The Influence of Region on Reading Habits in Indonesia: RM-MANOVA Analysis of Population Aged 5+ (2018)

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Abstract

This study explores the reading habits of the Indonesian population aged 5 and above, focusing on differences between urban and rural areas. Using data from the 2018 BPS survey, the research examines the proportion of individuals who engaged in reading various materials in printed and electronic formats over the past seven days. A Repeated Measures Multivariate Analysis of Variance (RM MANOVA) was employed to assess the influence of regional factors on reading behavior. The results indicated significant disparities: urban populations tend to read a broader range of materials such as newspapers, magazines, and scientific texts, while rural populations focused more on textbooks and basic materials. These findings highlight the need for regionally tailored literacy strategies to ensure equitable access to reading resources across Indonesia.

Keywords: Indonesian literacy, reading habit, repeated measure manova, statistical assumption test, urban and rural area.

Research Ariticle   Open Acces
Email: jurnalparameter@gmail.com
Homepage: https://ojs3.unpatti.ac.id/index.php/parameter

Submitted: March 2025
Accepted: August 2025

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1. INTRODUCTION

Reading is not merely the activity of pronouncing or spelling written texts, but a complex process that involves understanding and interpreting meaning. According to the Indonesian Dictionary (KBBI), reading means a process of pronouncing or repeating written text [1] [2]. However, experts such as Tarigan define reading as an effort by the reader to understand the message conveyed by the author through written language [3]. Rahim further explains that reading involves not only the act of pronouncing text but also visual, cognitive, psycholinguistic, and metacognitive processes [4]. As a key language skill, reading plays a vital role in acquiring information, enhancing reasoning, and expanding one's perspective. Despite this importance, Indonesia still faces serious literacy challenges, as many students struggle with basic reading comprehension skills. This highlights the urgent need to strengthen literacy education across all levels.

Even though reading has great advantages, the literacy rate still faces various challenges in Indonesia. According to the evaluation results of the Programme for International Student Assessment (PISA), the literacy rate of students in Indonesia has been proven to be low. In the PISA 2018 report, Indonesia was seventh from the bottom with a score of 382. Meanwhile, in 2015, Indonesia obtained a score of 395 and was in 64th place out of 72 countries. Even though the literacy rate had increased from 375 in 2012 to 395 in 2015, in 2018, it actually had a decrease to 382 [5]. This indicates that literacy challenges in Indonesia remain significant, and further efforts are required to enhance interest and access to reading in various regions.

One of the main factors influencing low reading habits in Indonesia is the difference in access to literacy between regions. People in urban areas tend to have wider access to reading materials than those in rural areas, who often have limited education facilities, libraries, and other supporting infrastructures. Differences in regions and socio-economic levels are factors that contribute to the literacy gap. Tampubolon stated that reading can help develop someone's reasoning skills; however, without adequate access, reading habits are difficult to develop [6]. Therefore, it is important to conduct a more in-depth analysis regarding how regional factors influence the reading habits of the Indonesian population.

This study aims to evaluate the influence of regional factors on reading habits in Indonesia using the Repeated Measures Multivariate Analysis of Variance (RM-MANOVA) method. Based on data on the Proportion of the Population Aged 5 and Above Who Have Read in the Past Seven Days in 2018, this study is expected to provide insights regarding the differences in reading patterns based on regions and become a reference for policy concerning literacy improvement in Indonesia. To date, not many studies have evaluated the effect of region on reading habits using an iterative multivariate approach such as RM-MANOVA, making this study a novel contribution by offering a more nuanced understanding of how regional dynamics influence reading behavior across populations.

