Middle East Technical University

Department of Statistics

# STAT 365

# SURVEY SAMPLING TECHNIQUES

# TERM PROJECT

**Physical Activities' Impact On Academic Performance of University Students**

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# Introduction

## a)Introduction

Academic success of university students plays a dramatic role in individual life.

The desire of succession may lead to ignoring the various aspects of life. Moreover, having spent time on different activities rather than working is assumed to be detrimental for academic success. But, physical activities are accepted to be substantially instrumental for overall health of the body, well-being of individuals, both mental and spiritual health and consequently for academic success, despite the general assumptions. Thus, it should not be overlooked. The research investigated these claims and statistically answers the assumptions by looking into the relation between physical activity and academic success on METU students. In terms of mental health level, CGPA, focus level. The population of interest in the study is Middle East Technical University undergraduate students. The relation of physical activity and academic success is a common research topic which has different conclusions for every research. The study aims to support one of the previous proposals about the relation.

## b)Data Description

The data has 194 observations with 18 initial variables and extra 5 derived variables from initial ones. The data consists in total, 13 categorical variables and 10 numerical variables. The variables are detaily explained in the table below. The observation number 194 is sufficient for ± 7 confidence interval.

| Variable | Description |
|---|---|
| Gender | Gender of the participant |
| Year | Birth Year of the Participant |
| Height | Height of the participant |
| Weight | Weight of the participant |
| University | University where participant studies |
| Faculty | Faculty of participant |
| Department | Department of participant |
| Degree | Participants' education level |
| CGPA | CGPA of participant (1:0-0.99,2:1-1.99,3:2-2.99,3-4.0) |

| | |
|---|---|
| Physical Activeness | Number of days in a week spent for physical activity |
| Activity time | Participants' each session time in hours for doing physical activity |
| Study time | Participants' weekly study time in hours |
| Average time | Participants' average time for each study session |
| Focus | Participants' distraction ratio in each study session |
| Stress | Stress level of participant during exams |
| Worrying | If participant constantly worries about education |
| Guilty level | If participant feels guilty before/after exams |
| Isolation | If participant isolates from friends and family during exam weeks |
| BMI | Body Mass Ratio |
| Active | If participant does physical activity(if yes:1,no:0) |
| Ratio | Ratio |
| Focus | Focusness level of participant |
| ILL | Illness level of participant |

**c)Research Questions**

The questions of interest are:

Does physical activity have a positive effect or any effect on academic performance?

Whether being physically active affects academic success?

Does spending time more on physical activities rather than work affects success

Does doing physical activity enhance the focus level?

Is there any relation between focus level and academic success?

Does physical activity have an influence over mental health?

**d)Research Philosophy**

Epistemology has chosen to be the research philosophy of the study. Since the topics of interest are mostly generalized assumptions and claims. The survey aims to reveal the statistical facts behind those. People develop knowledge based on their perceptions and experiences. The research aims to find the truth for METU students.

## Literature Review

There are many researches about connecting the link between physical activity and academic success many of them have conducted on different target populations. Some are pre-school age children and some are various ages of school. The following researchers have used for source of inspiration

*Physical Activity and Academic Success: Links on a University Campus: Haley Mull, BS*

*The Investigation of the Relation between Physical Activity and Academic Success Ruchan Iri , Serkan Ibis & Zait Burak Aktug1*

The majority of previous research has revealed positive correlations between physical activity and academic success (Chomitz et al., 2009; Coe, Pivarnik, Womack, Reeves, & Malina, 2006; Datar & Sturm, 2006; Dwyer, Sallis, Blizzard, Lazarus, & Dean, 2001; Fox, BarrAnderson, Neumark-Sztainer, & Wall, 2010; Grissom, 2005; Sibley & Etnier, 2003; Taylor, Sallis, & Needle, 1985; Tomporowski, 2003). Since every population and sample is different than each other there is not a significant way to reach the global truth, assumptions. Thus, continuing studies needed for different populations.

