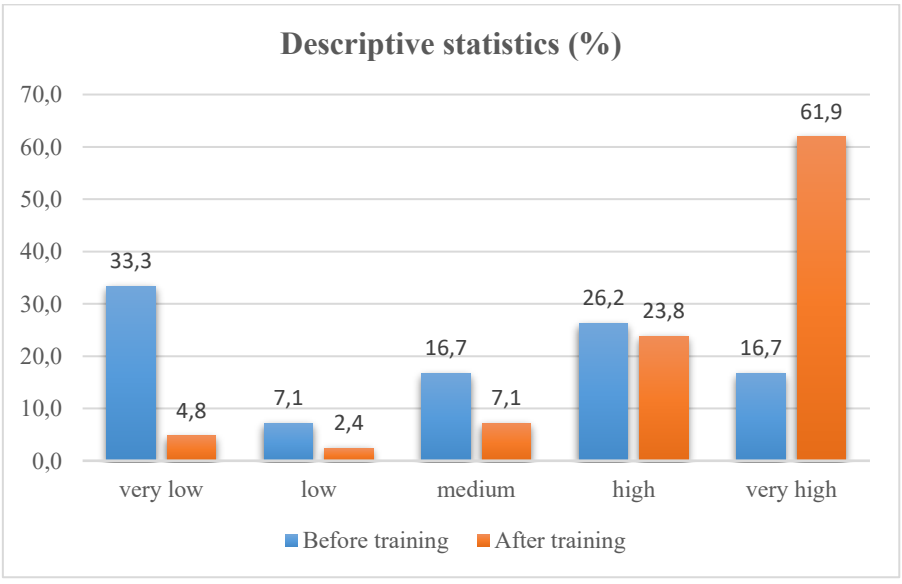

Figure 3. Comparison of participants' self-assessed ability to conduct descriptive statistics before and after training

Before the training sessions only 16.7 % of participants revealed very high knowledge and 26.2% high knowledge in descriptive statistics while 33.3% of them revealed very low knowledge. After the training sessions a significant improvement was seen in descriptive statistics knowledge with 61.9% of participants declaring very high knowledge and only 4.8% of them very low knowledge. The percentage of participants declaring very high knowledge increased significantly from 16.7% to 61.9%. Meanwhile the percentage of participants declaring very low knowledge decreased from 33.3% to 4.8% indicating substantial improvement. This shift of participants from very low knowledge to very high knowledge levels provide evidence of the effectiveness of the training sessions. Most notably, the increase in the performers from 16.7% to 61.9% shows a strong positive effect. A Wilcoxon Signed Rank Test was used to test whether the median of scores significantly changed.

Table 2. Wilcoxon Signed Rank test for descriptive statistics before and after training

		N	Mean Rank	Sum of Ranks	Z	Asymp.Sig (2-tailed)
Descriptive Statistics After. – Descriptive Statistics Before.	Negative Ranks	0[a]	.00	.00	-4.918	.000
	Positive Ranks	31[b]	16.00	496.00		
	Ties	11[c]				
	Total	42				

a. Descriptive Statistics After. < Descriptive Statistics Before.
b. Descriptive Statistics After. > Descriptive Statistics Before.
c. Descriptive Statistics After. = Descriptive Statistics Before.

Participants' test results were compared before and after the training sessions. On average, participants performed better (Median = 5) after the training than before (Median = 3). A Wilcoxon Sign-Rank Test indicated that this improvement was statistically significant, Z=-4.918, p=.000<0.05.

Testing Hypothesis with SPSS

Before the training sessions of Hypothesis Testing, 9.5 % of the participants revealed very high knowledge and 21.4% high knowledge while 38.1% of them revealed very low knowledge. After the training sessions a significant improvement was seen in testing hypothesis knowledge with 42.9% of participants declaring very high knowledge and only 4.8% of them very low knowledge. The percentage of participants declaring very high knowledge increased significantly from 9.5% to 42.9%. Meanwhile the percentage of participants declaring very low knowledge decreased from 38.1% to 4.8% indicating substantial improvement.

