Abstract

This report presents a statistical investigation of daily music listening time among students in Cambodia. The analysis applies descriptive statistics, point estimation, confidence intervals, and hypothesis testing based on concepts from Chapters 1–4 of *Fundamental Statistics*. Although music genre data were collected, they are summarized descriptively due to the small sample size and high category diversity.

1 Introduction

Music is an important part of daily life for many students in Cambodia. Students listen to music while studying, relaxing, or commuting. The purpose of this project is to analyze the average daily time students spend listening to music. By applying statistical methods, we aim to summarize the data, estimate the population mean, construct a confidence interval, and test a hypothesis related to listening time.

Although respondents also reported their preferred music genres, the sample size ($n = 38$) is insufficient for formal inference on categorical variables. Thus, genre data are presented only as descriptive context.

2 Dataset Description

2.1 Source of Data

The data were collected through an online survey distributed to students in Cambodia between December 26–28, 2025. Each participant reported their average daily music listening time in minutes, along with demographic and preference information.

2.2 Variables

- X: Daily music listening time (minutes) — numerical, continuous
- Music type — categorical (e.g., Pop, Classical, Hip-hop)
- Gender, age — not analyzed inferentially in this report

2.3 Sample Size

After data cleaning, the final sample size is:

$$n = 38$$

2.4 Data Cleaning

Inconsistent entries such as “30minutes”, “2h”, and “2 Hours” were standardized:

- Non-numeric text removed
- Hours converted to minutes (e.g., “2h” $\rightarrow$ 120)

2.5 Music Genre Summary

Due to response diversity, similar genres were grouped for clarity:

Music Type (Grouped)	Frequency
Pop / K-pop	10
Classical	9
Hip-hop / Rap	5
Romantic	4
Chill / Study (Lofi, Relaxing)	2
Other / Mixed	8

Classical and Pop/K-pop were the most frequently reported genres, reflecting both global trends and academic cultural context.

2.6 Final Dataset (Listening Time in Minutes)

Obs.	Minutes	Obs.	Minutes
1	30	20	30
2	240	21	3
3	140	22	30
4	30	23	60
5	180	24	60
6	60	25	120
7	30	26	25
8	120	27	240
9	80	28	180
10	120	29	240
11	120	30	200
12	30	31	1
13	360	32	60
14	140	33	150
15	60	34	60
16	50	35	200
17	30	36	120
18	60	37	12
19	120	38	240

3 Descriptive Statistics (Chapter 1)

3.1 Summary Statistics

The following were computed from the data:

- Sample mean: $\bar{x} = 99.0$ minutes
- Median: 60 minutes
- Range: 1 to 360 minutes

- Sample variance: $s^2 = 5852.5$
- Sample standard deviation: $s = 76.5$ minutes
- First quartile (Q_1): 30, Third quartile (Q_3): 140
- Interquartile range (IQR): 110 minutes

3.2 Outlier Detection

Using the IQR rule:

$$\text{Lower Fence} = 30 - 1.5 \times 110 = -135 \quad \text{(no lower outliers)}$$

$$\text{Upper Fence} = 140 + 1.5 \times 110 = 305$$

Values above 305 are outliers. The observation **360 minutes** is identified as an upper outlier.

3.3 Interpretation

The distribution is **right-skewed** (mean > median), driven by a few students reporting very high listening times (e.g., 240–360 min). The median better represents a "typical" student. The large standard deviation ($s = 76.5$) indicates high variability in listening habits.

4 Point Estimation (Chapter 2)

4.1 Population Parameters and Estimators

Let μ denote the true mean daily music listening time among Cambodian students. We estimate μ using the sample mean $\bar{X} = 99.0$.

4.2 Properties

The sample mean $\bar{X}$ is:

- **Unbiased**: $\mathbb{E}[\bar{X}] = \mu$
- **Consistent**: $\bar{X} \xrightarrow{p} \mu$ as $n \to \infty$

4.3 Standard Error

$$SE(\bar{X}) = \frac{s}{\sqrt{n}} = \frac{76.5}{\sqrt{38}} \approx 12.41 \text{ minutes}$$

5 Confidence Interval (Chapter 3)

5.1 95% Confidence Interval

Since σ is unknown and $n = 38$, we use the t-distribution with $df = 37$. Critical value: $t_{0.025,37} \approx 2.026$.

$$\bar{x} \pm t_{\alpha/2,n-1} \cdot \frac{s}{\sqrt{n}} = 99.0 \pm 2.026 \cdot 12.41$$
$$\Rightarrow 99.0 \pm 25.1 \quad \Rightarrow \quad (73.9,\ 124.1)$$

5.2 Interpretation

We are 95% confident that the true mean daily music listening time for students in Cambodia lies between **73.9 and 124.1 minutes**.

6 Hypothesis Testing (Chapter 4)

6.1 Hypotheses

We test whether the average listening time differs from 120 minutes (2 hours), a value suggested by informal student discussions:

$$H_0 : \mu = 120 \quad \text{vs.} \quad H_a : \mu \neq 120$$

6.2 Test Statistic

$$t = \frac{\bar{x} - \mu_0}{s/\sqrt{n}} = \frac{99.0 - 120}{12.41} \approx -1.692$$

6.3 Decision and Conclusion

With $df = 37$, the two-tailed p-value ≈ 0.099. At $\alpha = 0.05$, p-value $> \alpha$, so we **fail to reject** H_0.

Conclusion: There is insufficient statistical evidence to conclude that the average daily music listening time among Cambodian students differs from 120 minutes.

7 Final Conclusion

This project analyzed daily music listening time among 38 Cambodian students using core statistical methods. Key findings include:

- Listening time is highly variable and right-skewed (median = 60 min, mean = 99 min).
- The 95% confidence interval for the mean is (73.9, 124.1) minutes.
- We found no significant evidence that the mean differs from 120 minutes.
- Classical and Pop/K-pop were the most common music genres.

Limitations: The sample is small, non-random (convenience-based), and collected over a short holiday period, which may affect generalizability. Self-reported data may also introduce bias.

Future work: A larger, stratified sample could enable analysis of listening time by gender, age, or genre preference using appropriate inferential methods.