

## Analysis of the Influence of Learning Strategies on the Academic Achievement of Gen-Z Students with Data Visualization Using Matplotlib in Python

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**Abstract** - This research examines the influence of learning strategies on the Grade Point Average (GPA) of Generation Z (Gen-Z) students. The background of this research is to understand how the learning strategies used by Gen-Z students affect their GPA. The research aims to analyze the influence of various learning strategies, identify the most effective ones, and demonstrate the use of the Matplotlib library in Python for data visualization. This research is quantitative in nature using statistical methods to evaluate the results. Data was collected through a questionnaire distributed to students, including the frequency of using learning strategies such as reading books, watching YouTube tutorials, doing practice questions, taking private lessons/online tutoring, and participation in training/seminars/workshops. Data analysis was carried out using Python and the Matplotlib library to visualize the data and provide a clear picture of the effectiveness of the learning strategy implemented. The research results show that active and technology-integrated learning strategies have a significant influence on increasing the academic achievement of Gen-Z students. Specifically, strategies such as watching YouTube tutorials and doing practice questions had a positive correlation with improving students' GPAs. These findings indicate the importance of adapting learning methods that suit the characteristics and learning preferences of Gen-Z students.

### Keywords :

*Learning strategies;*  
*Academic Achievement;*  
*Gen-Z students;*  
*Matplotlib;*  
*Python;*

### Article History:

Received: 12-11-2024  
Revised: 14-12-2024  
Accepted: 02-01-2025

**Article DOI :** 10.22441/collabits.v2i1.28450

## 1. INTRODUCTION

Universities are currently faced with new challenges in improving student academic achievement, especially for those who are just starting higher education, namely Generation Z (Gen-Z). Gen-Z has unique characteristics that differ from previous generations, which influences their learning strategies. One of the factors that has great potential to affect academic achievement is the learning strategies used by Gen-Z students.<sup>1</sup>

In recent years, the use of information and communication technology in the learning process has become very popular. The use of these technologies, including the Matplotlib library in Python, allows for more effective data visualization and can improve students' analytical skills.<sup>2</sup> Matplotlib allows students to create different types of graphs that help in the visual understanding of the data they have.<sup>3</sup> This study aims to provide a clear picture of the influence of learning

strategies on the academic achievement of Gen-Z students. Effective learning strategies are expected to be identified, so that colleges can implement methods that suit the characteristics and needs of Gen-Z students to improve academic achievement.<sup>4</sup> The purpose of choosing this title is to answer the urgent need to understand how learning strategies integrated with technology can contribute improving the academic achievement of Gen-Z students. Thus, this research only academically relevant but also practical in providing guidance for educational institutions in developing more adaptive and effective learning methods.

### Problem Formulation

- A) How does active learning strategies affect the academic achievement of Generation Z students in higher education?
- B) Can the use of information and communication technology in learning strategies increase the

GPA of Generation Z students?

- C) Which learning strategies are most effective in improving the academic achievement of Generation Z students?

### Research Objectives

- A) Analyze the influence of various learning strategies on the academic achievement of Gen-Z students.
- B) Identifying the most effective learning strategies to improve the academic performance of Gen-Z students.
- C) Demonstrate how to use the Matplotlib library in Python to analyze and visualize student academic achievement data.

### Research Benefits

1. For Educators  
Providing guidance in developing effective learning strategies for Gen-Z students.
2. For Students  
Improve academic understanding and achievement through learning strategies that are appropriate to their characteristics.
3. For Researchers  
Provide examples of applications of using Matplotlib in Python in educational research, as well as enrich the literature on effective learning strategies.
4. For Educational Institutions  
Provide input for the development of curriculum and teaching methods that are more adaptive to technological developments and the needs of Gen-Z.

## 2. LITERATURE REVIEW

### A) Learning Strategies

Learning strategies are various methods or techniques used by educators to effectively convey subject matter to students. This strategy is designed to improve students' understanding, engagement, and academic achievement. In the context of Generation Z (Gen-Z) students, who are known for their high-tech skills and different learning tendencies from previous generations, the learning strategies used must be tailored to their characteristics. This study measures the learning strategies applied by Gen-Z students using

a questionnaire that includes the following strategies: Reading Books<sup>5</sup>, Watching Youtube Tutorials<sup>6</sup>, Doing Practice Questions<sup>7</sup>, Taking Tutoring Private or Online Tutoring<sup>8</sup>, and Seminar or Workshop Training<sup>9</sup>.

These strategies were chosen because of their popularity among Gen-Z students and their ability to support an effective learning process. This study aims to analyze the influence of each of these strategies on student academic achievement.