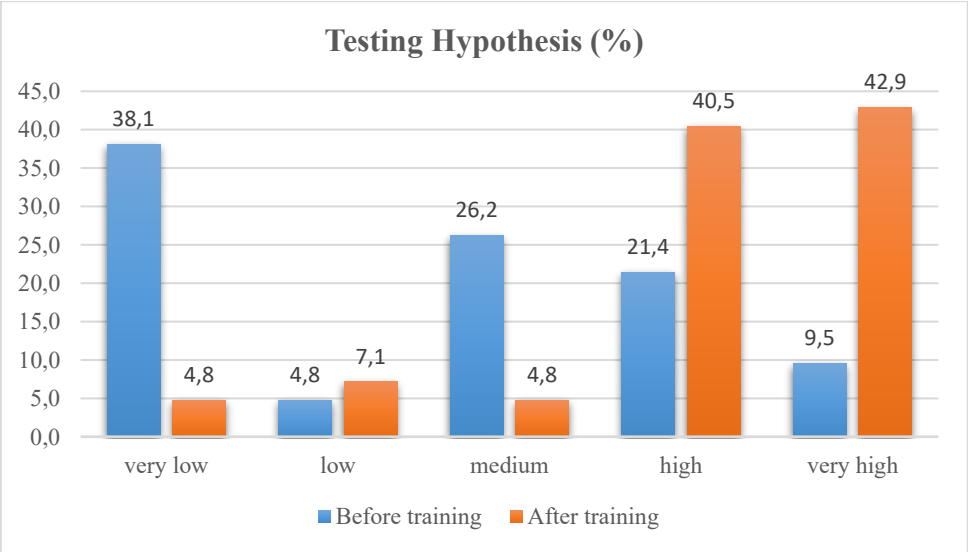

Figure 4. Comparison of participants' self-assessed ability to test hypothesis before and after training

This shift of participants from very low knowledge to very high knowledge levels provides evidence of the effectiveness of the training sessions. Most notably, the increase in the performers from 9.5% to 42.9% shows a strong positive effect. A Wilcoxon Signed Rank Test was used to test whether the median of scores significantly changed.

Table 3. Wilcoxon Signed Rank test for testing hypothesis before and after training

		N	Mean Rank	Sum of Ranks	Z	Asymp.Sig (2-tailed)
Hypothesis testing After. – Hypothesis testing Before.	Negative Ranks	0[a]	.00	.00	-5.250	.000
	Positive Ranks	35[b]	18.00	630.00		
	Ties	7[c]				
	Total	42				

a. Hypothesis testing After. < Hypothesis testing Before.
b. Hypothesis testing After. > Hypothesis testing Before.
c. Hypothesis testing After. = Hypothesis testing Before.

Participants' test results were compared before and after the training sessions. On average, participants performed better (Median = 4) after the training than before (Median = 3). A Wilcoxon Sign-Rank Test indicated that this improvement, was statistically significant, Z=-5.205, p=.000<0.05.

Correlation Analysis with SPSS

Regarding the Correlation Analysis knowledge before the training sessions, 7.1% of participants revealed very high knowledge and 26.2% high knowledge while 38.1% of them revealed very low knowledge. After the training sessions a significant improvement was seen in correlation analysis knowledge with 42.9% of participants declaring very high knowledge and only 7.1% of them very low knowledge. The percentage of participants declaring very high knowledge increased significantly from 7.1% to 42.9%. Meanwhile the percentage of participants declaring very low knowledge decreased from 38.1% to 7.1% indicating substantial improvement.

