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Improving the Operational Skills of SPSS Statistics Software for 3rd Year Statistics Undergraduate Students at Wolkite University: Action Research

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ABSTRACT

Statistics is essential in daily life, making it crucial for educators and learners to master its use and interpretation. SPSS statistical software helps avoid mathematical errors and ensures accurate results for researchers, students, and educators. Low proficiency in the operating skills of SPSS hinders students' academic achievement in science. The main objective of the research was to improve the skills of Wolkite University's third-year statistics students by improving the operational skills of statistical SPSS software. Hence, since the total population is small, all students were included in the sample. The data from the student questionnaire has been tabulated and analysed with the use of descriptive statistical methods, and the student's performance before and after the training was recorded using inferential statistics. The SPSS version 27 software was used for analysing the collected data. From the descriptive statistics of the total 23 (100%) students, the proportion of male and female students is 20 (86.96%) and 3 (13.04%), respectively. Before the training, of the total of 23 (100%) students, 19 (82.6%) had good skills, and the remaining 4 (17.4%) students had very good skills. However, after training, 13 (56.5%) students had very good skills, and the remaining 10 (43.5%) students had excellent skills in SPSS software. The proposed actions for increasing the performance of students in SPSS were focused on improving basic statistical data using SPSS statistical software.

Keywords: Operational, Statistics, SPSS, Statistical Software

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1. INTRODUCTION

Education plays a key role in the development of a country. Our country, Ethiopia, is prioritizing education for development by expanding universities, colleges, and technical vocational schools, increasing university intake capacities, fostering university-industry linkages, and enhancing science and technology programs. Ethiopian universities are adopting active learning techniques (Redondo et al., 2019). Educational assessment, like improving SPSS software, requires a clear conception of all intended learning outcomes of the instruction and a variety of assessment procedures (Aragaw Asfaw *et al.*, 2022). Educational entities have the freedom to choose their developmental trajectories and objectives. Utilizing statistical software like SPSS (Statistical Package for the Social Sciences) is vital in contemporary statistical analysis in various sectors, including academia, industry, and research (Suray *et al.,* 2019), to evaluate student attitudes and achievements.

IBM's SPSS is a robust software extensively used to address technical challenges in data-centric tasks (Aragaw Asfaw *et al.*, 2022). First released in 1968 as the Statistical Package for the Social Sciences (SPSS) (Gogoi, 2020), it continues to be a favored tool for quantitative data analysis. Since IBM's acquisition in 2009, it has been officially named IBM SPSS Statistics, but it is still widely known as "SPSS" among users (IBM, 2020). The software greatly simplifies the analysis of extensive datasets, conserving time and effort. SPSS's statistical analysis capabilities support various research phases, including data gathering, presentation, interpretation, analysis, and conclusion (Abebew Aklog *et al*., 2023). It serves as a tool for researchers, students, and educators to eliminate manual calculation errors and achieve accurate results, provided the data input is precise (Abatan and Olayemi, 2014). SPSS is popular among students, researchers, professionals, and scientists for predicting future trends accurately and clearly through statistical analysis. It also helps students present their research effectively and empowers professionals to interact with data, promoting creativity and innovation in their fields (Abebew Aklog *et al*., 2023).

Enhancing student engagement in SPSS statistical software skills is vital for bolstering the teaching and learning process, as it improves understanding and retention of statistical analysis techniques. We have observed that students' engagement in enhancing their SPSS skills is minimal due to a lack of familiarity with statistical analysis. Typically, students at this stage are introduced to statistical software, activities, and fundamental principles. Classrooms should be equipped with the necessary resources and guidance to facilitate meaningful exercises and experiments that bolster students' comprehension of statistical analysis. This challenge has led us to explore methods to boost students' academic performance and interest in statistical methods. This study is significant in developing strategies for the professional growth of academic staff, in line with their readiness to employ statistical software packages with undergraduate students. Therefore, the goal of this action research is to improve the SPSS statistical software skills of 3rd-year undergraduate statistics students at Wolkite University, Ethiopia, in 2024.

