MIDDLE EAST TECHNICAL UNIVERSITY

A Study of Learning Strategies and Study Behaviors among METU Students

FINAL PROJECT

STAT 365

DEPARTMENT OF STATISTICS OF
MIDDLE EAST TECHNICAL UNIVERSITY

Ecril Deniz	Pınar İlgin Güvenir	İbrahim Öztürk
2614568	2614659	2666741

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1. Introduction

Academic success among university students is shaped by a combination of behavioral, environmental, and individual factors. While traditional perspectives often emphasize the total amount of time devoted to studying, Recent evidence suggests that the quality of study behaviors may be more influential than the quantity of time devoted to studying.. In particular, self-regulatory learning strategies such as regular topic review and consistent lecture attendance are considered critical components of effective learning.

University students are exposed to diverse academic demands and social contexts that influence their learning behaviors. Study habits, learning preferences, time allocation, living arrangements, and study environment conditions interact in complex ways to affect academic performance. Understanding these relationships is especially important in academically competitive institutions such as Middle East Technical University, where students from different departments face high performance expectations.

This study aims to examine the relationship between academic success and study-related behaviors among METU undergraduate students. Using survey data, the study evaluates whether self-regulatory strategies (lecture attendance and regular review) are stronger predictors of cumulative GPA (cGPA) than the total volume of weekly study hours. Additionally, the study explores how study environment adaptability and extracurricular activities relate to academic performance.

2. Aim of the Study

The primary aim of this study is to examine how METU students' academic success relates to their study behaviors, learning strategies, extracurricular activities, and study environments. Rather than focusing solely on the quantity of study time, the study emphasizes the relative importance of **self-regulation, engagement, and adaptability** in academic performance.

2.1 Literature Review

2.1.1 Study Quantity vs. Study Quality

Previous research has shown that simply increasing study hours does not necessarily lead to improved academic outcomes. Plant et al. (2005) demonstrated that effective study strategies and focused engagement are stronger predictors of academic performance than total study time alone. Similarly, Credé and Kuncel (2008) found that class attendance is one of the strongest behavioral predictors of GPA.

2.1.2 Self-Regulated Learning Strategies

Self-regulated learning, which includes behaviors such as reviewing material regularly and attending lectures, has been widely linked to academic success. Zimmerman (2002)

emphasized that students who actively regulate their learning processes tend to achieve higher academic outcomes. Lecture attendance, in particular, has been consistently shown to have a strong positive relationship with GPA (Romer, 1993).

2.1.3 Study Environment and Academic Performance

The effectiveness of different study environments has gained attention in recent years. While quiet and structured environments are traditionally preferred, some studies suggest that academically successful students may be more adaptable to varying conditions (Jamieson et al., 2010). This adaptability may reflect stronger concentration skills and self-regulation.

2.1.4 Extracurricular Activities and Time Allocation

Participation in extracurricular activities, particularly sports, has been shown to have mixed effects on academic outcomes. While moderate involvement can support well-being, excessive participation may compete with academic time (Pike & Kuh, 2005). The balance between academic and non-academic activities remains a key concern for university students.

2.2 Objectives

The objectives of this study are:

- To examine whether **self-regulatory learning strategies** (lecture attendance and topic review) are stronger predictors of academic success than **weekly study hours**.
- To investigate whether **extracurricular activities** (sports and social activities) compete with students' weekly study time.
- To analyze whether **academically successful students** are able to study effectively across different environments, indicating reduced dependence on ideal study conditions.

3. Data Description

The dataset used in this study was collected through a structured survey administered to **121 METU undergraduate students**. The questionnaire was designed to gather information on students' demographic characteristics, academic performance, study habits, learning strategies, study environments, and extracurricular involvement. Data were collected using both face-to-face surveys and online survey links.