2. METHOD

This study used data obtained from Statistics Indonesia (BPS), which described the reading habits of the Indonesian population aged 5 and above in the past seven days. This data included the proportion of reading in printed and electronic form with information classified based on province, reading category, and type of region. Data were obtained from a survey conducted in 2018. This study aims to evaluate the

influence of regional factors on reading habits in Indonesia using the Repeated Measures Multivariate Analysis of Variance (RM-MANOVA) method. Based on data on the Proportion of the Population Aged 5 and Above Who Have Read in the Past Seven Days in 2018, this study is expected to provide insights regarding the differences in reading patterns based on regions and become a reference for policy concerning literacy improvement in Indonesia. To date, not many studies have evaluated the effect of region on reading habits using an iterative multivariate approach such as RM-MANOVA, making this study a novel contribution by offering a more nuanced understanding of how regional dynamics influence reading behavior across populations.

The research process is illustrated in the diagram above, beginning with data collection followed by data cleaning and structuring. It continues with assumption testing, which includes the normality test (Mardia), homogeneity test (Box's M), and correlation test (Bartlett). Once all assumptions are satisfied, the RM-MANOVA analysis is conducted. The results are then interpreted to draw conclusions regarding the influence of regional factors on the variation in types of reading materials across Indonesia.
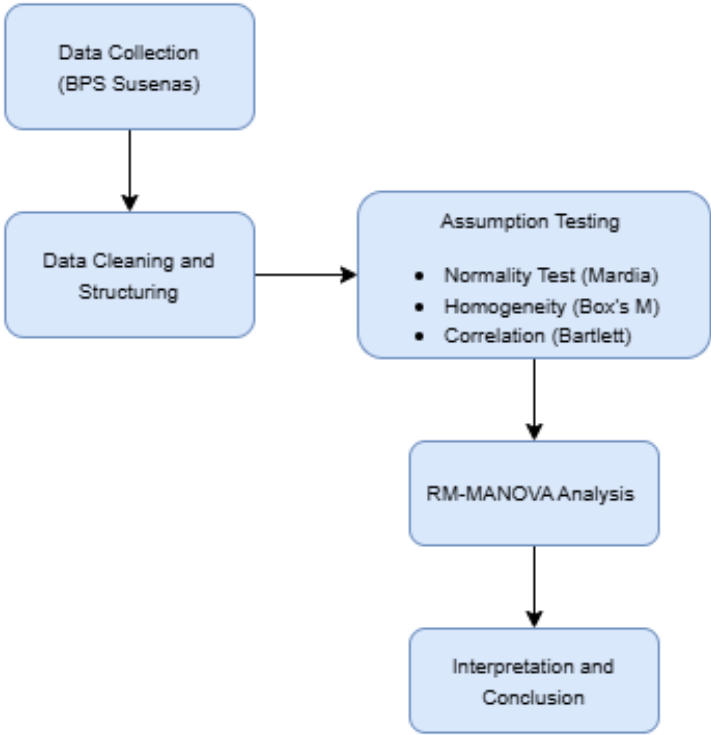

Figure 1. Flowchart of Data Analysis

In this study, several variables were analyzed. The independent variables were environmental factors, particularly the type of region (urban or rural) and the province where the respondents live. The dependent variables were the types of reading materials commonly accessed by the population, such as newspapers, magazines, storybooks, school textbooks, scientific texts, and other reading categories. This structure allows the study to assess how regional differences influence the diversity of reading behaviors across Indonesia.

The sampling in this study was based on data from the National Socio-Economic Survey (Susenas) managed by Statistics Indonesia (BPS). This survey used a stratified random sampling method, which ensures that samples represent various population

groups by considering administrative areas and regional characteristics. Data were collected from various provinces throughout Indonesia and analyzed based on the difference between urban and rural areas. With this approach, the study can provide deeper insights into reading habits at various levels of society, thereby resulting in a more accurate understanding of the reading patterns of the Indonesian population.

