

The Effect of Using Geoda on Student Learning Outcome in Geographic Information Systems

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ABSTRACT

Geoda is an open-source software that is usually used in spatial data analysis. One of the courses that discusses spatial and geographic data is the Geographic Information System Class. In the previous semester, new students in the class were introduced to new software, one of which was Geoda Software. In the middle of lecture meeting, there was a training on Geoda Software. The composition of the training material consists of : skills to upload spatial maps into geoda software, how to combine excel tables into spatial maps, and Spatial Data Visualization (Thematic Map, Scatter Plot, Bubble Chart & Parallel Chart). Before and after the training, there was a pre-test and post-test to find out whether students have good spatial analytical skills after using Geoda or not. From the results, it can be seen that the analytical skills of students in the Geography Information System class have increased significantly, with pre-test score of 56 (per 100) compared to post-test score about 83 (per 100).

Keywords: *geoda, learning outcomes, geographic information system, open source software, student skill*

1. INTRODUCTION

There was technology transformation in Industrial revolution from 1.0 to 5.0. There are many statistics Software, such as Geoda. Geoda is a free software that is intended to perform graphical visualization that is easy to use by users and also for spatial analysis, especially non-geographical information systems (GIS). Spatial statistical techniques are techniques and methods that are mostly used and specifically developed for object classification (topological, geometric, and geographical) and analysis of geographic data distribution (Mariane et.al., 2017). Geoda includes functionality ranging from simple mapping, exploratory data analysis, visualization of global and local spatial autocorrelation, and spatial regression. An interesting feature is the interactive environment, combining statistical graphs with maps, utilizing the technology of dynamically interconnected windows (Anselin et.al., 2006).

One of the courses that discusses spatial and geographic data is the Geographic Information System Class. In the previous semester, new students in the class were introduced to new software, one of which was Geoda Software. In the middle of lecture meeting, there was a training on Geoda Software. The composition of the training material consists of: skills to upload spatial maps into geoda software, how to combine excel tables into spatial maps, and Spatial Data Visualization (Thematic Map, Scatter Plot, Bubble Chart & Parallel Chart). Before and after the training, there was a pre-test and post-test.

The objective of this research is to find out: (1) how the value of the pre test score before students are given training using Geoda; (2) how the value of the post test score after students were given training using Geoda; (3) which score is higher between pre-test and post-test; (4) does Geoda provide a significant skill increase to students.

2. METHODS

The study design used in research was pre-experimental design. The number of research samples involved were 40 students who took part in the training. Training is carried out using online zoom media. Data collection

used google form to provide pre-test and post-test. The scores from the pre-test were then compared with the scores from the post-test.

Data analysis techniques used in this research are Descriptive Statistics and Inferential Statistics. Descriptive Statistics displays a Bar Chart, while Inferential Statistics uses a Paired t test. In the paired T test, the p-value is displayed which will then be compared with the alpha value (5%).

The composition of the training material consists of:

- 1) skills to upload spatial maps into geoda software,
- 2) skills to how to combine excel tables into spatial maps,
- 3) skills to Spatial Data Visualization: Thematic Map
- 4) skills to Spatial Data Visualization: Scatter Plot
- 5) skills to Spatial Data Visualization: Bubble Chart
- 6) skills to Spatial Data Visualization: Parallel Chart.

Table 1. Geoda Research Instruments

| No. | Training Material | Ordered Number | Number of Question | Score |
|-----|---|----------------|--------------------|-------|
| 1 | Skills to upload spatial maps into geoda software | 1 | 1 | 100 |
| 2 | Skills to how to combine excel tables into spatial maps | 2 | 1 | 100 |
| 3 | Skills to Spatial Data Visualization: Thematic Map | 3 | 1 | 100 |
| 4 | Skills to Spatial Data Visualization: Scatter Plot | 4 | 1 | 100 |
| 5 | Skills to Spatial Data Visualization: Bubble Chart | 5 | 1 | 100 |
| 6 | Skills to Spatial Data Visualization: Parallel Chart | 6 | 1 | 100 |

3. RESULTS AND DISCUSSION

After the data collection process is complete, the next step is to perform data analysis. The first stage is compiling a summary of the data in the form of the average score of students before the test and after the test using Table 1.

Table 2. Mean Score Pre & Post test

| Code | Training Material | Mean Score of Pre-Test | Mean Score of Post-Test |
|------|---|------------------------|-------------------------|
| A | Uploading Spatial Maps | 51 | 80 |
| B | Combining Excel Tables into Maps | 54 | 81 |
| C | Spatial Data Visualization : Thematic Map | 56 | 84 |
| D | Spatial Data Visualization : Scatter Plot | 55 | 82 |
| E | Spatial Data Visualization : Bubble Chart | 65 | 87 |
| F | Spatial Data Visualization : Parallel Chart | 58 | 85 |

Source: Processed data by author

Then the graphic process is carried out using a Bar Chart to visually find out which material from the training is the easiest and which one is the most difficult according to students before the Geoda training has been carried out. From the results of the pre-test, it can be seen that the data visualization material using Bubble Chart is the easiest according to them. This is shown by the highest average score among the others in Figure 1.

