PARAMETER
JURNAL MATEMATIKA, STATISTIKA DAN TERAPANNYA

e-ISSN. 2829-6303
Vol. 04 No. 1, April 2025
Page 167-174

ANALYSIS OF EDUCATION FUNDING ALLOCATION AND STUDENT ENROLLMENT DIFFERENCES BETWEEN SMA AND SMK STUDENTS IN INDONESIA : RM MANOVA APPROACH

Aniq Farichatus Zahwa[1]*, Dafinah Ramadhani[2], Shindi Shella May Wara[3], Aviolla Terza Damaliana[4]

[1,2,3,4] Bachelor's Program in Data Science, Faculty of Computer Science,
Universitas Pembangunan Nasional "Veteran" Jawa Timur
Rungkut Madya St, Gn. Anyar, Surabaya, 60294, Jawa Timur, Indonesia

E-mail Correspondence Author: *aniqfz52@gmail.com*

Abstract

The Indonesia Smart Program (PIP) is one of the government's efforts to improve access to education for underprivileged students. The purpose of this study is to examine how PIP educational aid was distributed and how successful it was in Indonesia in 2022 at the Senior High School (SMA) and Vocational High School (SMK) levels. The method used is Repeated Measures Multivariate Analysis of Variance (RM Manova) for education. The research data was obtained from the official government data portal of Indonesia (data.go.id). The results of the study do not show any significant differences in the distribution of assistance between SMA and SMK across various regions. Further research is needed to consider other factors that may have an impact.

Keywords: *Education aid, MANOVA, PIP, SMA, SMK.*

: https://doi.org/10.30598/parameterv4i1pp167-174

1. INTRODUCTION

Education is a crucial factor in preparing future generations to face the rapid advancements of the times. Therefore, every educational institution is required to be capable of handling all issues, whether they are local, national, or involve rapid and comprehensive changes **[1]**. Mustangin et al. state that educational assistance programs can provide children from underprivileged families with knowledge, confidence, and the skills necessary to face various life challenges **[2].**

Each year, the Indonesian government has made significant progress in improving the quality and accessibility of education at various institutions, including Senior High Schools (SMA) and Vocational High Schools (SMK). The Ministry of Education and Culture (Kemendikbud) also states that the allocated funds and the implemented education programs are expected to increase student enrollment and enhance teaching quality to strengthen human resource development **[3]**.

Repeated Measures Multivariate Analysis of Variance (RM Manova) is used to analyze whether there are significant differences between two or more dependent variables. In this study, the independent variable is the educational level (SMA and SMK), while the dependent variables are the funds received at each educational level.**[4]**

The objective of this research is to analyze and determine whether there are significant differences in the distribution of educational assistance among SMA and SMK students in Indonesia using the RM Manova method. This method allows for the analysis of differences while considering multiple variables simultaneously. The hypothesis is tested at a 95% confidence interval with a significance level (alpha) of 5%. The hypothesis is accepted if the significance value (Sig) is less than 0.05 **[5]** .

Thus, this study provides further information regarding the effectiveness of education funding distribution in improving educational accessibility across Indonesian provinces. Based on previous research conducted by Yusup B. Wirastiani 2019, titled "Evaluation of the Indonesia Pintar Program in Improving Access to Education in Junior High Schools" then a better understanding of the correlation between these factors will enable policymakers to implement targeted strategies to enhance both the quantity and quality of education.

2. RESEARCH METHOD

2.1. Data Source

This study utilizes data obtained and processed from the official government data portal: https://data.go.id/dataset/dataset/data-bantuan-pendidikan-program-indonesia-pintar-pip-tahun-2022. This dataset contains information on recipients of the Indonesia Smart Program (PIP) educational aid across various educational levels in Indonesia. However, this research focuses only on recipients at the SMA and SMK levels..

The dataset includes several variables related to the distribution of educational assistance, such as educational level, recipient region, and the number of student beneficiaries in each school. This data is used to analyze distribution patterns and the effectiveness of PIP assistance in optimizing access to education for students from economically disadvantaged backgrounds.

2.2. Research Variables

This study examines variables related to the distribution of educational assistance from the Indonesia Smart Program (PIP) at the SMA and SMK levels. The table below describes each variable used.

Table 1. Variabel Description

Variable	Description	Category
X1	Total PIP assistance received	Nominal value (in Rupiah)
X2	Number of students receiving aid	Nominal value
Y	Educational Level	1 = SMA 2 = SMK

Explanation:

- **X1 = Total PIP Assistance Received (in Rupiah)**
  This variable represents the total amount of educational assistance funds received by PIP beneficiary students in each province.
- **X2 = Number of Student Beneficiaries**
  A numerical value indicating the total number of students receiving PIP assistance in each province.
- **Y = Education Level**
  1 = Senior High School (SMA)
  2 = Vocational High School (SMK)

2.3. Data Analysis Method

This study employs the Repeated Measures Multivariate Analysis of Variance One-Way (RM Manova) method to evaluate differences in PIP assistance distribution based on educational level (SMA and SMK) across different provinces. RM Manova is a statistical technique that allows simultaneous analysis of multiple dependent variables measured repeatedly within a group or across different groups.