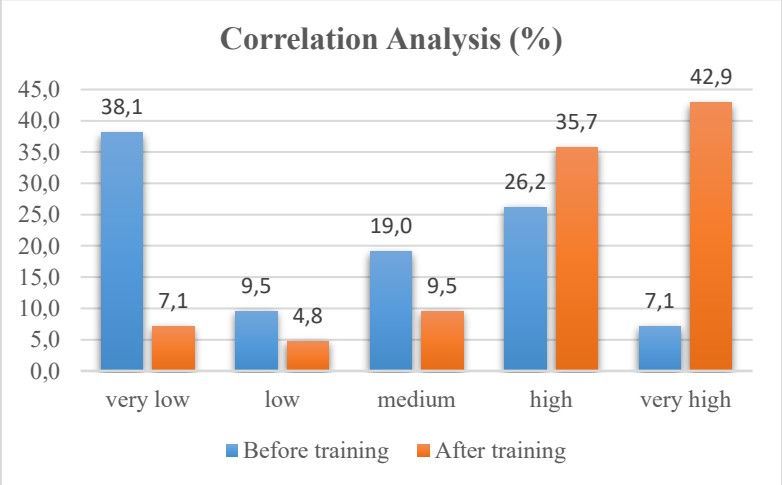

Figure 5. Comparison of participants' self-assessed ability to conduct correlation analysis before and after training

This shift of participants from very low knowledge to very high knowledge levels provides evidence of the effectiveness of the training sessions. Most notably, the increase in the performers from 7.1% to 42.9% shows a strong positive effect. A Wilcoxon Signed Rank Test was used to test whether the median of scores significantly changed.

Table 4. Wilcoxon Signed Rank test correlation analysis before and after training

		N	Mean Rank	Sum of Ranks	Z	Asymp.Sig (2-tailed)
Correlation Analysis After. – Correlation Analysis Before.	Negative Ranks	0[a]	.00	.00	-5.178	.000
	Positive Ranks	34[b]	17.50	595.00		
	Ties	8[c]				
	Total	42				

a. Correlation Analysis After. < Correlation Analysis Before.
b. Correlation Analysis After. > Correlation Analysis Before.
c. Correlation Analysis After. = Correlation Analysis Before.

Participants' test results were compared before and after the training sessions. On average, participants performed better (Median = 4) after the training than before (Median = 3). A Wilcoxon Sign-Rank Test indicated that this improvement, was statistically significant, Z=-5.178, p=.000<0.05.

Regression Analysis with SPSS

In the Regression Analysis domain before the training sessions, 4.8% of participants revealed very high knowledge and 28.6% high knowledge while 42.9% of them revealed very low knowledge. After the training sessions a significant improvement was seen in correlation analysis knowledge with 42.9% of participants declaring very high knowledge and only 4.8% of them very low knowledge. The percentage of participants declaring very high knowledge increased significantly from 4.8% to 42.9%. Meanwhile the percentage of participants declaring very low knowledge decreased from 42.9% to 4.8% indicating substantial improvement.