## Aim of The Research

The study tries to explain the relation between academic success and physical activity.

The many previous researched reflected on the same topic but study differs from most of them with investigating physicals activities impact on success from difference perspectives such as mental health and focus level. The research tries to reflect the result on METU students and compare them with previous studies. Moreover, research aims to promote physical activity and removing the scientific misbeliefs about physical activity being detrimental to success. Hence, study works on explaining the relation explicitly.

## Survey Methodology

### a) Sample Design

The population of the target was chosen of undergraduate students of METU the non-probability sampling method "Convenience sampling" was used. Since it was the most applicable and feasible one. As a result to have an scientific inferences about population "Psudo Design" method is used. Since design weights are not available due to non probability sampling, the post stratification method was used to calculate psudo weights. While determining the weight two calibration technique of post stratification "cell weighting" and "Rake weighting" has compared to having the better functioning method. Gender and Department information of population has been used as auxiliary variables for weighing.

### b) Data Collection Method

The data is collected throughout an online survey. Google form was used. The survey took 16 days to complete and a total number of 194 questionnaires have been reached. The survey took place between 2021-12-04 and 2021-12-21.

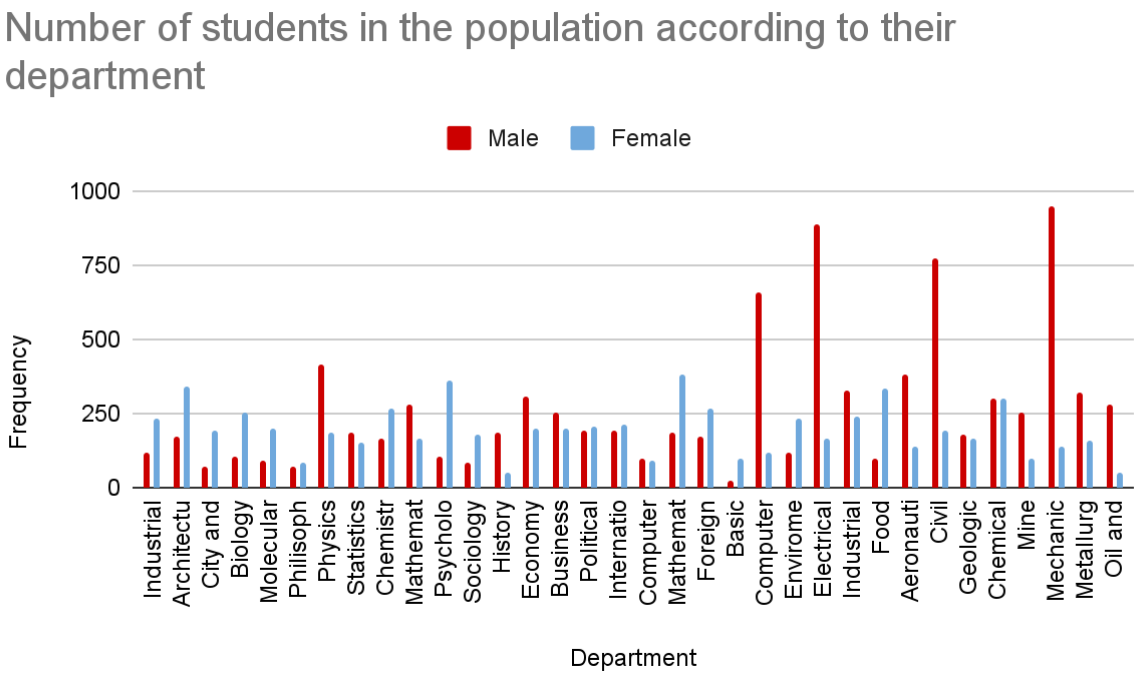
### c) Methods of Analysis

Excel is used for accessing the auxiliary variables and calculating sample weight with basic cell tables. Descriptive statistics and statistical tests were used to have an inference about sample and estimation inference about population. “survey” package from rcran is used to calculate population parameters and population inference estimation. “dplyr” package from rcran is used with data manipulation.