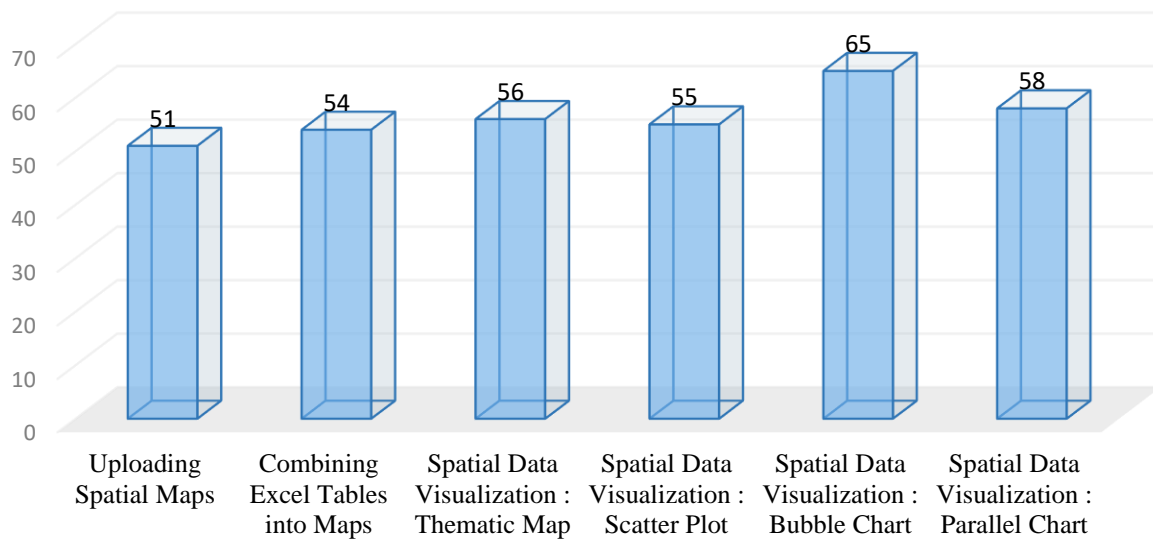


Figure 1. Mean score of pre-test

After all the training materials have been given, a post test is conducted to find out which ones are the easiest and which ones are the hardest after the training materials are taught. From the results, it can be seen in Figure 2, showing that even after raining, Bubble Chart is the easiest material to compare with other materials. Then the most difficult material is described with the lowest average score, it can be concluded that Uploading Spatial Maps is a material that is more difficult than others. This requires further investigation of why students have difficulty uploading the map.