Statement of the Problem

Low students' practical skill in knowing and implementing SPSS statistical software is the factor that hinders students' academic achievement and performance in science education. In the statistics laboratory room, students' active involvement is necessary to increase their operating skill levels when applying SPSS statistical software. I am teaching this student statistical computing-I course, and I deliver a practical mid-exam (30%) for them, and the exam covers: opening, data entry, codding, import and export data, analysis, and reading the output. From this, most students were unable to do import and export, analysis, and reading the output. Generally, students scored below half, which means that out of 30, only nine students scored above 15. As an instructor, the existence of such a problem prompts me to develop a proposal of action research on the topic of improving the operating skills of SPSS software for third-year statistics students.

Research Questions

- What is the actual students SPSS skill performance?
- How undergraduate students are managing their data?

- How could students read or interpreted the SPSS output?

Objective of the Study

1.3.1 General objective of the study

The general objective of this study was to improve skill on statistics SPSS software in the case of 3rd year statistics undergraduate students at Wolkite University.

1.3.2 Specific objectives of the study

- To increase the actual students SPSS skill performance.
- To investigate how undergraduate students are managing their data.
- To improve students' ability on output interpretation.

RESEARCH METHODOLOGY

Study Area

The experiment was conducted at Wolkite University, College of Natural and Computational Science, for statistics 3rd-year students in 2024. Wolkite University is one of the higher education institutions in Ethiopia. Wolkite (also transliterated Wolkite) is the capital town and separate woreda in southwestern Ethiopia. The administrative centre of the Gurage zone, this town has a latitude and longitude of 8°17′N, and 37°47′E, and is about 158 km and 256.4 km far from Addis Ababa and Hawassa, respectively. The Gurage Zone comprises altitudes ranging from 1001 to 3500 meters above sea level. Based on the local agro-climatic classification, the zone is classified into three agro-climatic zones. Dega (excessive altitude) covers 28.3% of the area and ranges between 2500-3662 mass; Weinadega (mid-altitude) at 1500–2500 mass encompasses about 64.9% of the area; and Kola (lowland) at 100–1500 mass covers 6.8% of the area. The average annual minimum and maximum temperatures and rainfall ranged from 18°C to 39°C and 450 to 820 mm, respectively.

Target Group

The target groups of this action research were 3rd year statistics students, which were 23 in number; out of these, 20 were males and 3 were females, respectively. Third-year students were selected because they' lack data analysis skills and use statistical software efficiently. To be efficient with statistical software, it takes training and practice using SPSS. Therefore, this action research was implemented in the mentioned department so as to fill this gap.

Methods of Data Collection

In our study aimed at enhancing students' SPSS statistics software skills at Wolkite University, we gathered data from primary sources such as questionnaires, focus group discussions, and observations involving third-year statistics department students. Additionally, we reviewed various books and research conducted by different scholars to inform our study. A total of 23 students participated in the questionnaire distribution.

Method of Data Analysis

In this study, the data was organized in a table and expressed descriptively using statements, and comparisons were made between before and after the intervention of strategies, and then the results were expressed either in statements or percentages. First, the data was organized and managed based on the action research objectives and

will be entered and analyzed using SPSS version 27. The quantitative data includes frequency, percentage, and a paired sample t-test. Results were presented using tables.

Statistical Software

For the analyzing the provided data, SPSS latest version 27 software was used, and a significant level of alpha 0.05 was employed for conducting statistical tests.