The analysis and calculations are made in the R programming language. Pie charts, histograms, barplots and boxplots used for univariate and bivariate analysis.Chi square and nonparametric tests of Mann Whitney, Wilcoxon signed rank and Kruskal Wallis are used for statistical testing. Shapiro-Wilk test used for testing normality but not included in the paper since all of the data is distributed non normally.

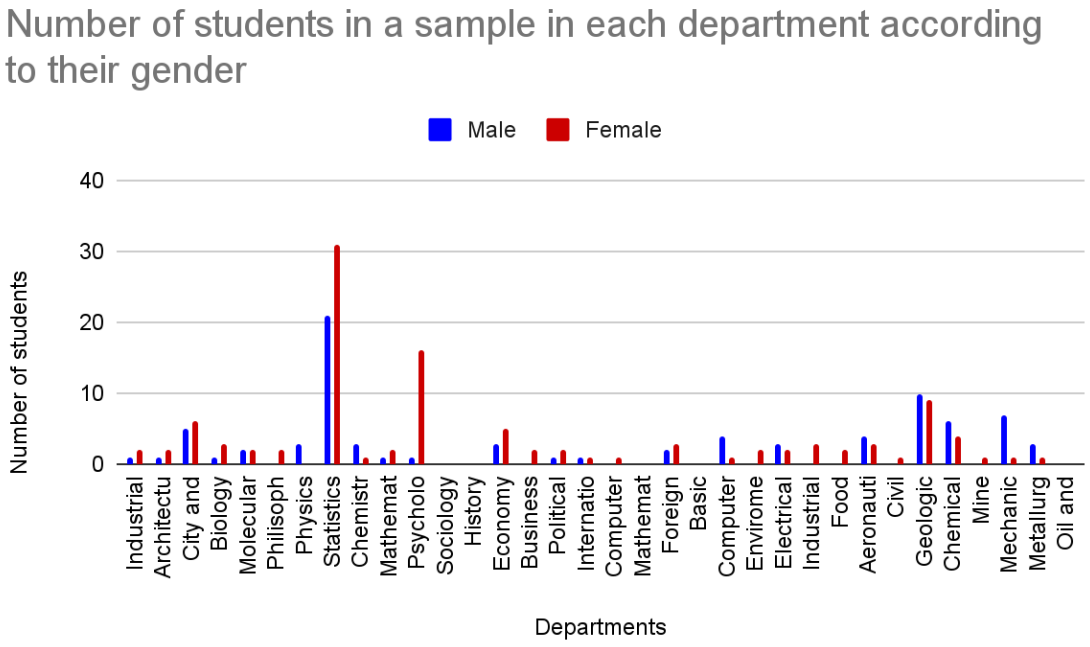
## Results and Findings

The population data of gender is obtained from “yokatlas.yok.gov.tr”. The gender distribution of the last three years is available. Average gender proportions of the last three years for each department had been calculated to have a population data of the gender. Additionally, the population data of the number of students enrolled in each department is obtained from Middle East Technical University.

