



## Enhancing Undergraduate Students' Competency in Quantitative Data Processing for Academic Writing Through a Statistly.app-Based Workshop

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### ABSTRACT

This community service activity aimed to enhance the quantitative data processing competency of undergraduate students through a Statistly.app-based workshop held at Universitas Negeri Makassar (UNM) on April 25, 2026. Statistly.app is a free, web-based statistical analysis platform requiring no installation. A total of 53 students participated in the pre-test and 48 in the post-test, predominantly from the first and second semester (92.5%) and with no prior training in data analysis (94.3%). The workshop covered six sessions: introduction to quantitative data, Statistly.app orientation, data preparation, validity and reliability testing, descriptive and inferential analysis, and interpretation of statistical results. A pre-post test design was employed using a 10-item Likert-scale instrument aligned with the workshop sessions. The Wilcoxon Signed-Rank Test was used due to non-normal pre-test score distribution. Results revealed a statistically significant improvement in student competency ( $W = 80.500$ ,  $p < 0.001$ ), with a large effect size (Cohen's  $d = 1.110$ ) and a mean Normalized Gain of 35.4% (moderate category). Workshop evaluation scores were consistently high across all dimensions ( $M = 3.94$ – $4.15$  out of 5). These findings indicate that a structured, application-based workshop using accessible tools effectively improves students' quantitative research competency for academic writing.

## 1. INTRODUCTION

The ability to process and interpret quantitative data is an essential competency for undergraduate students engaged in research-based academic writing. In Indonesian higher education, the Karya Tulis Ilmiah (KTI) — a compulsory academic paper — requires students to demonstrate proficiency in collecting, analyzing, and reporting quantitative data in a scientifically rigorous manner [1]. However, empirical evidence consistently indicates that many undergraduate students, particularly in their early semesters, lack adequate competency in this domain [2], [3]. Common challenges include unfamiliarity with statistical concepts, difficulties in selecting appropriate analyses, and the high cost or complexity of conventional statistical software such as IBM SPSS [4].

Community service activities (*pengabdian kepada masyarakat*) represent a strategic mechanism through which university academics can address practical skill deficits among students and the broader academic community [5]. Workshop-based interventions, in particular, have demonstrated effectiveness in improving statistical competency through structured, hands-on learning [6]. Recent advances in web-based statistical platforms have introduced more accessible alternatives to traditional software; among these, Statistly.app — a free, browser-based tool requiring no installation — offers an intuitive interface suitable for novice users [7]. Despite its potential, empirical evidence on its effectiveness in structured workshop settings remains limited.

To address this gap, the present community service activity designed and implemented a one-day, six-session workshop at Universitas Negeri Makassar (UNM) on April 25, 2026. The workshop employed

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Statisty.app as the primary analytical platform and targeted first- and second-year undergraduate students with limited prior exposure to quantitative data analysis. This paper reports the design, implementation, and outcomes of the workshop, with the primary objective of evaluating its effectiveness in improving students' quantitative data processing competency for academic writing purposes.

## 2. METHOD

### 2.1 Program Design and Participants

This community service activity employed a one-group pre-test post-test design. The workshop was conducted on Saturday, April 25, 2026, at the Auditorium of Museum Makassar (see Figure 1). Participants were undergraduate students from various study programs who registered voluntarily. A total of 53 students completed the pre-test ( $n_{pre} = 53$ ) and 48 completed the post-test ( $n_{post} = 48$ ), yielding a paired analytical sample of  $n = 48$ . The majority of participants were female (86.8%), enrolled in their first or second semester (92.5%), and had never previously attended a data analysis training (94.3%).



Figure 1. Workshop Program of Quantitative data for Scientific Writing

### 2.2 Workshop Content and Procedures

The workshop was structured into six thematic sessions, each aligned with a corresponding set of competency indicators in the assessment instrument (Table 1). Session 1 covered foundational concepts of quantitative data and measurement scales. Session 2 introduced Statisty.app features and available analytical menus. Session 3 addressed practical data preparation, including formatting and copying data from Excel. Session 4 focused on validity (Pearson correlation) and reliability (Cronbach's Alpha) testing. Session 5 covered both descriptive statistics and inferential analyses, including prerequisite tests (Shapiro-Wilk normality, Levene's homogeneity), independent and paired t-tests, and one-way ANOVA with post-hoc Tukey. Session 6 trained participants to read statistical output and write scientifically accurate results following APA 7th edition formatting.