The survey includes the following questions:

1. Year of birth
2. Gender
3. Academic department
4. Year of study
5. Cumulative GPA
6. Current living arrangement
7. Average weekly study hours outside of lectures
8. Study resources commonly used during studying
9. Weekly time spent on sports activities
10. Weekly time spent on social media
11. Weekly time spent on social activities

The following statements were rated using a 5-point Likert scale (from strongly disagree to strongly agree):

12. Understanding lessons is easier with visual materials
13. Verbal explanations improve learning
14. Hands-on practice helps understanding
15. Regular review of lecture topics
16. Regular lecture attendance
17. Use of instructors' office hours when needed
18. Dorm room is a comfortable study environment
19. Ability to focus when studying in a café
20. Overall effectiveness of personal study habits

Data Preparation

Before analysis, responses were reviewed for consistency and completeness. Variables were coded appropriately for statistical analysis, and GPA categories were converted into approximate numeric values when required. Likert-scale items were treated as ordinal variables in line with standard practices in educational research.

4. Methodology

4.1 Participants

The study sample consists of 121 undergraduate students enrolled in various departments at Middle East Technical University. Participants represent different year levels and living arrangements.

4.2 Sampling Method

Data for this study were collected from 121 METU undergraduate students using a structured questionnaire. Due to time and accessibility constraints, a non-probability sampling approach was employed. Specifically, convenience sampling was used as the primary recruitment method, whereby participants were selected based on ease of access through face-to-face surveys conducted on campus. This approach allowed for efficient data collection from students across different departments and years of study.

In addition to face-to-face data collection, the survey was distributed online enabling broader participation. As respondents were encouraged to share the survey link with their peers, elements of snowball sampling were also present. This combination facilitated the inclusion of participants beyond the initial contact group and increased the overall sample size.

Participation in the survey was voluntary, and respondents completed the questionnaire either in person or online. Although the sampling method does not allow for full randomization, efforts were made to reach students from diverse academic backgrounds to enhance the representativeness of the sample.

4.3 Data Collection Procedure

- Surveys were administered face-to-face and online via shared links.
- Participants were informed about the purpose of the study.
- Participation was voluntary, and informed consent was obtained.
- Anonymity and confidentiality were strictly maintained.

5. Data Analysis and Results

The collected data were analyzed using both descriptive and inferential statistical methods. This section presents the findings related to academic success, study behaviors, learning strategies, study environments, and extracurricular activities.

5.1 Descriptive Statistics

- Demographic variables (gender, year of study, department) were summarized using frequency distributions.
- Study behaviors and learning strategies were described using central tendency measures.
- Living arrangements and study environment perceptions were presented categorically.

5.2 Inferential Analyses

- Correlation Analysis (Pearson/Spearman): Used to examine relationships between cGPA and study behaviors, learning strategies, and environmental factors.
- Multiple Linear Regression: Applied to assess the relative impact of lecture attendance, regular topic review, and weekly study hours on academic success.
- Additional Regression Models: Used to analyze the relationship between extracurricular activities and weekly study hours.

5.3 Self-Regulatory Learning Strategies and Academic Success

Research Question

Hypothesis Development

To provide a statistical answer to the research question, we established a set of hypotheses. These hypotheses aim to test whether the quality of study (strategies) outweighs the quantity of study (hours) in predicting academic performance at METU.

Null Hypothesis (H0): There is no significant relationship between study behaviors (strategies or volume) and academic success (GPA).

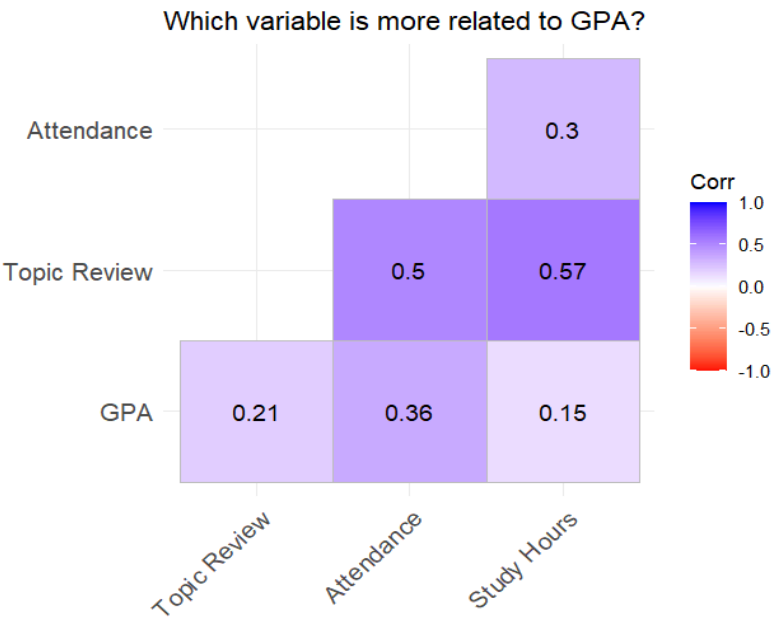
Alternative Hypothesis (H1): Self-regulatory learning strategies (Topic Review and Lecture Attendance) are significantly stronger and more positive predictors of academic success (GPA) than the total volume of weekly study hours.