2.1. Chi-Square Bartlett Test

In order to test the homogeneity of variance between groups in this study, the Bartlett Test was carried out. This test is a statistical method to test the overall significance of correlation in a correlation matrix. In this case, the null hypothesis in this test stated that the data observed came from a multivariate normal population distribution with all correlation coefficients having null values. The formula for Bartlett's statistical test is as follows [7]:

$$\chi^2 = -\left(n - 1 - \frac{2p + 5}{6}\right)\ln|\boldsymbol{P}| \tag{1}$$

with
- n : the number of data
- p : the number of response variables
- $\boldsymbol{P}$: the Correlation Matrix

Bartlett's test was based on statistics with a theoretical distribution that provides accurate, critical values when the sample sizes are equal. The critical value can also be used to obtain a very precise approach in the case of varying sample sizes. However, Bartlett's Test is highly sensitive to the violation of the normality assumption of distribution. Therefore, before implementing this test, it is important to ensure that the distribution of scores in each group has met the normality assumption of an appropriate normality test [8].

2.2. Homogeneity of Covariance Test (Box's M test)

Box's M Test is a statistical technique used to examine the assumption of homogeneity of variance-covariance in the context of multivariate analysis [9]. This assumption is really important to ensure that variation between groups in the data does not show significant differences before proceeding with further analysis, such as Repeated Measures Analysis of Variance (RM-MANOVA). This test calculated the difference between covariance matrices from several groups and assessed whether the differences were significant. If the test results in a p-value higher than 0.05, then the assumption of homogeneity is considered met, which means that the data can be further analyzed without adjustment. On the other hand, if the p-value is less than or equal to 0.05, then the assumption of homogeneity is not met [10] [11]. In a study in the Education field, as conducted by Nugraheni & Sugiman [12], multivariate statistical analysis can be used to evaluate the effectiveness of the learning method, where the homogeneity test has an important role in the validity of research results. Furthermore, testing the assumption of homogeneity of variance-covariance matrices using Box's M Test is particularly important before conducting MANOVA in educational research, especially in studies related to reading habits or reading comprehension, as violations of this

assumption may lead to incorrect statistical conclusions and compromise the validity of multivariate analysis results [13].

$$M = \left(\sum_{i=1}^{g} (n_1 - 1) \ln|\boldsymbol{S_i}| \right) - (N - g) \ln|\boldsymbol{S}| \tag{2}$$

with

g : the number of groups in the analysis
n_i : the sample size for the i-th group
$\boldsymbol{S_i}$: the covariance matrix in the i-th group
N : the number of total samples in the analysis
$\boldsymbol{S}$: the total covariance matrix (combination of all groups)

2.3. Multivariat Normality Test (Mardia't test)

The normality test is a statistical method used to evaluate whether the distribution of data collection or variables is in accordance with normal distribution. This test has an important role in assessing whether the data collected comes from a population that follows normal distribution or not [14]. In this study, a multivariate normality test was conducted using Mardia's Skewness and Kurtosis methods. This normality test is important because non-normal distribution can cause bias in the hypothesis test and parameter estimation [15]. Mardia's Skewness measures the symmetry of the multivariate distribution. If the data distribution is symmetric, the skewness value will be around zero. On the other hand, if the skewness value is significantly different from zero, then it is considered not normally distributed. The formula used to calculate Mardia's Skewness value can be stated as follows [16]:

$$b_{1,p} = \frac{1}{n^2} \sum_{i=1}^{n} \sum_{j=1}^{n} \left[(\boldsymbol{X_i} - \underline{\boldsymbol{X}})^T \boldsymbol{S}^{-1} (\boldsymbol{X_j} - \underline{\boldsymbol{X}}) \right]^3 \tag{3}$$

with :

n : the number of samples in the dataset
$\boldsymbol{X_i}$: the i-th observation data vector
$\underline{\boldsymbol{X}}$: the mean data vector
$\boldsymbol{S}$: the covariance matrix of the sample

Mardia's Kurtosis is used to measure the peak level of multivariate data distribution. Distribution with high kurtosis is called leptokurtic, while distribution with low kurtosis is called platykurtic. The formula of Mardia's Kurtosis is as follows:

$$b_{2,p} = \frac{1}{n^2} \sum_{i=1}^{n} \left[(\boldsymbol{X_i} - \underline{\boldsymbol{X}})^T \boldsymbol{S}^{-1} (\boldsymbol{X_i} - \underline{\boldsymbol{X}}) \right]^2 \tag{4}$$

with :

n : the number of samples in the dataset
$\boldsymbol{X_i}$: the i-th observation data vector
$\underline{\boldsymbol{X}}$: the mean data vector
$\boldsymbol{S}$: the covariance matrix of the sample