Planned Action

Students's improvement in statistical software is very important because it helps them learn more. As researchers, we tried to solve the above-stated problem using different activities. After identifying the problem, we developed an action plan that is listed below. The implementation of an action plan was mandatory to solve current problems. From the beginning, the major concern of the study was improving Wolkite University third-year statistics students' operational skills in using SPSS software in handling, organizing, presenting, and analyzing statistical data. As researchers, we collected information from a questionnaire survey, an interview, and our observations. After all, based on the above information from the 3rd year statistics department, we already confirmed the presence of the problem, and we designed the action plans into the following categories or parties in the table below for training **(**Error! Reference source not found.**).**

Implementation of planned action

To improve the student's statistical software operational skill level in basic data handling, organization, presentation, and analyzing statistical data using SPSS statistical software in the statistical computing-I course for Wolkite University third-year statistics students, the following actions were taken into consideration: The possible solution of this action research was to facilitate and intensively assist in various interventions for improving students's software skills, like data handling, data organization, presentation, and analysis of statistical data.

Therefore, we developed and planned the following tasks to minimize the problems that lead to low student improvement levels in the computer lab activity.

- One period was used for training about the importance of practicing statistical software (SPSS) for students, rules and regulations in computer laboratories, and the handling skills of lab equipment's computers.
- Interactive oral teaching was delivered to students before the start of training.
- An active teaching method suitable for computer lab activity and bringing high student improvement levels was used.
- Guidelines to practice SPSS before the start of training were provided.
- Teaching aids like videos that support SPSS training were utilized.
- A group was formed that had a mixture of low-, medium-, and high-achievement students.
- Specific tasks were provided for each individual and group member, like data entry, data cleaning, data transformation, analysis, and output reading.
- Marks were assigned for each computer lab session (training) as reinforcement.

RESULT AND DISCUSSION

The main objective of this study was to improve students' SPSS software skill performance in the Wolkite University third-year statistics department. The data were collected from the 3rd year statistics undergraduate students, and we used all statistics third-year students (a total of 23 students) for our data collection because they were small in number. In this section, the results obtained through the questionnaire, interview, and training (before and after) from the data source (students) are presented and analyzed. and of them, 20 were male and only 3 were female **(**

Table 2**)**.

Descriptive Statistics

There were 23 students in total, with the gender distribution being 20 males (86.96%) and 3 females (13.04%), as shown in **Figure 1.** This indicates that the majority of the 3rd-year statistics students were male. According to **Figure 2**, all 23 students (100%) were assessed for their skills in SPSS software before training. Among them, 19 students (82.6%) were found to have good skills, while 4 students (17.4%) had very good skills. These results suggest the necessity for software training to enhance the students' proficiency in SPSS. **Figure 3** presents post-training data for the same 23 students, showing that 13 students (56.5%) had very good skills in SPSS, and the remaining 10 students (43.5%) had excellent skills. This demonstrates the effectiveness of the training in significantly improving their software skills. **Figure 4** indicates the geographic background of the 23 students: 14 students (60.9%) were from rural areas, while 9 students (39.1%) were from urban areas. **Figure 5** shows the age distribution of the 23 students: 5 students (21.7%) were aged between 16-20 years, 15 students (65.2%) were aged between 21-25 years, and 3 students (13.0%) were aged 26 years or older.

Test of association between pre and post training

The researchers prepared pre- and post-test questions for students, and the results were recorded and analyzed before and after SPSS training. After training, their skill in data analysis improved.

Table 2. Summary statistics for assessing variation of SPSS software for Statistics 3rd year students.

ID no.	Sex	Residence	Age	Awareness before training	Awareness after training
1	1	1	1	1	3
2	1	1	2	1	2
3	1	0	1	2	2
4	0	0	2	1	3
5	1	0	2	1	2
6	0	0	2	1	2
7	1	1	1	1	3
8	1	0	2	1	2
9	1	1	2	1	2
10	0	1	2	2	3
11	1	0	2	1	3

12	1	0	3	1	2
13	1	0	2	2	2
14	1	0	1	2	2
15	1	1	2	1	3
16	1	1	2	1	3
17	1	0	1	1	3
18	1	1	2	1	2
19	1	0	2	1	3
20	1	1	3	1	2
21	1	0	2	1	2
22	1	0	3	1	3
23	1	0	2	1	2