Before conducting formal hypothesis testing via multiple linear regression, a **Pearson Correlation Analysis** was performed to explore the initial relationships between variables. The primary objective of this step was to visualize the strength and direction of the associations between academic success (GPA) and its potential predictors: self-regulatory strategies (topic review and lecture attendance) and total study volume (weekly study hours).

To facilitate a clear comparison, a **Correlation Heatmap** was generated. This visualization serves as an essential diagnostic tool for two reasons:

Identifying Associations: It provides a visual confirmation of whether self-regulatory behaviors or study volume have a more prominent direct link to GPA.

Detecting Multicollinearity: It ensures that our independent variables (e.g., Review and Attendance) are not so highly correlated that they would undermine the reliability of the subsequent regression model.



The **Correlation Heatmap** provides the initial visual evidence to address our research question by illustrating the raw associations between variables. The most prominent observation is the strong, positive correlation between **Academic Success (GPA)** and self-regulatory strategies, specifically **Lecture Attendance** and **Topic Review**. In contrast, the relationship between **Weekly Study Hours** and GPA appears significantly weaker and less defined, as indicated by the lighter color shading. This visual distinction suggests that active engagement with course material and consistent attendance are more closely linked to higher academic performance than the sheer volume of time spent studying.

Following the initial visualization, a **Multiple Linear Regression** analysis was conducted to formally test our hypotheses and determine the unique contribution of each variable to academic success. By examining the regression coefficients (β) and p-values, we can assess which study behaviors remain significant predictors of GPA when all factors are considered simultaneously.

```
Call:
lm(formula = scale(GPA_num) ~ scale(Review) + scale(Attendance) +
    scale(Hours_num), data = df %>% filter(!is.na(GPA_num)))

Residuals:
     Min       1Q   Median       3Q      Max
-2.16741 -0.64531 -0.09289  0.76552  1.89861

Coefficients:
                  Estimate Std. Error t value Pr(>|t|)
(Intercept)       -0.01375    0.10205  -0.135  0.89314
scale(Review)      0.01059    0.13816   0.077  0.93908
scale(Attendance)  0.34225    0.11488   2.979  0.00376 **
scale(Hours_num)   0.03887    0.12363   0.314  0.75395
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.9632 on 86 degrees of freedom
  (12 observations deleted due to missingness)
Multiple R-squared:  0.1333,    Adjusted R-squared:  0.1031
F-statistic:  4.41 on 3 and 86 DF,  p-value: 0.006197
```

The multiple linear regression analysis was performed using standardized variables to evaluate the relative impact of each predictor on academic success. The overall model is statistically significant (**F(3, 86) = 4.41**, **p = 0.006197**), indicating that the combination of learning strategies and study volume significantly predicts GPA variations among METU students. Upon examining the standardized coefficients, **Lecture Attendance** emerged as the most dominant and the only statistically significant predictor in the model (**beta = 0.34225**, **p = 0.00376**). This high level of significance ($p < 0.01$) demonstrates a robust positive relationship; specifically, for every one-standard-deviation increase in attendance frequency, GPA is predicted to rise by **0.342** standard deviations, holding all other factors constant.