2.4. Repeated Measures Multivariate Analysis Of Variance (RM-MANOVA)

RM MANOVA is a statistical technique used to test the significance of simultaneous differences in mean values between groups across two or more dependent variables. This technique is particularly useful for analyzing multiple dependent variables measured on interval or ratio scales, allowing for simultaneous evaluation of treatment or time effects across several variables [17].

This study was conducted using the Repeated Measures Multivariate Analysis of Variance (RM MANOVA) method to analyze the influence of regional factors on the reading habits of the population in Indonesia. This statistical method was able to analyze data using several dependent variables measured at various time points or treatment conditions for the same subject [18]. In this study, the dependent variables analyzed were newspapers, magazines, story books, school textbooks, scientific reading, and other reading categories. The data used has gone through a cleaning process. Test Statistic can be stated as follows [19]:

- Wilk's lambda

$$\Lambda = \frac{|\boldsymbol{W}|}{|\boldsymbol{W} + \boldsymbol{B}|} \tag{5}$$

- Pillai's trace

$$P = tr[\boldsymbol{B}(\boldsymbol{B} + \boldsymbol{W})^{-1}] \tag{6}$$

- Hotelling Lawley trace

$$H = tr(\boldsymbol{B}\boldsymbol{W}^{-1}) \tag{7}$$

- Roy's largest root

$$R = \lambda_{max}\big(\boldsymbol{W}(\boldsymbol{B} + \boldsymbol{W})\big)^{-1} \tag{8}$$

with
$\boldsymbol{W}$: the within-group sum of squares and cross-product matrix
$\boldsymbol{B}$: the between-group sum of squares and cross-product matrix.

3. RESULTS AND DISCUSSION

1. Chi-Square Bartlett Test
   Bartlett test was conducted to evaluate whether there was a significant relationship between variables in the dataset. The results in **Table 1** showed Chi-square statistics of 243.7937 with a degree of freedom of 15.0 and a *p-value* of 0.0000. Since the *p-value* was less than 0.05, the null hypothesis (H_0) which states that variables are independent, could be rejected. This identified significant correlation between variables; thus, multivariate analysis could be followed because the correlation assumption is met.

Table 1. Bartlett's Assumption Test

Test Statistic	Value	Degree of freedom	*p-value*
Chi-Square Statistic	243.7937	15.0	0.0000

2. Homogeneity of Covariance Test (Box's M test)

Box's M test was used to test the homogeneity of the covariance matrix between categories, in this case, between urban and rural areas. The results in **Table 2** showed Box's M test statistics of -32.1964 with a degree of freedom of 21.0 and a *p-value* of 1.0000. Since the *p-value* was more than 0.05, the null hypothesis (H_0) which stated that the covariance matrix between categories is homogeneous, could not be rejected. This indicated that the assumption of homogeneity of the covariance matrix was met, which was an important requirement for multivariate analysis.

Table 2. Box's-M Assumption Test

Test Statistic	Value	Degree of freedom	p-value
Box's-M Statistic	-32.1964	21.0	1.0000

3. Multivariate Normality Test (Mardia's)

Mardia test was used to test the multivariate normality through skewness and kurtosis measurement based on Mahalanobis distance. The results in **Table 3** showed that Skewness was 16.7227 with a *p-value* of 1.0000, and kurtosis was -42.0896 with a *p-value* of 1.0000. Since the *p-value* was less than 0.05, the null hypothesis (H_0) which stated that data follows a multivariate normal distribution, could not be rejected. This indicated that the data met the assumption of multivariate normality, which supported the feasibility of using the MANOVA method.