Key terms: Sex: female=0, male=1; residence: Urban=1, Rular=0; Age: 17-21=1, 22-26 =2, above 26 =3; Awareness before training: good=1, v. good=2, excellent=3; Awareness after training: good=1, v. good=2, excellent=3

Table 3. Paired sample statistics of training

Paired Samples Test					
		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	post training	1.9130	23	.59643	.12436
	pre training	1.1304	23	.34435	.07180

shows that 23 students participated in the training, and the average mid-exam score of the pre-training students was 1.1304, and the post-training mean mid-exam score them was 1.913. It seems that the students scored better after obtaining training, the standard deviation score of pre-training was 0.344 (34.4%) and the standard deviation post-training score was 0.596 (59.6%). This result showed that in the pre-training session, there was small variability (34.4%), which means that almost all students had the same skill level, and in the post-training session there was relatively high variability (59.6%), which means there were dispersed exam scores among students. **Table 1.** Description of action plan categories flow

Categories	**Descriptions of the Activities**	**Activities in each category**	**Problems will be solved**	**Time frame**
C-1	Training on introducing how to start SPSS for Windows.	Opening and exiting SPSS, creating a data file, data entry, importing and exporting data from Excel.	Opening SPSS, data entry, saving data	Morning and afternoon
C-2	Mastering data management techniques using SPSS.	Inserting new variables, labelling variables and values, deleting variables, cleaning data with SPSS, splitting files, merging data and files, transforming variables, and creating indicator variables.	Manage data using software (coding data, editing of data, imputing missing data and treatment of outliers).	Morning and afternoon

C-3	Developing proficiency in conducting descriptive statistical analysis using SPSS.	Measures of central tendency (mean, median, sum, quartiles….), measures of variations, using different types of graphs (histogram, bar chart….), relationship between categorical variables (cross-tabulation, chi-squared test),	Exploring descriptive Statistics measure of variation, frequency, percentage	Morning and afternoon
C-4	Improving their skills in inferential Statistical techniques	Association between numerical variables (correlation), t-test, analysis of variances, Linear regression, Binary Logistic regression model, and output reading.	Performing Inferential Statistics using SPSS (test of association, linear regression, logistic regression and output reading	morning

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8	1	0	2	1	2
9	1	1	2	1	2
10	0	1	2	2	3
11	1	0	2	1	3
12	1	0	3	1	2
13	1	0	2	2	2
14	1	0	1	2	2
15	1	1	2	1	3
16	1	1	2	1	3
17	1	0	1	1	3
18	1	1	2	1	2
19	1	0	2	1	3
20	1	1	3	1	2
21	1	0	2	1	2
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Table 4 indicated that there was a significant relationship (P-value = 0.000) between pre- and post-training, and the correlation between them was 0.722, which showed a moderate relationship. This means the student had a good prior skill, and then after taking training, they could add skills to their prior skill in the post-training session. **Table 5** showed that there was a significant mean difference between the pre-and post-training exam results. The hypothesis of the analysis was $H_0: \mu_D = 0 \ VS \ H_0: \mu_D \neq 0$, then our sig–value (0.000), which could show us we had enough evidence to reject the null hypothesis, which is that there were the same exam scores between pre-and post-training. In this regard, we could say that there are different exam results between pre-and post-training.

CONCLUSION

The findings of this action research highlight the significance of training in improving students' skills with SPSS statistical software. Knowledge of statistical software is essential for any data analysis in research. Prior to the training, students struggled with basic tasks such as opening and closing SPSS, managing data, and performing both descriptive and inferential statistics using SPSS. However, after the training, students were able to perform these tasks effectively. This improvement indicates that students' skills in using SPSS for data management and statistical analysis have increased. Consequently, students are now capable of handling both simple and complex data analyses with SPSS. Moreover, such training programs can boost students' foundational knowledge and motivation for future research endeavors. Therefore, we conclude that SPSS training is crucial for improving students' skills in using SPSS software statistical software.