### B) Characteristics of Mahasiswa GEN-Z

Generation Z, or Gen-Z, is a group of individuals born between the mid-1990s and early 2010s. According to Tapscott (2009), Gen-Z is known to have high technological skills and tends to be more independent in learning than previous generations. They grow up in an environment that is highly connected to the internet and digital technology, which influences the way they learn and interact with information.<sup>10</sup> Research by Williams (2017) shows that Gen-Z is more responsive to the use of digital media in learning.<sup>11</sup>

### Matplotlib Library in Python

Matplotlib is a Python library used to create diverse data visualizations, such as line charts, bar charts, and pie charts. According to Hunter (2007), Matplotlib is very effective for use in educational research because of its ability to visualize data clearly and easily understand.<sup>12</sup>

## 3. RESEARCH METHODS

### Type of Research

This research is a quantitative research with an experimental approach. The main purpose of this study is to test the influence of learning strategies on the academic achievement of Gen-Z students. The experimental research design is used to control other variables that may affect the results so that more valid and reliable conclusions can be obtained.

### DATA COLLECTION TECHNIQUES

This research uses an online questionnaire distributed to students of the Class of 2023. This questionnaire is designed to collect data on the learning strategies used by students and their academic achievement (GPA).

interpretation.

## DATA COLLECTION STEPS

### A) Questionnaire Creation

- 1) Designing a Questionnaire: The questionnaire is designed using Google Forms and consists of questions related to learning methods and GPA.
- 2) Create a Questionnaire Link: The questionnaire link is shared with respondents via email, social media, or other communication platforms.
- 3) Collecting Responses: The data that has been filled in by the respondents is collected and stored in a spreadsheet format for further analysis. Data was collected from 107 respondents.

### B) Data Separation and Cleaning

- 1) Data Separation: Data is separated based on the learning method used by the respondents. Each learning method is stored in a separate dataframe.
- 2) Data Cleaning: Invalid or incomplete data is deleted to ensure the accuracy of the analysis.

## Data Analysis Techniques

This study uses quantitative methods with descriptive and inferential data analysis techniques to evaluate the influence of various learning strategies on the academic achievement of Gen-Z students. The data analyzed included the average GPA of students who used five different learning methods: reading books, doing practice questions, taking private tutoring/online tutoring, participating in training/seminars/workshops, and watching YouTube tutorials. The data was obtained through a Google Form questionnaire distributed to Gen-Z students.

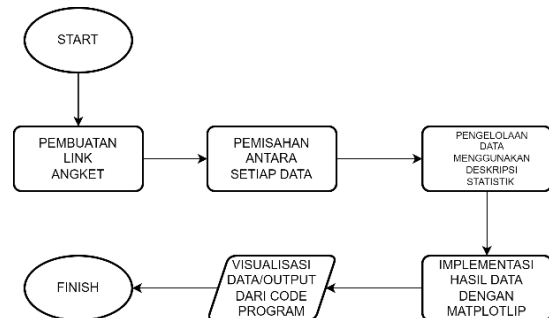
## Steps of Data Analysis

### A) Data Management Using Statistical Descriptions

- 1) Calculating Descriptive Statistics: Calculating the average score, the smallest GPA, and the largest GPA from the data that has been collected and cleaned.
- 2) Creating Descriptive Statistics Tables: Compiling the results of descriptive statistical calculations into tables for easy

### B) Flowchart Algorithm on Data Analysis

Figure 1. Data Analysis Flowchart Algorithm



### C) Implementation of Data Results with Matplotlib

In this section, it will be explained how the results of the questionnaire data that we have obtained and then re-analyzed using the Matplotlib library to see the plot visualization from the comparison between the learning method and the GPA obtained in the previous semester. The visualizations used include *bar charts*, *line charts*, and *pie charts*.

Figure 2. Importing the Matplotlib Library

```
import matplotlib.pyplot as plt
import numpy as np
```

Figure 3. Entering Data

```
# Data jumlah siswa berdasarkan metode belajar
metode_belajar = ['Membaca Buku', 'Mengerjakan Soal',
                 'Les Privat', 'Seminar Workshop', 'Menonton YouTube']
jumlah_siswa = [24, 19, 3, 9, 50]
```

Figure 4. Entering GPA Data

```
# Data IPK berdasarkan metode belajar
ipk_kategori = ['2.76-3.00', '3.01-3.50', '3.51-4.00']
ipk_data = {
    'Membaca Buku': [1, 3, 20],
    'Mengerjakan Soal': [2, 5, 12],
    'Les Privat': [2, 0, 1],
    'Seminar Workshop': [0, 4, 5],
    'Menonton YouTube': [4, 17, 29]
}
```