Table 3. Mardia's Assumption Test

Test Statistic	Value	p-value
Mardia's Skewness Statistic	16.7227	1.0000
Mardia's Kurtosis Statistic	-42.0896	1.0000

4. Repeated Measures Multivariate Analysis of Variance (RM-MANOVA)

RM-MANOVA was used to assess the differences in means between groups for several dependent variables measured repeatedly, including newspapers, magazines, story books, school textbooks, scientific texts, and other reading categories based on regional factors (urban and rural areas). The results in **Table 4** showed that the Wilks' Lambda value was 0.2473 with an F-value of 30.4375 and a *p-value* of 1.7964e-16. Since the *p-value* was much lower than 0.05, the null hypothesis (H_0) which stated that there is no significant difference in reading patterns between regions, could be rejected. This means that regional factors have a significant influence on the population's reading patterns.

Table 4. Repeated Measures Multivariate Analysis of Variance (RM-MANOVA) Test

Test Statistic	Value	Numerator df	Denominator df	F-value	p-value
Wilk's lambda	0.2473	6.0000	60.0000	30.4375	0.0000
Pillai's trace	0.7527	6.0000	60.0000	30.4375	0.0000
Hotelling-Lawley trace	3.0438	6.0000	60.0000	30.4375	0.0000
Roy's greatest root	3.0438	6.0000	60.0000	30.4374	0.0000

The results of the RM-MANOVA analysis showed a significant difference in reading patterns between urban and rural populations. This is clearly illustrated in the bar chart shown in **Figure 2**, where urban residents demonstrate higher average reading rates across most categories, particularly newspapers, magazines, storybooks, school texts, and knowledge-based materials. The highest gap is seen in newspaper reading, where urban readers (around 24%) far exceed rural readers (around 10%), highlighting the influence of better infrastructure, internet access, and information exposure in urban areas.
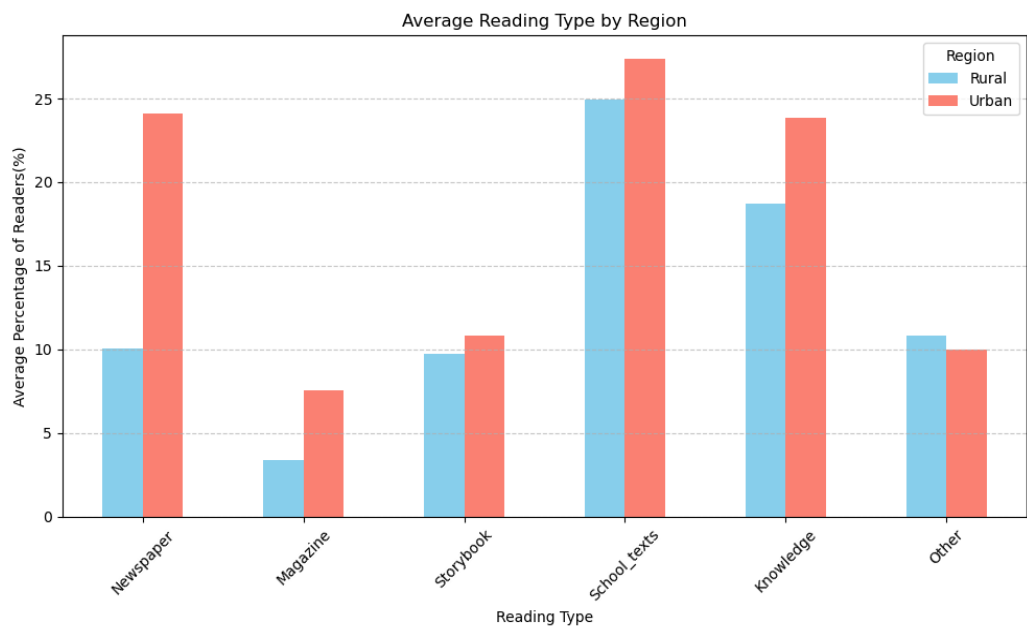

Figure 2. Average Reading Type by Region

Urban populations tend to engage with a broader variety of reading materials, supported by access to diverse resources such as digital platforms, libraries, and bookstores. In contrast, rural populations showed a greater reliance on school textbooks and functional readings like those in the "Other" category. While schoolbook reading remains high in both regions, rural readers generally had fewer opportunities to explore entertainment or non-formal reading content such as magazines and storybooks, which were more prominent in urban environments.