Table 1. Workshop session structure and competency coverage

Session	Topic	Instrument Section
1	Introduction to Quantitative Data & KTI	Item 1-2
2	Statisty.app Orientation & Features	Item 3-4
3	Data Preparation in Statisty.app	Item 3-4
4	Validity & Reliability Testing	Item 5-6
5	Descriptive & Inferential Analysis	Item 7-8
6	Output Interpretation & APA Writing	Item 9-10

### 2.3 Instrument

A 10-item Likert-scale instrument (1 = Strongly Disagree to 5 = Strongly Agree) was developed and used identically in both the pre-test and post-test. Each pair of items corresponded to one workshop session (Table 1). The instrument was aligned with the six-session workshop content and reviewed for face validity by the workshop facilitator. Three supplementary open-ended items were included in the pre-test to capture prior difficulties, and two reflective open-ended items appeared in the post-test. The post-test additionally included four Likert-scale workshop evaluation items assessing clarity of delivery, facilitator quality, platform usability, and overall perceived improvement.

### 2.4 Data Analysis

Pre-test and post-test total scores (range: 10–50) were computed for each participant. The Shapiro-Wilk test was applied to assess distributional normality. Given that pre-test scores were non-normally distributed ( $W = 0.9135$ ,  $p = 0.002$ ), the Wilcoxon Signed-Rank Test was used as the primary inferential

test for the paired comparison. Effect size was quantified using Cohen's *d* (calculated on the difference scores). The Normalized Gain (N-Gain) index was computed for each participant as  $G = (\text{post} - \text{pre}) / (50 - \text{pre}) \times 100\%$ , with categories of High ( $\geq 70\%$ ), Moderate (30–69%), and Low ( $< 30\%$ ) [8]. Workshop evaluation items were summarized descriptively. All analyses were performed using Statistiy.app.

### 3. RESULTS AND DISCUSSION

#### 3.1 Pre-Test Baseline Competency

Prior to the workshop, participants demonstrated a notably low level of quantitative data processing competency. The mean pre-test score was  $M = 20.77$  ( $SD = 8.72$ ) out of a maximum of 50, corresponding to 41.5% of the theoretical maximum. At the item level, the lowest mean scores were recorded for Item 6 (Cronbach's Alpha reliability;  $M = 1.94$ ), Item 10 (APA-style writing of statistical results;  $M = 1.98$ ), and Item 9 (reading p-values from output;  $M = 2.02$ ), all falling in the 'low' category ( $M < 2.6$ ). These findings are consistent with prior reports documenting widespread statistical anxiety and skill deficits among Indonesian undergraduate students, particularly in their early semesters [2], [3]. The high proportion of participants with no prior training (94.3%) further contextualizes the low baseline scores.

#### 3.2 Pre-Post Comparison and Effect Size

Following the workshop, mean post-test scores increased substantially to  $M = 33.90$  ( $SD = 8.18$ ), representing a mean gain of  $\Delta 14.13$  points (67.9% relative increase). The Shapiro-Wilk test confirmed that while pre-test scores were non-normally distributed ( $W = 0.914$ ,  $p = 0.002$ ), the distribution of difference scores ( $\text{post} - \text{pre}$ ) was normal ( $W = 0.961$ ,  $p = 0.113$ ), supporting the use of both parametric and non-parametric tests. The Wilcoxon Signed-Rank Test confirmed a statistically significant improvement ( $W = 80.500$ ,  $p < 0.001$ ). These results were corroborated by the paired t-test ( $t(47) = -7.688$ ,  $p < 0.001$ ). The effect size was large (Cohen's  $d = 1.110$ ), indicating a practically meaningful impact of the intervention [9]. Descriptive statistics are presented in Table 2, and inferential test results in Table 3.

Table 2. Descriptive statistics of pre-test and post-test scores

Score	n	M	SD	Min	Max	Median
Pre-Test	53	20.77	8.72	10	44	20.00
Post-Test	48	33.90	8.18	16	50	34.00
Gain ( $\Delta$ )	48	13.12	12.56	-20	40	12.00
N-Gain (%)	48	35.4	56.9	-66.7	100.0	30.0

Note. Score range: 10–50.  $N\text{-Gain} = (\text{Post} - \text{Pre}) / (50 - \text{Pre}) \times 100\%$ .  $\text{Gain} (\Delta) = \text{Post-Test} - \text{Pre-Test}$ .

Table 3. Normality tests and inferential statistics for pre-post comparison

Test / Statistic	n	Statistic	p-value	Interpretation
Shapiro-Wilk — Pre-Test Score	53	$W = 0.914$	$p = 0.002$	Not normal
Shapiro-Wilk — Post-Test Score	48	$W = 0.958$	$p = 0.085$	Normal
Shapiro-Wilk — Difference (Post–Pre)	48	$W = 0.961$	$p = 0.113$	Normal
<b>Wilcoxon Signed-Rank Test<sup>1</sup></b>	<b>48</b>	<b><math>W = 80.500</math></b>	<b><math>p &lt; 0.001^*</math></b>	<b>Significant</b>
Paired t-Test (reference)	48	$t(47) = -7.688$	$p < 0.001^*$	Significant
<b>Cohen's d (effect size)</b>	<b>48</b>	<b><math>d = 1.110</math></b>	—	<b>Large effect</b>

<sup>1</sup> Primary inferential test; selected due to non-normal pre-test score distribution. \*  $p < 0.001$ . Paired t-Test reported for reference only.