Figure 5. Input Color In Data

```
# Mengatur warna untuk setiap metode belajar
colors = {
    'Membaca Buku': 'blue',
    'Mengerjakan Soal': 'green',
    'Les Privat': 'red',
    'Seminar Workshop': 'purple',
    'Menonton YouTube': 'orange'
}
```

Figure 10. Creating a pie chart for GPA comparison with study methods

```
# Membuat pie chart untuk perbandingan IPK dengan metode belajar
ipk_total = sum(ipk for ipk in ipk_data.values())
ax[1].pie(ipk_total, labels=metode_belajar, colors=colors, autopct='%1.1f%%', startangle=140)
ax[1].set_title('Persentase IPK Berdasarkan Metode Belajar')
```

Figure 11. Displaying charts

```
# Menampilkan diagram
plt.tight_layout()
plt.show()
```

#### D) Data Visualization with Matplotlib

In this section, we'll create different types of graphs to visualize the data that has been previously inputted.

Initialize an image with four subplots in a single column. The size of the figure is 10x24 inches.

Figure 6. Creating a Subplot

```
# Membuat subplot
fig, ax = plt.subplots(4, 1, figsize=(10, 24))
```

Create a pie chart to display the percentage of the number of students based on the learning method.

Figure 7. Creating a Pie Chart for the Number of Students Based on Learning Methods

```
# Membuat pie chart untuk jumlah siswa berdasarkan metode belajar
ax[0].pie(jumlah_siswa, labels=metode_belajar,
         colors=colors, autopct='%1.1f%%', startangle=140)
ax[0].set_title('Persentase Metode Belajar Siswa')
```

Figure 8. Create a Line Graph for the number of students based on the learning method

```
# Membuat grafik garis untuk jumlah siswa berdasarkan metode belajar
ax[1].plot(metode_belajar, jumlah_siswa, '-o-', color='black') # '-o-' untuk garis dengan titik
ax[1].set_title('Perbandingan Metode Belajar Siswa')
ax[1].set_xlabel('Metode Belajar')
ax[1].set_ylabel('Jumlah Siswa')

# Menambahkan angka di atas setiap titik pada grafik jumlah siswa
for i, txt in enumerate(jumlah_siswa):
    ax[1].annotate(txt, (metode_belajar[i], jumlah_siswa[i]), textcoords='offset points', xytext=(0,10), ha='center')
```

Figure 9. Create a line graph for GPA based on study method

```
# Membuat grafik garis untuk IPK berdasarkan metode belajar
for metode, ipk in ipk_data.items():
    ax[2].plot(ipk_kategori, ipk, '-o-', label=metode, color=colors[metode])
# Menambahkan angka di atas setiap titik pada grafik IPK
for i, txt in enumerate(ipk):
    ax[2].annotate(txt, (ipk_kategori[i], ipk[i]), textcoords='offset points', xytext=(0,10), ha='center')

ax[2].set_title('Perbandingan IPK Berdasarkan Metode Belajar')
ax[2].set_xlabel('Kategori IPK')
ax[2].set_ylabel('Jumlah Siswa')
ax[2].legend()
```

### 4. RESULTS AND DISCUSSION

#### A) DATA DESCRIPTION

This study used data from 105 students who applied five different learning methods: Reading Books, Doing Problems, Private Tutoring, Workshop Seminars, and Watching YouTube. Each study method is analyzed based on the number of students and their GPA distribution in the GPA categories of 2.76- 3.00, 3.01-3.50, and 3.51-4.00.

#### B) DESCRIPTIVE STATISTICAL RESULTS

The following table shows the average, the smallest GPA, and the largest GPA of each study method.

Table 1. Hasil dari Statistik Deskriptif

Metode Belajar	Rata-Rata IPK	IPK Terendah	IPK Tertinggi
Membaca Buku	3.66	2.76	4.00
Mengerjakan Soal	3.53	3.01	4.00
Les Privat	3.38	2.50	3.51
Seminar Workshop	3.53	2.76	4.00
Menonton YouTube	3.51	3.01	3.76

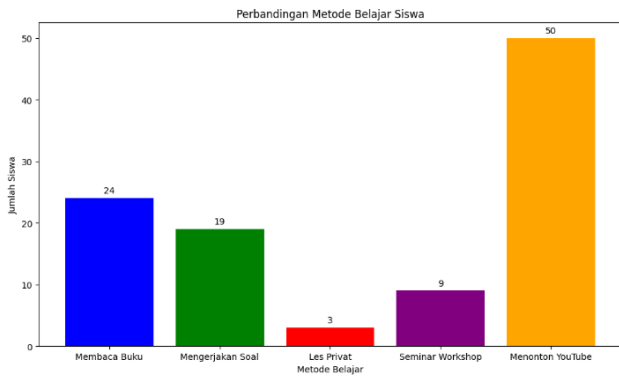
#### C) DATA VISUALIZATION RESULTS

Here is a visualization of the data generated from the analysis using Matplotlib:

1. Visualization of the number of students based on learning methods

The bar chart shows that the "Watching YouTube" learning method has the highest number of students (50 students), followed by "Reading Books" (24 students), "Doing Problems" (19 students),

"Workshop Seminar" (9 students), and "Private Tutoring" (3 students).