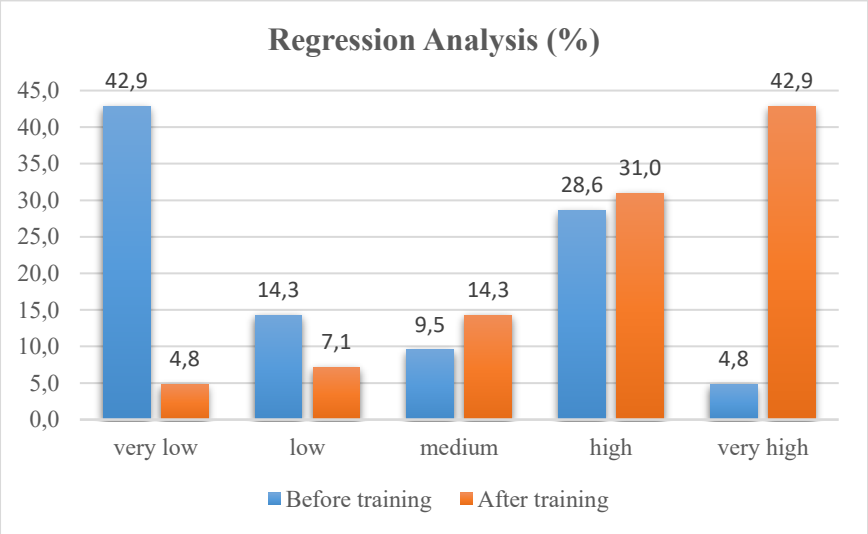

Figure 6. Comparison of participants' self-assessed ability to conduct regression analysis before and after training

This shift of participants from very low knowledge on regression analysis to very high knowledge levels provides evidence of the effectiveness of the training sessions. Most notably, the increase in the performers from 4.8% to 42.9% shows a strong positive effect. A Wilcoxon Signed Rank Test was used to test whether the median of scores significantly changed.

Table 5. Wilcoxon Signed Rank test for regression analysis before and after training

		N	Mean Rank	Sum of Ranks	Z	Asymp.Sig (2-tailed)
Regression Analysis After. – Regression Analysis Before.	Negative Ranks	0[a]	.00	.00	-5.394	.000
	Positive Ranks	37[b]	19.00	703.00		
	Ties	5[c]				
	Total	42				

a. Regression Analysis After. < Regression Analysis Before.
b. Regression Analysis After. > Regression Analysis Before.
c. Regression Analysis After. = Regression Analysis Before.

Participants' test results were compared before and after the training sessions. On average, participants performed better (Median = 4) after the training than before (Median = 2). A Wilcoxon Sign-Rank Test indicated that this improvement was statistically significant, Z=-5.394, p=.000<0.05.

Categorical Data Analysis with SPSS

In the Categorical data analysis domain before the training sessions, 7.1% of participants revealed very high knowledge and 26.2% high knowledge while 38.1% of them revealed very low knowledge. After the training

sessions a significant improvement was seen in categorical data analysis knowledge with 40.5% of participants declaring very high knowledge and only 7.1% of them very low knowledge. The percentage of participants declaring very high knowledge increased significantly from 7.1% to 40.5%. Meanwhile the percentage of participants declaring very low knowledge decreased from 38.1% to 7.1% indicating substantial improvement.

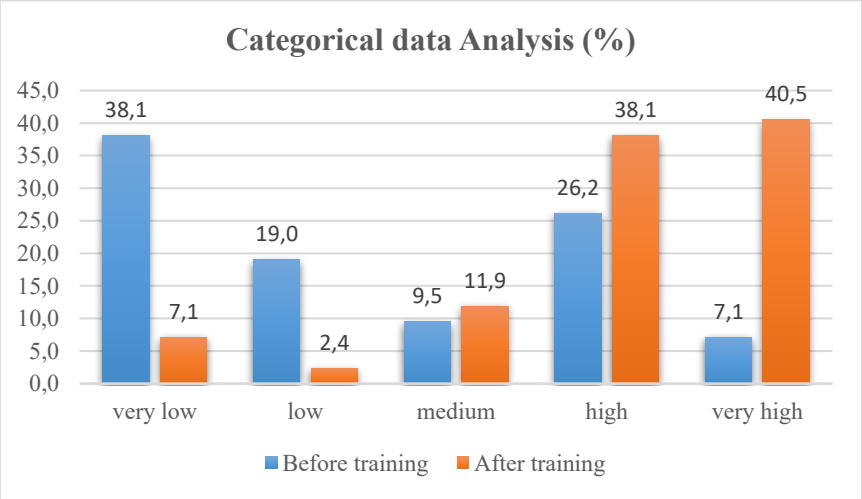

Figure 7. Comparison of participants' self-assessed ability to analyse categorical data before and after training

This shift of participants, from very low knowledge of categorical data analysis to very high knowledge levels, provides evidence of the effectiveness of the training sessions. Most notably, the increase in the performers from 7.1% to 40.5% shows a strong positive effect. A Wilcoxon Signed Rank Test was used to test whether the median of scores significantly changed.