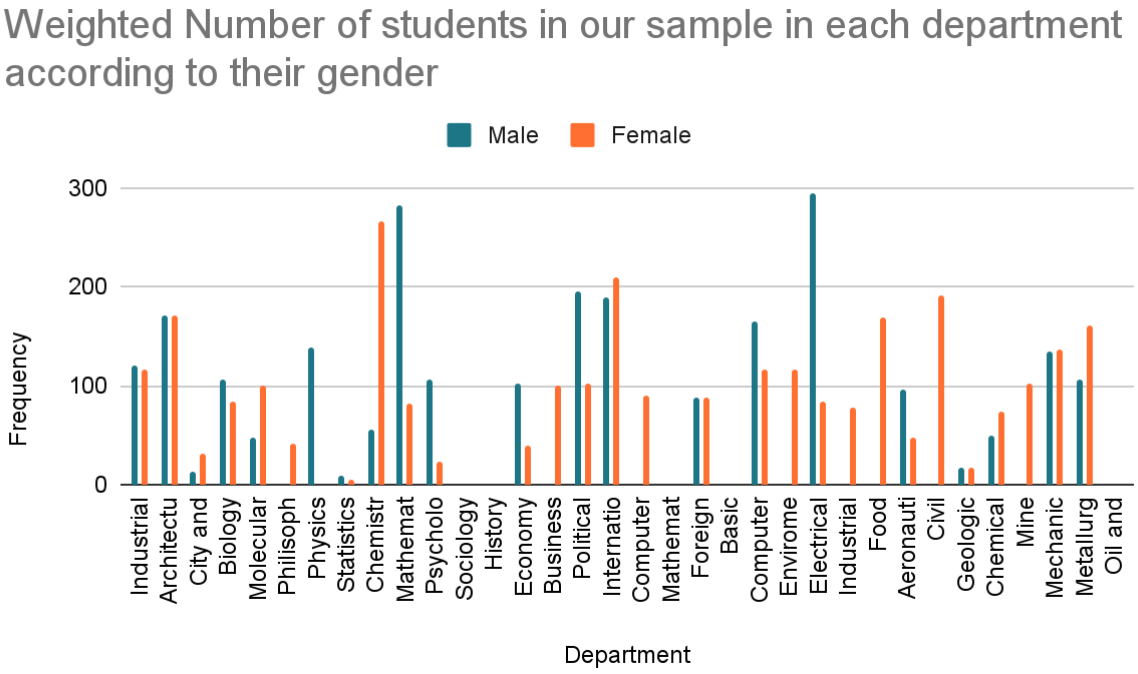



Hence, the population data "gender" and "department" are used as auxiliary variable to calibrate the sample with population

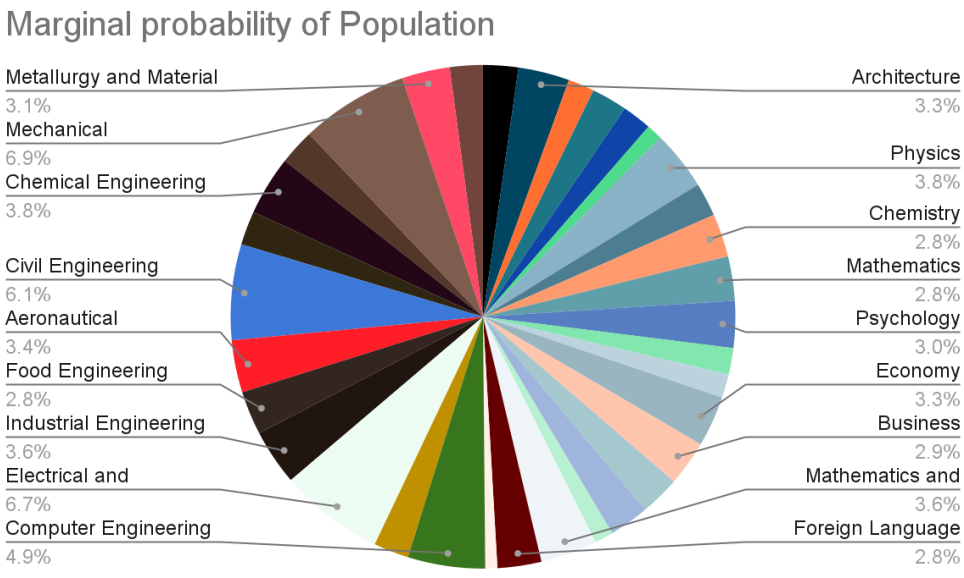
The following table shows the joint distribution of "gender" and "department" in the sample