Scientific and knowledge-based materials also appeared more dominant in urban areas due to the presence of higher education institutions, professional demands, and a culture of staying informed. Meanwhile, textbooks were read more frequently in rural areas as they often serve as the main or only available source of formal reading material, especially in the absence of digital facilities, libraries, and bookstores. These patterns reflected broader disparities in access to education and information resources between urban and rural settings.

These findings have important implications for literacy programs in Indonesia. In rural areas, efforts should focus on providing more varied reading materials, not just school textbooks. This can be done by offering mobile libraries, local reading centers, or printed digital content that does not require internet access. Literacy activities that are relevant to the local community and daily life can also help increase interest in reading, as shown in the TBM (Taman Bacaan Masyarakat) program implemented in Gempol Village (Rubiyad & Fajriyah, 2025), which successfully improved literacy by offering

community-based reading spaces and participatory activities [20]. Meanwhile, in urban areas, where access to reading sources is already better, programs should aim to improve students' ability to think critically through reading scientific and educational texts. Therefore, literacy programs need to be adjusted based on regional conditions so that people in every area can have equal access to useful and interesting reading materials.

4. CONCLUSION

The multivariate analysis results indicate that all assumptions required for RM-MANOVA were met, which are the correlation between variables (Bartlett Test), homogeneity of the covariance matrix (Box's M-Test), and multivariate normality (Mardia Test). The results of RM-MANOVA indicate a significant difference in reading patterns between urban and rural areas. People in urban areas tend to have wider access to various types of readings, such as newspapers, magazines, story books, and school textbooks, while people in rural areas are more focused on readings that support their daily activities and primary education. This difference, as revealed through the RM-MANOVA analysis, reflects the influence of regional factors on reading habits. It is likely shaped by environmental differences, varying information needs, and possibly educational level. However, this study has not taken into account individual factors such as age or education level, which may also contribute to variations in reading habits. Future studies should consider incorporating these demographic variables for a more comprehensive understanding of literacy behavior.

AUTHOR CONTRIBUTIONS STATEMENT

- First Author : Conceptualization, methodology, software, validation, formal analysis, investigation, data curation, writing-original draft, writing-review & editing, visualization, project administration.
- Second Author : Conceptualization, methodology, validation, formal analysis, investigation, writing-original draft, writing-review & editing, project administration.
- Third Author : Conceptualization, methodology, validation, formal analysis, investigation, writing-original draft, writing-review & editing, project administration.
- Fourth Author : Conceptualization, methodology, software, validation, formal analysis, investigation, writing-original draft, writing-review & editing, project administration.

- Fifth Author : Conceptualization, methodology, validation, formal analysis, resources, supervision.
- Sixth Author : Conceptualization, methodology, validation, formal analysis, resources, supervision.

All authors discussed the results and contributed to the final manuscript.

CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interest.

DATA AVAILABILITY

The data that support the findings of this study are openly available from Badan Pusat Statistik (BPS) at https://www.bps.go.id/id/statistics-table/1/MjA3NiMx/proporsi-penduduk-berumur-5-tahun-ke-atas-yang-membaca-baik-cetak-maupun-elektronik-selama-seminggu-terakhir-menurut-provinsi-jenis-bacaan-dan-tipe-daerah-2018.html, titled "Proporsi Penduduk Berumur 5 Tahun ke Atas yang Membaca (Baik Cetak maupun Elektronik) Selama Seminggu Terakhir Menurut Provinsi, Jenis Bacaan, dan Tipe Daerah, 2018", accessed 3 August 2025.

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