In stark contrast, the other variables failed to demonstrate meaningful predictive power. **Weekly Study Hours** yielded a negligible and non-significant coefficient (**beta = 0.0388**, **p = 0.75395**), and **Topic Review** showed even less impact with a coefficient of nearly zero (**beta = 0.01059**, **p = 0.93908**). The Adjusted R-squared value of **0.1031** suggests that while the model explains approximately **10.3%** of the variance in student GPAs, this variance is almost entirely driven by the attendance variable. These results allow us to confidently reject the null hypothesis in favor of our alternative hypothesis (H1), concluding that **Lecture Attendance** is a far more powerful and significant predictor of academic success than the total volume of study hours. This statistically proves that consistent engagement through being present in class is the most vital behavior for achieving a higher GPA in the METU environment.

Although the initial heatmap suggested a visual correlation between **Topic Review** and **GPA**, the regression analysis revealed that this effect diminishes when **Lecture Attendance** is controlled. This suggests that the positive impact of reviewing is largely shared with the influence of being present in class. Once attendance is accounted for, the unique contribution of reviewing and total study hours becomes statistically non-significant, further reinforcing that attendance is the primary engine of academic success in this model.

5.4 Study Environment Adaptability and Academic Success

Research Question

Are students with higher cumulative GPA able to study effectively across different study environments, indicating reduced dependence on ideal study atmospheres?

The analysis is based on survey responses collected from METU students.

- **Cumulative GPA (cGPA):**
  Reported in ordered categories and converted to approximate numeric midpoints to allow quantitative analysis.
- **CafeFocus:**
  A 5-point Likert-scale variable measuring students' agreement with the statement *"I can focus well when studying in a café."*
- **DormComfort:**
  A 5-point Likert-scale variable measuring agreement with *"My dorm room provides a comfortable environment for studying."*
  This variable was analyzed only for students who reported living in dormitories.

These variables capture perceived study effectiveness in **both structured (dormitory)** and **less controlled (café)** environments.

Methodology

Because the focus and comfort variables are measured on ordinal Likert scales, **Spearman's rank correlation** was used to examine the association between GPA and study environment effectiveness. This method is appropriate for ordinal data and does not require assumptions of normality or linearity.

Simple linear regression models were also fitted to summarize the direction and approximate magnitude of the relationships. These models are descriptive and do not imply causation.

Café Study Environment

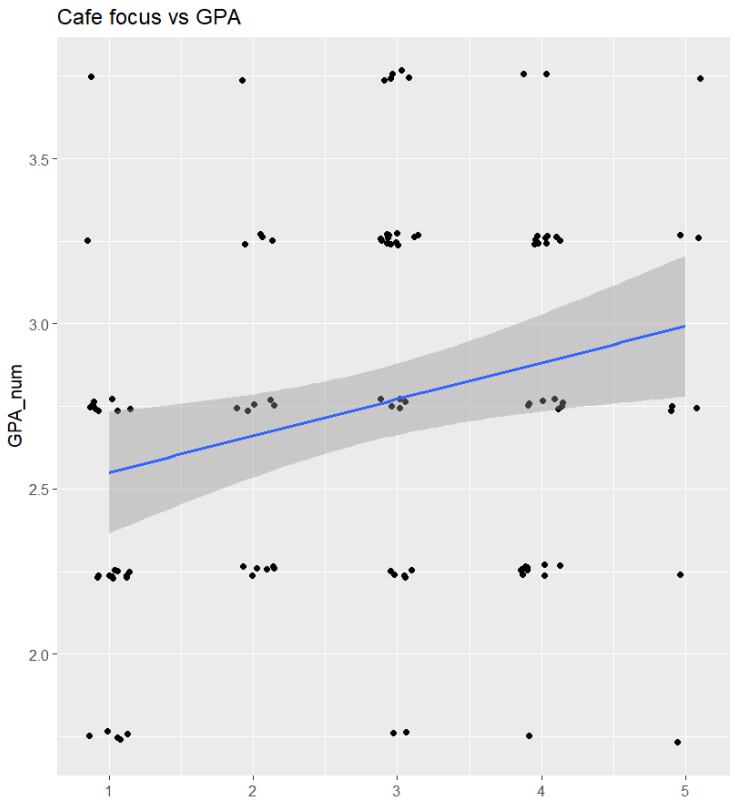


Figure 1

A statistically significant positive association was found between GPA and the ability to focus while studying in cafés (Spearman's $\rho = 0.238$, $p = 0.0139$). This indicates that students with higher GPA tend to report greater ability to maintain focus in café environments, despite their typically higher levels of noise and distraction.