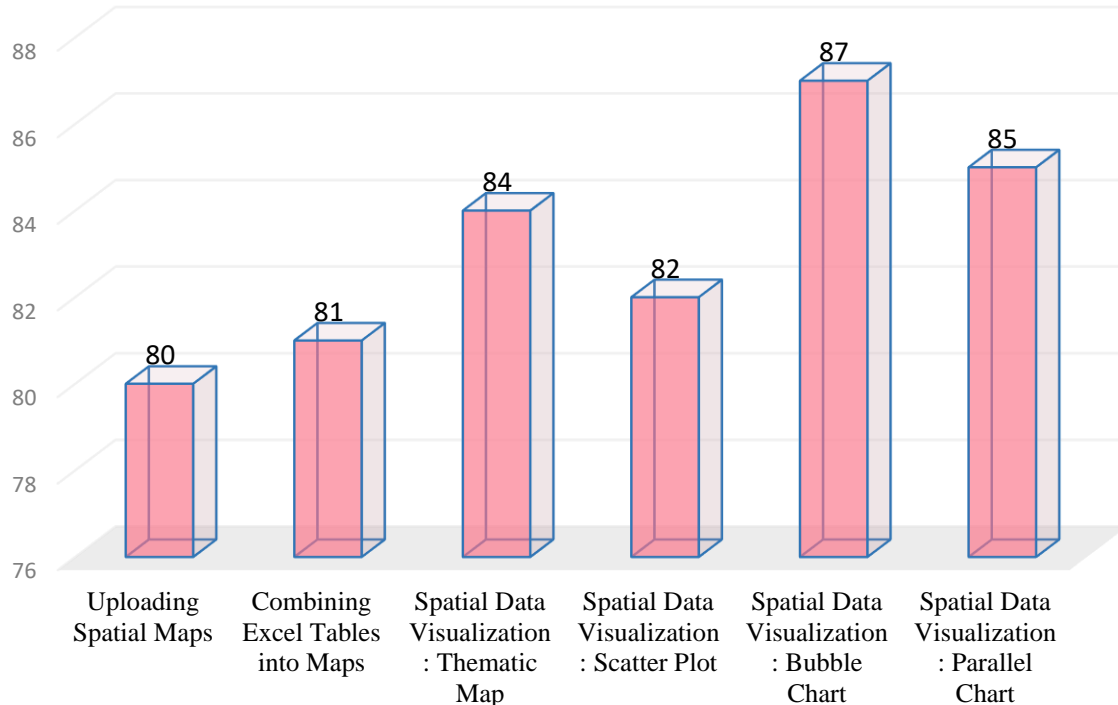


Figure 2. Mean score of post-test

After the post-test and pre-test scores were collected, a simple comparative analysis was performed using a Bar Chart. The results can be seen in Figure 3, which shows that descriptively each value of the training material experienced an increase in the average score after being given training using Geoda. The fairly low gap on Bubble Chart shows that Bubble Chart is an easy material, so the improvement experienced is not as high as other materials. This is because the Bubble Chart pre-test score was already high at the time of the pre-test.

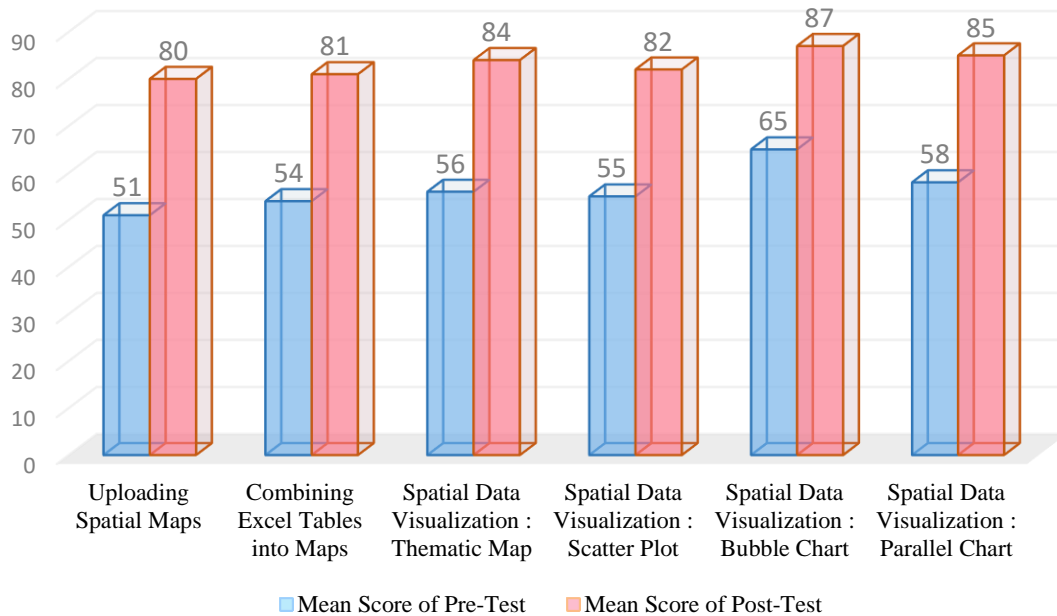


Figure 3. Mean score per indicator pre-test & post-test

From the result of Paired T-Test, it shows that the p-value statistics (5.04×10^{-32}) is less than α ($0.05=5\%$), so it could be concluded that analytical skills of students in the Geography Information System class have increased significantly, with pre-test score of 56 (per 100) compared to post-test score about 83 (per 100) with using Geoda.

Table 3. Paired t-test result

| | Mean Score (Before) | Mean Score (After) |
|------------------------------|---------------------|--------------------|
| Mean | 56 | 83 |
| Variance | 14.20512821 | 7.282051282 |
| Observations | 40 | 40 |
| Pearson Correlation | -0.025210761 | |
| Hypothesized Mean Difference | 0 | |
| df | 39 | |
| t Stat | -36.40679257 | |
| P(T<=t) one-tail | 5.04241E-32 | |
| t Critical one-tail | 1.684875122 | |
| P(T<=t) two-tail | 1.00848E-31 | |
| t Critical two-tail | 2.02269092 | |

4. CONCLUSION

After the analysis process is carried out, it is concluded that:

- (1) Pre-Test scores of students before being given Geoda material, were at an average score of 53.
- (2) The student's Post-Test score after being given Geoda material, was at an average score of 83. So, Students have better skills to **upload spatial maps into geoda software, how to combine excel tables into spatial maps, and Spatial Data Visualization** (Thematic Map, Scatter Plot, Bubble Chart & Parallel Chart) after using Geoda.
- (3) Post test scores give a score of 27 higher than the pre test. The analytical skills of students in the Geography Information System class have increased significantly, with pre-test score of 56 (per 100) compared to post-test score about 83 (per 100). So, **Students have good spatial analytical skills after using Geoda**

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