This method is useful in identifying PIP assistance distribution patterns by considering both educational level and regional factors. According to Puspitasari et al., several assumptions must be met for RM Manova analysis to be valid: (1) data must be independent, meaning each observation should not be interdependent; (2) samples must be randomly selected to ensure generalization of the research findings; (3) data should follow a normal distribution for each combination of analyzed factors; and (4) homogeneity of covariance must be met, meaning that variance and covariance between groups must be uniform. When these assumptions are met, RM Manova can provide more accurate results in evaluating the impact of independent variables on the dependent variables [6].

Repeated Measures MANOVA can provide a deeper analysis of the differences in the amount of aid received simultaneously, considering both educational categories and administrative regions. This method allows the study to identify whether there are significant distribution patterns in the allocation of PIP assistance.

Several data analysis methods used for Repeated Measures MANOVA are as follows[7].

1. Conduct data exploration using the official government website (data.go.id) to understand the distribution of PIP assistance across all provinces in Indonesia.
2. Identify the research variables used and define the categories for each variable.
3. Convert certain variables into categorical factors to align with RM MANOVA analysis.
4. Perform assumption tests for RM MANOVA, including Bartlett's test, Box's M test, and Mardia's test.
5. Conduct RM MANOVA analysis to examine differences in the distribution of PIP assistance between education levels (SMA and SMK) and analyze its interaction with the provincial factor.
6. Use post-hoc tests if significant differences are found to determine which categories have the most distinct distribution of assistance.
7. Assess model fit by comparing results from various statistical measures such as Wilks' Lambda, Pillai's Trace, Hotelling's Trace, and Roy's Largest Root.
8. Formulate conclusions and recommendations based on the analysis results to support decision-making regarding the effectiveness and equity of the PIP program.

3. RESULTS AND DISCUSSION

3.1. Data Description

The total number of students and total allocated funds for each educational level in this dataset are based on 34 provinces in Indonesia. The province names appear repeatedly since the allocation of funds and student numbers is divided between SMA and SMK.

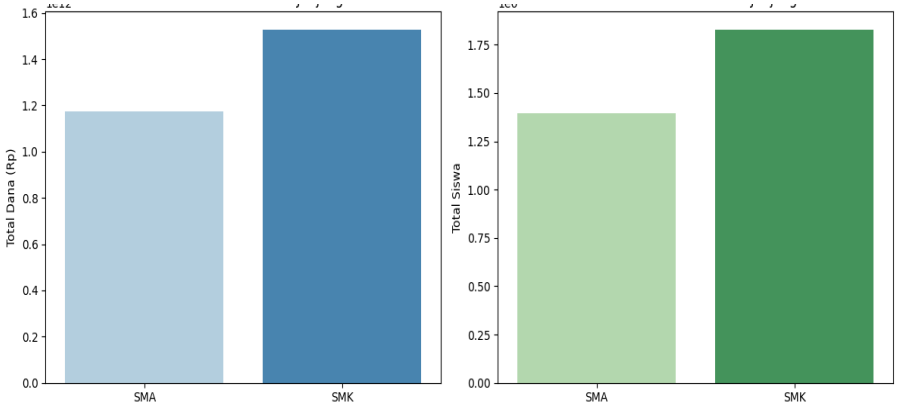

Figure 1. Data Description

The graphical representation of the data distribution shows that the total funding for SMA is lower than for SMK. Similarly, the number of SMA students is fewer than that of SMK students. This indicates a proportional relationship between these factors.

3.2. Bartlett's Test for Correlation Between Variables

This test is used to determine whether there is a significant correlation among the variables in the dataset. Similarly, as stated by G. Haumahu, Bartlett's test is used to assess whether the correlation matrix is an identity matrix or not.**[8].**

H_0 = The variables have no correlation (independent)

H_1 = There is a significant correlation among the variables

Based on the test results, the following output was obtained.

Table 2. Bartlett Test

Test Name	Test Statistic	Df	p-value	Result
Bartlett	508.4035	3.0	0.0000	Reject H_0. There is a relationship between variables (not independent).

Thus, the Chi-Square value obtained is 508.4035, with a degrees of freedom (Df) of 3 and a p-value of 0.0000. H_0 is rejected because the p-value is < 0.05, which means there is a significant difference in the data.