The regression analysis supports this finding, showing a positive slope between CafeFocus and GPA. However, the relatively low R^2 value suggests that café focus alone explains only a small portion of GPA variation.

Dormitory Study Environment

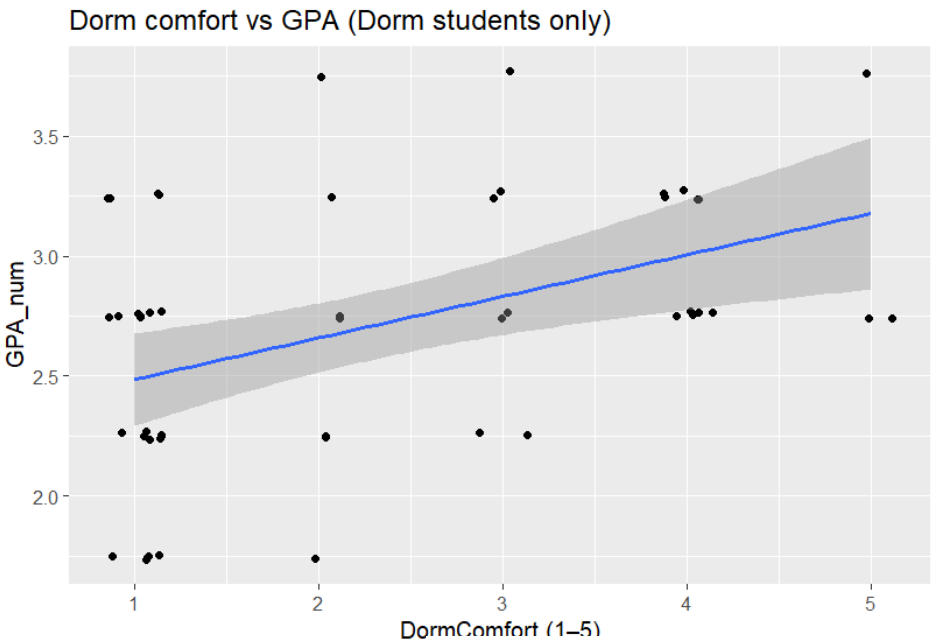


Figure 2

Among students living in dormitories, a stronger positive association was observed between GPA and dorm study comfort (Spearman's $\rho = 0.433$, $p = 0.00168$). This result indicates that academically successful students are more likely to perceive their dorm rooms as comfortable and effective study environments.

The corresponding regression model shows a meaningful positive relationship, with dorm comfort explaining a larger proportion of GPA variation compared to café focus.

Discussion

Taken together, these results suggest that academically successful students tend to study effectively across **different types of environments**. While study comfort in dormitories shows a stronger association with GPA, higher-GPA students also report effective focus in cafés, which are generally less structured and more distracting.

This pattern supports the interpretation that higher academic performance may be associated with **greater adaptability and self-regulation in study behaviors**, rather than strict reliance on ideal study conditions. In other words, academically successful students appear better able to maintain effective studying even when environmental conditions are not optimal.

Importantly, these findings reflect **associations rather than causal relationships**. It is possible that stronger self-regulatory skills contribute both to higher GPA and to effective studying across environments.

Conclusion

The analysis provides evidence that students with higher GPA tend to report effective studying in both structured and less controlled environments. This suggests that academic success may be linked to reduced dependence on specific study atmospheres and greater adaptability to varying study contexts.

5.5 Extracurricular Activities and Weekly Study Time

Research Question

Does participation in extracurricular activities compete with the amount of time students allocate to weekly studying?

Hypothesis Development

University students have limited discretionary time, and engagement in extracurricular activities may require reallocating time that could otherwise be devoted to studying. Sports activities, in particular, demand fixed schedules and physical effort, which may directly compete with study time. Social activities, on the other hand, may be more flexible and therefore less likely to reduce study hours.

Based on this time-allocation framework, the following hypotheses were formulated:

- **Null Hypothesis (H_0):**
  Participation in extracurricular activities (sports activity hours and social activity hours) has no significant relationship with weekly study hours.