LIST OF FIGURES

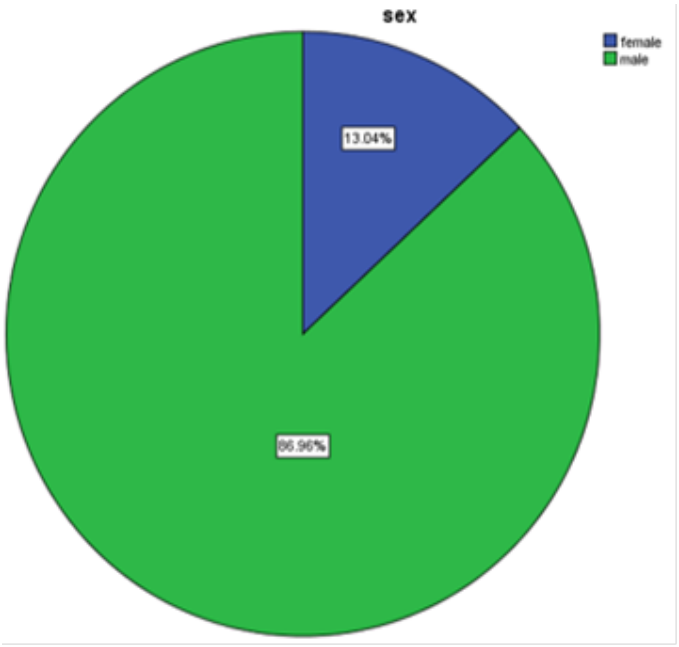

Figure 1. Number of students on gender.