3.3. Box's M Test for Homogenity of Covariance

This test aims to examine whether the covariance matrix of different groups in the dataset is homogeneous (equal) or heterogeneous (different). MANOVA indicates that the variance of each dependent variable is the same across all groups and that the correlations between each dependent variable are also consistent across groups **[9]**. However, if not all groups have the same variance, comparison tests cannot be performed. This is because the differences observed may result from variance differences between groups rather than actual effects. **[10]**.

H_0 = The covariance matrix across groups is homogeneous

H_1 = The covariance matrix across groups is not homogeneous

Based on the test results, the following output was obtained:

Table 3. Box's M Test

Test Name	Test Statistic	Df	p-value	Result
Box's M	-25.5116	3.0	1.0000	Fail to reject H_0. Covariance across provinces is homogeneous.

Thus, the Box's M value obtained is -25.5116, with degrees of freedom (Df) = 3.0 and a p-value of 1.0000.

Since the p-value > 0.05, H_0 fails to be rejected, meaning there is no significant difference in the covariance matrix across provinces.**[11]**

It can be assumed that the data has homogeneous covariance, allowing the use of statistical approaches that assume covariance homogeneity.

3.4. Multivariate Normality Test (Mardia's Test)

The assumption of normality in multivariate data is tested using Mardia's test. Mardia's test assesses multivariate normality through two main components: skewness and kurtosis. Skewness measures the symmetry of the data distribution, while kurtosis evaluates the degree of peakedness or flatness of the distribution.**[12]**.

H_0 = The data follows a multivariate normal distribution

H_1 = The data does not follow a multivariate normal distribution

Based on the test results, the following output was obtained:

Table 4. Mardia's Test

Test Name	Test Statistic	p-value	Result
Mardia's Skewness	8.4466	0.0765	Fail to reject H_0. Data follows a multivariate normal distribution.
Mardia's Kurtosis	-6.0294	1.000	Fail to reject H_0. Data follows a multivariate normal distribution.

- Mardia's Skewness has a p-value of 0.0765 > 0.05, indicating insufficient evidence to reject H_0, meaning there is no significant asymmetry in the data.
- Mardia's Kurtosis has a p-value of 1.0000 > 0.05, showing no significant difference compared to a normal distribution.
- Since both p-values are greater than 0.05, H_0 fails to be rejected, meaning the data follows a multivariate normal distribution.**[13].**

The test results indicate that the data does not deviate from multivariate normality, allowing it to be used in statistical methods that assume a normal distribution.

3.5. Multivariate Test Results for One-Way RM MANOVA

This study will investigate the effect of two independent variables, also known as predictor variables, on the occurrence or variation in the value of the dependent variable.**[14]**. A One-Way Repeated Measures Analysis of Variance (ANOVA) was conducted to evaluate whether there is a significant difference between SMA and SMK levels concerning the dependent variables, namely fund allocation and the number of students.

Table 5. Multivariate Test Results for One-Way RM MANOVA

Factor	Wilk's Lambda	Df	f-value	p-value	Conclusion
Intercept	0.8571	2.0	5.4198	0.0067	Reject H0.
Level	0.9679	2.0	1.0795	0.3458	Fail to reject H0.

The results above include the hypothesis tested using *Repeated Measures Analysis of Variance (One-Way)* with a significance level of 5%, meaning the p-value must be below 0.05 for the hypothesis to be accepted. **[15]**.

The hypothesis above is explained as follows:

From the multivariate test results, the intercept shows a Wilk's Lambda value of 0.8571, an F-value of 5.4198, and a p-value of 0.0067 ($p < 0.05$). These results indicate a statistically significant overall difference in fund allocation and the number of students in the dataset. This means that the distribution of funds and the number of students in the dataset exhibit meaningful statistical variation.

From the multivariate test results for the education level factor, Wilk's Lambda is 0.9679, the F-value is 1.0795, and the p-value is 0.3458 ($p > 0.05$). These results indicate that there is no significant difference in fund allocation and the number of students across

education levels. Similar results were also obtained from other multivariate statistical tests, namely Pillai's Trace with a value of 0.0321, Hotelling-Lawley Trace at 0.0332, and Roy's Greatest Root at 0.0332. All tests yielded a p-value greater than 0.05.

Considering all these analyses, the null hypothesis (H_0) fails to be rejected, meaning that no significant difference was found in fund allocation and the number of students between SMA and SMK levels.

Based on these test results, which indicate no significant difference, it can be interpreted that the fund distribution is relatively equal and the number of students at each level is also relatively balanced. The analysis also shows that provinces exhibit significant differences (p-value < 0.001), suggesting that fund allocation and student numbers vary more based on geographic location rather than education level.