- **Alternative Hypothesis (H_1):**
  Higher participation in extracurricular activities—particularly sports—is associated with a reduction in weekly study hours.

Methodology

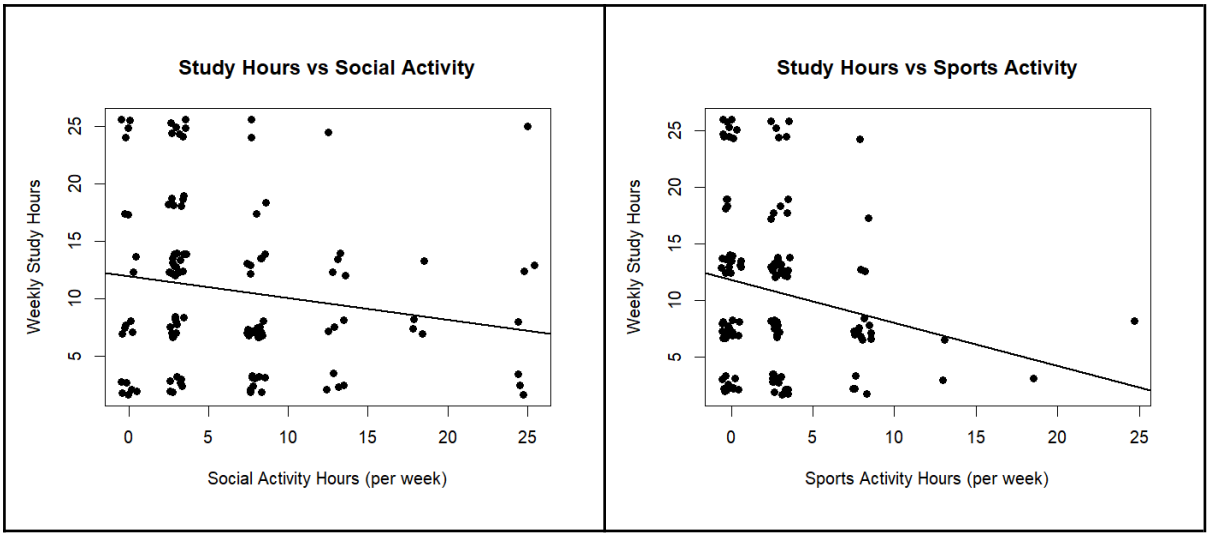
A multiple linear regression analysis was conducted to evaluate whether extracurricular activities compete with weekly study time. Weekly study hours were regressed on sports activity hours and social activity hours.

Categorical time ranges were converted into approximate numeric midpoints to allow quantitative analysis. Prior to modeling, all variables were cleaned and checked for missing values, and no missing observations were detected for the variables included in the regression.

The regression model is specified as:

$$StudyHours\_i = \beta\_0 + \beta\_1(SportsHours\_i) + \beta\_2(SocialActivityHours\_i) + \varepsilon\_i$$

Results:




```
##
## Call:
## lm(formula = StudyHours_num ~ SportsHours_num +
SocialActivityHours_num,
##     data = df)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -10.056  -4.635  -1.403   3.922  16.905
##
## Coefficients:
##                           Estimate Std. Error t value Pr(>|t|)
## (Intercept)                12.5563     0.9747  12.883   <2e-16 ***
## SportsHours_num            -0.3161     0.1705  -1.853   0.0663 .
## SocialActivityHours_num    -0.1405     0.1006  -1.398   0.1649
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 7.005 on 118 degrees of freedom
## Multiple R-squared:  0.05763,    Adjusted R-squared:  0.04166
## F-statistic: 3.608 on 2 and 118 DF,  p-value: 0.03013
```

The overall regression model was statistically significant
(F(2, 118) = 3.61, p = 0.030), indicating that extracurricular activities jointly explain a small but meaningful portion of the variation in weekly study hours.

The estimated coefficients reveal differing effects across activity types:

- Sports Activity Hours showed a marginally significant negative association with weekly study time
  ($\beta = -0.316$, $p = 0.066$). This suggests that increased participation in sports is associated with a slight reduction in study hours.