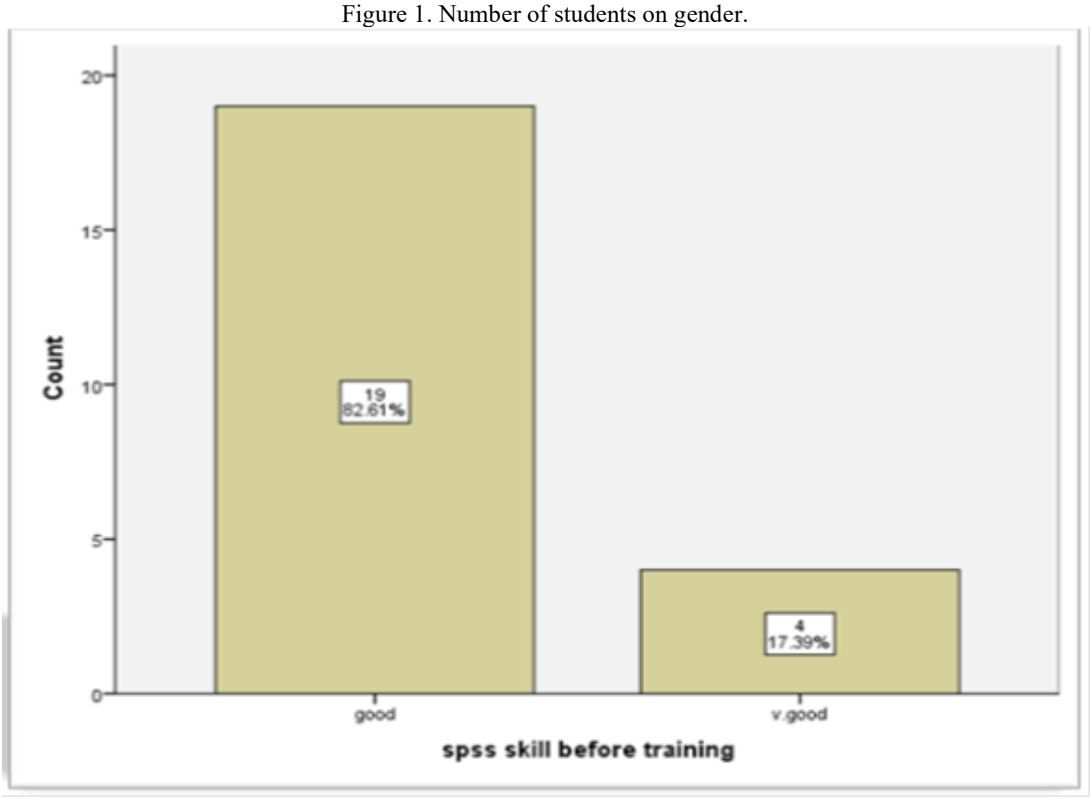

Figure 2. SPSS software operating skill before training.

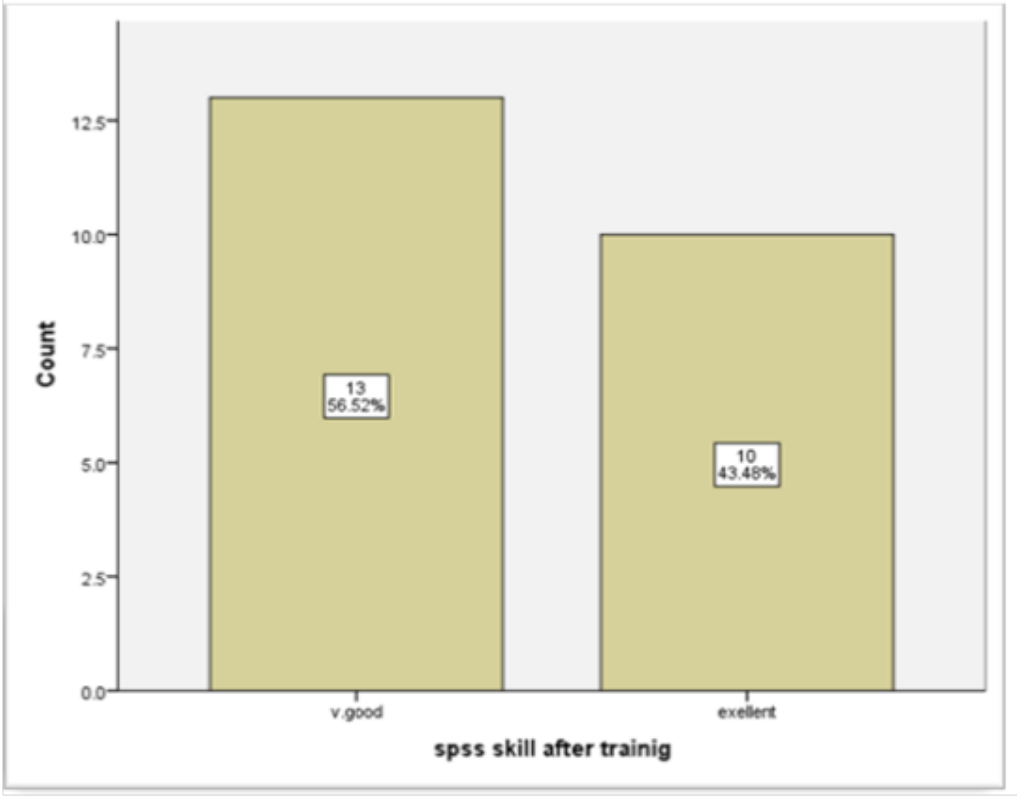

Figure 3. SPSS software operating skill after training.