4. CONCLUSSION

This study analyzes the differences in fund distribution and student enrollment between SMA and SMK levels. The findings indicate no significant differences, meaning that the null hypothesis (H0) is rejected. This suggests that the policies regarding fund allocation and student enrollment between the two educational levels are relatively balanced, without significant disparities. However, the significant intercept results indicate variation in general fund allocation and student distribution. Further research is needed to consider additional variables that may influence these results.

REFERENCES

[1] B. Baidah, M. Mislaini dan D. Hijaya, "Faktor yang Mempengaruhi Rendahnya Kualitas Pendidikan di Indonesia," *ALFIHRIS: Jurnal Inspirasi Pendidikan,* vol. 3, no. 1, pp. 45-55, 2025.

[2] M. Mustangin, M. F. Akbar dan W. N. Sari, "Analisis Pelaksanaan Program Pendidikan Nonformal bagi Anak Jalanan," *International Journal of Community Service Learning,* vol. 5, no. 3, pp. 234-241, 2021.

[3] Kemendikbud, "Laporan Kinerja Pendidikan Indonesia," Kementrian Pendidikan dan Kebudayaan Republik Indonesia, 2022.

[4] A. Armstrong dan A. Richard, "Rekomendasi untuk Analisis Desain Pengukuran Berulang: Pengujian dan Koreksi untuk Kebulatan dan Penggunaan Analisis Manova dan Model Campuran," *Optik Mata dan Fisiologis,* vol. 37, no. 5, pp. 585-593, 2017.

[5] E. S. Sahabat Adi Kusuma, "Analisis Komparatif Kinerja Keuangan Klien Terbesar TSMC Selama Kekurangan Chip Global: Pengerjaan Panas Silikon Taiwan," *Owner: Riset dan Jurnal Akuntansi,* vol. 7, no. 1, pp. 829-840, 2023.

[6] I. D. Pursitasari, B. Harianto, S. S. Wulan, D. Hermanto dan D. Ardianto, "Multivariate Analysis of Variance (MANOVA) in the Field of Health and Mathematics and Natural Sciences Education di Bidang Kesehatan dan Pendidikan MIPA," *Jurnal Ilmiah Kanderang Tingang,* vol. 15, no. 1, pp. 117-126, 2024.

[7] O'Brien, G. Ralph dan K. K. Mary, "MANOVA Method for Analyzing Repeated Measures Designs: An Extensive Primer," *Psychological Bulletin,* vol. 97, no. 2, p. 316, 1985.

[8] G. Haumahu dan N. Lewaherilla, "Penerapan Analisis Komponen Utama dalam Mereduksi Faktor-Faktor Penyebab Diari di Provinsi Maluku," *MAp (Mathematics and Applications) Journal,* vol. 2, no. 1, pp. 41-46, 2020.

[9] S. Sutrisno dan D. Wulandari, "Multivariate Analysis of Variance (MANOVA) untuk Memperkaya Hasil Penelitian Pendidikan.," *AKSIOMA: Jurnal Matematika Dan Pendidikan Matematika,* vol. 1, no. 2, pp. 582-593, 2018.

[10] I. Oktiana, M. Sapti dan P. Nugraheni, "Pengaruh Model Pembelajaran STAD Berbantuan Media Kahoot! terhadap Keaktifan dan Hasil Belajar Matematika Siswa," *Journal of Citizen Research and Development,* vol. 1, no. 2, pp. 582-593, 2024.

[11] A. A. Rahman dan L. Mirati, "Pengaruh Pendekatan Realistic Mathematics Education terhadap Motivasi dan Hasil Belajar Siswa Sekolah Dasar di Aceh Barat," *Taman Cendekia: Jurnal Pendidikan Ke-SD-An,* vol. 3, no. 2, pp. 323-333, 2019.

[12] E. D. Rinawiyanti dan B. Lianto, "Investigasi Kapabilitas Inovasi Teknologi pada Industri Alas Kaki di Jawa," *INOBIS: Jurnal Inovasi Bisnis dan Manajemen Indonesia,* vol. 2, no. 4, pp. 597-613, 2019.

[13] M. Mardia dan K. V, "Applications of Some Measures of Multivariate Skewness and Kurtosis in Testing Normality and Robustness Studies," *Sankhyā: The Indian Journal of Statistics,* vol. 36, pp. 115-128, 1974.

[14] A. R. W dan A. R.Pratama, "Analisis Sentimen Kebijakan Pendidikan di Masa Pandemi COVID-19 dengan CrowdTangle di Facebook," *AUTOMATA,* vol. 2, 2021.

[15] K. H. Young, "Catatan Statistik untuk Peneliti Klinis: ANOVA Pengukuran Berulang Satu Arah untuk Data dengan Pengamatan Berulang," *Kedokteran Gigi Restoratif dan Endodontik,* vol. 40, pp. 91-95, 2015.