- Social Activity Hours did not show a statistically significant relationship with study time
  ($\beta = -0.141$, $p = 0.165$), indicating no clear evidence that social activities reduce the amount of time students spend studying.

The model's explanatory power was modest
($R^2 = 0.058$, Adjusted $R^2 = 0.042$), implying that most variation in study hours is driven by factors beyond extracurricular involvement.

Discussion

The findings provide partial support for the alternative hypothesis. Sports participation appears to modestly compete with study time, likely due to its structured and time-intensive nature, which may reduce the time and energy available for studying. In contrast, social activities do not show a significant relationship with weekly study hours, suggesting greater flexibility or compensation across study schedules. The relatively low R^2 value indicates that study time is influenced by additional factors such as academic workload, motivation, course difficulty, and self-regulatory skills; therefore, extracurricular activities alone do not sufficiently explain variations in students' study time.

Conclusion

This analysis demonstrates that extracurricular activities have a limited impact on students' weekly study time. While sports participation may slightly reduce study hours, social activities do not appear to meaningfully compete with academic effort. Overall, the results suggest that students are generally able to balance extracurricular involvement with their academic responsibilities, and that time spent studying is shaped more strongly by individual study behaviors and academic engagement than by extracurricular participation.

6. Limitations

This study has several limitations. First, the use of convenience and partial snowball sampling may introduce sampling bias and limit the generalizability of the findings. Second, the data rely on self-reported measures, which may be subject to recall bias or social desirability bias. Finally, the cross-sectional nature of the data restricts causal interpretations; observed relationships represent associations rather than cause-and-effect conclusions.

7.Conclusion and Result:

The primary conclusion regarding learning strategies is that the "quality" of a student's engagement is a significantly more powerful predictor of success than the "quantity" of time spent studying. Our multiple linear regression analysis provides robust evidence to reject the null hypothesis, as Lecture Attendance emerged as the sole statistically significant predictor of GPA (beta = 0.34225, p = 0.00376). This suggests that being physically or virtually present in the classroom allows students to capture specific insights and instructional cues that cannot be replicated through independent study alone. Interestingly, while the initial heatmap showed a visual link between Topic Review and GPA, this effect disappeared in the formal model once attendance was accounted for. This indicates that the benefits of reviewing are often tied to regular attendance. Most importantly, the nearly absent impact of Weekly Study Hours (beta = 0.0388, p = 0.75395) proves that for METU students, simply "putting in the hours" without the active engagement provided by lectures does not guarantee a higher GPA.

The second part of the study provides significant evidence that academic excellence among METU students is closely associated with a high degree of environmental adaptability and self-regulatory focus. The analysis reveals that high-achieving students, characterized by higher cumulative GPAs, possess the unique ability to maintain academic productivity across a diverse spectrum of study environments. While a positive correlation was observed between GPA and the perceived effectiveness of structured settings such as dormitory rooms, a notable discovery was that these successful students also reported a superior capacity to sustain focus in less controlled and potentially distracting environments like cafés. This pattern suggests that academic success in a rigorous university setting is not strictly contingent upon the availability of ideal or specialized study conditions. Instead, it is driven by a student's internal ability to adapt their cognitive focus and learning behaviors to varying external contexts. Ultimately, the study concludes that environmental adaptability serves as a hallmark of academic resilience, indicating that the development of robust self-regulation skills is a more critical determinant of success than the physical characteristics of the study environment itself.

The final analysis highlights that the potential trade-offs between students' extracurricular involvements and their commitment to academic work. The regression model revealed that

while these activities explain a portion of the variance in study time ($F(2, 118) = 3.61$, $p = 0.030$), their overall impact is modest. A notable finding is the marginally significant negative relationship between Sports Participation and weekly study hours (beta = -0.32, $p = 0.066$), which suggests that intensive physical activities may modestly compete for time due to training schedules. However, Social Activity Hours showed no significant negative impact on study volume (beta = -0.14, $p = 0.165$). These findings suggest that METU students generally maintain an effective balance between their social lives and academics, though high-intensity commitments like sports may require more strategic time management to prevent a reduction in study time.

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