Table 6. Wilcoxon Signed Rank test for categorical data analysis before and after training

		N	Mean Rank	Sum of Ranks	Z	Asymp.Sig (2-tailed)
Categorical data analysis After. – Categorical data analysis Before.	Negative Ranks	0[a]	.00	.00	-5.239	.000
	Positive Ranks	35[b]	18.00	630.00		
	Ties	7[c]				
	Total	42				

a. Categorical data analysis After. < Categorical data analysis Before.
b. Categorical data analysis After. > Categorical data analysis Before.
c. Categorical data analysis After. = Categorical data analysis Before.

Participants' test results were compared before and after the training sessions. On average, participants performed better (Median = 4) after the training than before (Median = 2). A Wilcoxon Sign-Rank Test indicated that this improvement was statistically significant, $Z=-5.239$, $p=.000<0.05$.

Conclusions

The statistical analysis of before training data revealed that 40.5% of the participants show high knowledge in data entry in SPSS, while 38.1% of them declare very low knowledge. In descriptive statistics before the training only 16.7% reveal very high knowledge, while 33.3% show very low knowledge. In the domain of hypothesis testing 9.5% declare very high knowledge while very low 38.1% of them. Almost the same results are revealed in correlation analysis and categorical data analysis where 7.1% of participants declare very high knowledge and 38.1% of them very low knowledge. While respect to regression analysis only 4.8% of participants declare very high knowledge and 42.9% of them reveal very low knowledge.

Findings from analysis of after training data were so promising, in data entry and descriptive statistics only 4.8% of participants declare very low knowledge while 61.9% of them declare very high knowledge. Most notably, the increase in the performers in data entry from 40.5% to 61.9% shows a positive effect and the increase in the performers from 16.7% to 61.9% in descriptive statistics shows a strong positive effect.

In the domain of testing hypothesis and regression analysis only 4.8% of participants declare very low knowledge while 42.9% of them declare very high knowledge. Compared to before training, there is an increase in the very high level of knowledge from 9.5% to 42.9% in testing hypothesis and from 4.8% to 42.9% in regression analysis which shows in both cases a strong positive effect. After training only 7.1% of participants in the domain of categorical data analysis declare very low knowledge and 40.5% of them declare very high knowledge. Compared to before training the increase in the very high level of knowledge from 7.1% to 40.5% shows a strong positive effect.

This shift of participants from very low knowledge to very high knowledge levels provides evidence of the effectiveness of the training sessions. The application of the Wilcoxon Sign-Rank Test further confirmed that the above changes are statistically significant for all domains ($p<0.05$). The outcome reveals a noteworthy distinction between the participants' proficiency in using SPSS to process quantitative data prior to and following the SPSS training practice. On average, participants performed better after the training than before.

Recommendations

These findings demonstrate the success of the training in building statistical competencies and suggest that similar training formats could be beneficial in other educational or professional development settings. Overall, the program proved effective in addressing knowledge gaps and equipping participants with practical skills in SPSS-based data analysis. Based on these findings, it is recommended that future training be organized for a broader audience, including students, researchers and professionals from different fields. This would help ensure the sustained development of statistical skills. Furthermore, future training could benefit from the inclusion of domain-specific or advanced modules—such as time series analysis or multivariate analysis—in order to address different levels of expertise and meet specific research or professional needs. Making these efforts would not only reinforce the impact of the initial training but also promote long-term competency in statistical analysis using SPSS.

Scientific Ethics Declaration

* The authors declare that the scientific ethical and legal responsibility of this article published in EPESS Journal belongs to the authors.

Conflict of Interest

* The authors declare that they have no conflicts of interest

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