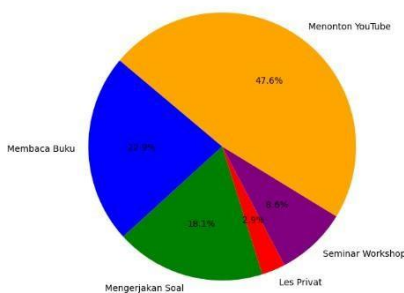
1) GPA visualization based on study method

The line graph shows that the "Reading Books" method has the highest GPA in all categories, followed by "Doing Questions" and "Workshop Seminars". The variation in GPA is evident among study methods, with "Watching YouTube" having the highest number of students in the highest GPA category.

2) Pie Chart for GPA percentage and number of students

The pie chart shows the percentage distribution of the number of students and GPA based on the study method, with "YouTube Watching" occupying the largest portion of the number of students, and the "Reading Books" and "Watching YouTube" methods account for most of the total GPA.

Persentase IPK Berdasarkan Metode Belajar



4.1 DISCUSSION

A) The influence of active learning strategies on academic achievement

The results of the analysis showed that active learning strategies, such as doing practice questions and participating in seminars/workshops, had a significant positive impact on academic achievement. The "Doing Questions" and "Workshop Seminar"

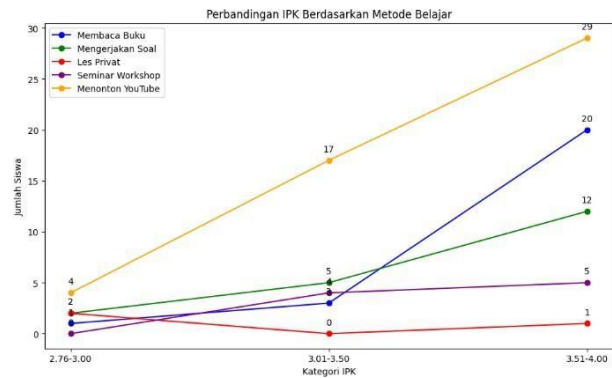
methods showed a good average GPA (3.53) and also the ability to achieve the largest GPA (4.00). This shows that activities involving active participation and practical exercises can improve students' academic outcomes.

B) The Use of Information and Communication Technology in Learning Strategies

Technologies such as "Watching YouTube" and "Private Tutoring/Online Tutoring" show varying results. While technology can support learning, its effectiveness depends largely on the quality of the material and student engagement.

C) The Most Effective Learning Strategies

The "Reading Books" and "Doing Questions" methods show better and more consistent academic results than the technology based. This shows that more interactive and in-depth learning methods tend to be more effective in increasing the GPA of Generation



Z students.

5. CONCLUSION AND SUGGESTION

A) Conclusion

This study examines the influence of various learning strategies on the academic achievement of Generation Z students, using data and visualizations from Matplotlib. The results showed that the "Reading Books" method was the most effective, with the highest average GPA 3.66 and a consistent GPA range from 2.76 to 4.00. This method shows significant success in improving students' academic achievement.

The "Doing Questions" method is also effective, with an average GPA of 3.53 and the ability to achieve the highest GPA of 4.00. This confirms that active practice contributes positively to academic

outcomes. On the other hand, technology-based methods such as "Watching YouTube" and "Private Tutoring/Online Tutoring" show mixed results, with an average GPA of 3.51 and 3.38, respectively, indicating lower effectiveness compared to conventional learning methods. Overall, more interactive and in-depth methods, such as reading books and doing problems, have been shown to be more effective in increasing students' GPAs compared to technology-based methods.

## B) Suggestion

### • Optimization of Traditional Learning Methods

Strengthen the use of the method of reading books and doing practice questions in the curriculum, Because both show a significant positive impact on academic achievement.

### • Increased Support for Online Learning

Increase resources and support for online methods such as private tutoring and YouTube tutorials, to make them more interactive and responsive to student needs.

### • Adaptation to Generation Z Characteristics

Integrate technology and practice-based approaches in learning to better suit the preferences of Generation Z, who tend to favor hands-on experience and technology.

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