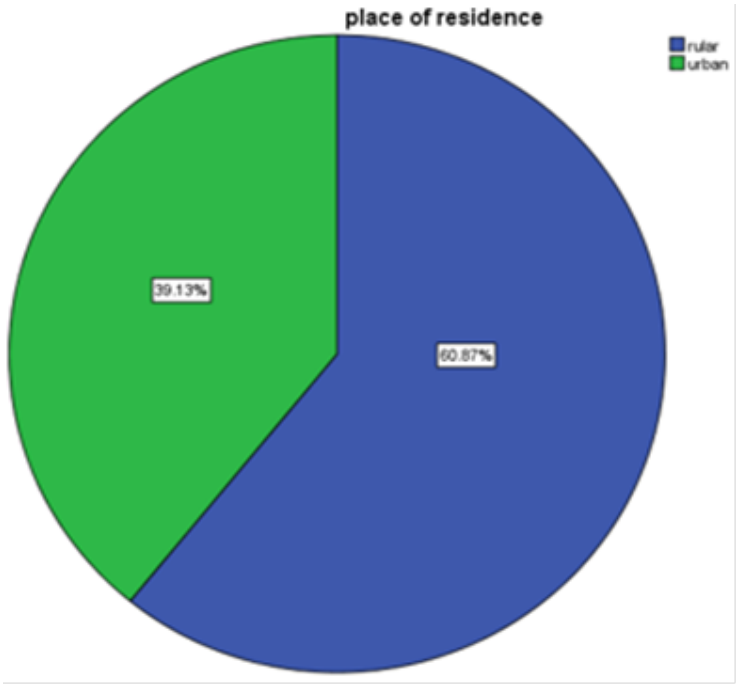

Figure 4. Students place of residence.

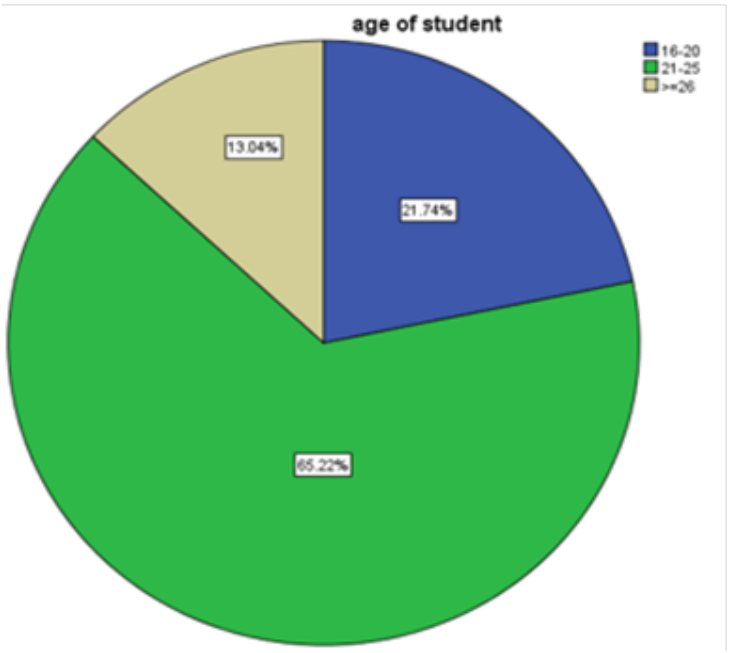

Figure 5. Students age group.

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			percentage	
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14	1	0	1	2	2
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17	1	0	1	1	3
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Table 4. Correlation analysis of pre and post training

		N	Correlation	Sig.
Pair 1	Post training & Pre training	23	.722	.000

Table 5. Paired sample test of pre and post training

Paired Differences								
	Mean	Std. Deviation	SE (Mean)	95% Confidence Interval of the Difference				
				Lower	Upper	t	df.	Sig (2-tailed)
Pair1 pre-post training	0.783	0.421	0.888	0.66	0.965	8.889	22	0.000

Acknowledgement

We extend our gratitude to the third-year undergraduate students of the Statistics Department at Wolkite University for their cooperation and provision of all the relevant information for this action research.

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