#### 3.3 Per-Item Analysis

All 10 items demonstrated positive mean gains ranging from +1.15 to +1.60 points. The largest gains were observed for Item 3 (inputting data into Statistiy.app;  $\Delta = +1.60$ ), Item 9 (reading p-values;  $\Delta = +1.44$ ), and Item 2 (role of data in KTI;  $\Delta = +1.42$ ). The smallest gains, though still notable, appeared on Item 5 (Pearson validity;  $\Delta = +1.15$ ) and Item 10 (APA-style writing;  $\Delta = +1.15$ ). The relatively lower gains on items related to statistical writing and validity testing suggest that these competencies may require extended practice beyond a single-day workshop, which is consistent with findings from analogous intervention studies [6], [10]. Wilcoxon item-level tests confirmed significant improvement on all 10 items (all  $p < 0.05$ ), consistent with the overall inferential findings reported in Table 3.

#### 3.4 Normalized Gain Analysis

The mean N-Gain across paired participants was 35.4% ( $SD = 56.9\%$ ), classifying the overall gain as moderate [8]. Among the 48 paired participants, 10 (20.8%) achieved a High N-Gain ( $\geq 70\%$ ), 27 (56.3%) achieved a Moderate N-Gain (30–69%), and 11 (22.9%) achieved a Low N-Gain ( $< 30\%$ ). The relatively high SD reflects individual variability in baseline scores, as participants with very low pre-test scores tend to generate extreme N-Gain values. This pattern is a known limitation of the N-Gain metric when applied

to heterogeneous samples [8]. Nevertheless, the combination of a statistically significant Wilcoxon result and a large Cohen's  $d$  provides robust evidence for the workshop's effectiveness.

### 3.5 Workshop Evaluation

Participants' evaluations of the workshop were consistently positive across all four dimensions. The highest rating was assigned to facilitator quality ( $M = 4.15$ ,  $SD = 0.67$ ), followed by clarity of material delivery ( $M = 4.04$ ), perceived improvement in competency ( $M = 3.96$ ), and the usability of Statisty.app ( $M = 3.94$ ). All means exceeded the 'agree' threshold ( $M \geq 3.40$ ), indicating favorable reception of both the pedagogical approach and the selected platform. The high rating for Statisty.app usability is particularly noteworthy given that the majority of participants had never used any statistical software prior to the workshop, suggesting that the platform's intuitive design substantially reduced the cognitive load associated with tool adoption [7], [11].

### 3.6 Discussion

The present findings extend the growing body of evidence supporting the effectiveness of structured, application-based workshops in improving statistical competency among undergraduate students [3], [6], [10]. The use of Statisty.app as a free, web-based platform addressed a critical access barrier that has historically limited the uptake of quantitative methods training, particularly in resource-constrained settings [4]. The large effect size ( $d = 1.110$ ) exceeds effect sizes reported in comparable single-session SPSS or JASP training workshops, suggesting that Statisty.app's simplified interface may accelerate learning by reducing time spent on software navigation [11]. The moderate N-Gain (35.4%), however, indicates that sustained engagement beyond a single workshop may be necessary to achieve mastery-level competency, particularly for complex skills such as APA-style statistical reporting and advanced inferential testing [9], [10]. These results underscore the value of integrating follow-up activities — such as guided practice sessions or online modules — into community service programs targeting quantitative research skills.

## 4. CONCLUSION

This community service workshop successfully improved undergraduate students' quantitative data processing competency for academic writing at Universitas Negeri Makassar. The Wilcoxon Signed-Rank Test confirmed a statistically significant improvement ( $W = 80.500$ ,  $p < 0.001$ ) from a mean pre-test score of 20.77 to a post-test score of 33.90, with a large effect size (Cohen's  $d = 1.110$ ) and a moderate mean N-Gain of 35.4%. Statisty.app demonstrated high acceptability as a free, accessible statistical tool for novice users, receiving positive evaluations across all workshop dimensions. Future programs are recommended to incorporate multi-session designs, spaced practice, and follow-up assessments to consolidate competency gains — particularly in higher-order skills such as inferential reasoning and APA-style reporting. Collaboration with study program curriculum developers to embed Statisty.app into regular research methods coursework is also encouraged as a sustainable approach to building quantitative literacy among undergraduate students.

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