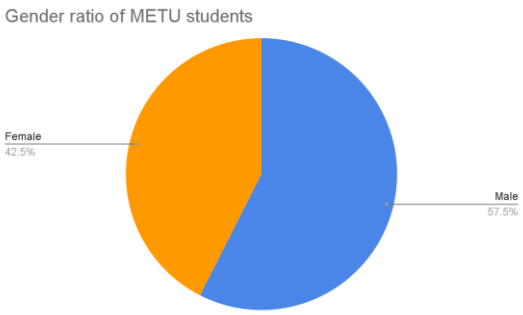



The cell weighting technique of post stratification is used to calculate psudo design weights for each cell




Due to lack of observation in sample the frequency of some cells is extremely small. (< 5) Additional weighting technique has used to compare the two post stratification methods in terms of standard error and design effect to choose the better functioning method.

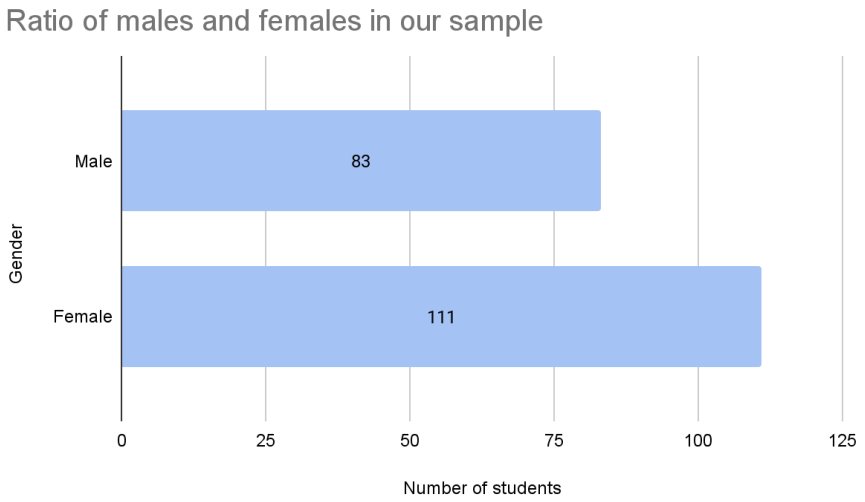




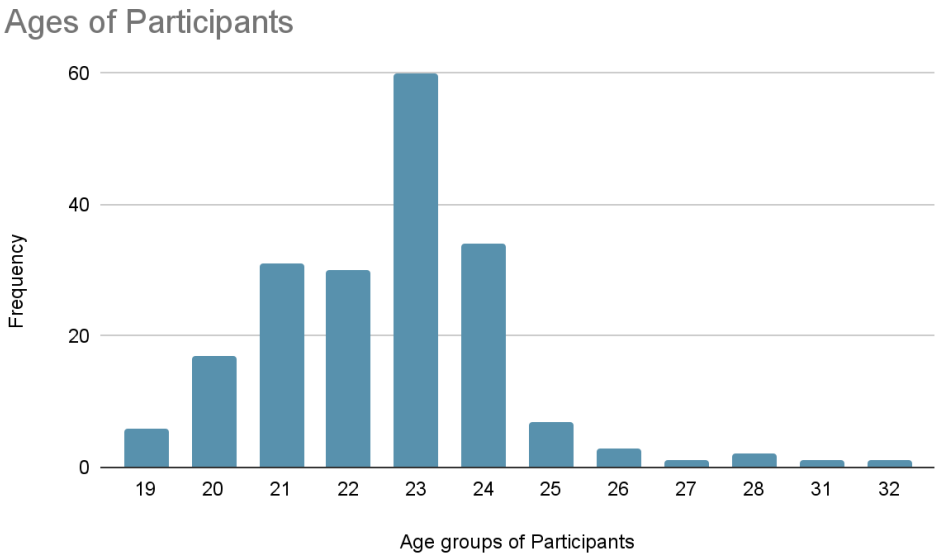

The tables above show the marginal probabilities of departments and gender in the population.

The Raking weighting technique is used to calculate psudo weights for sample from the marginal probabilities above.

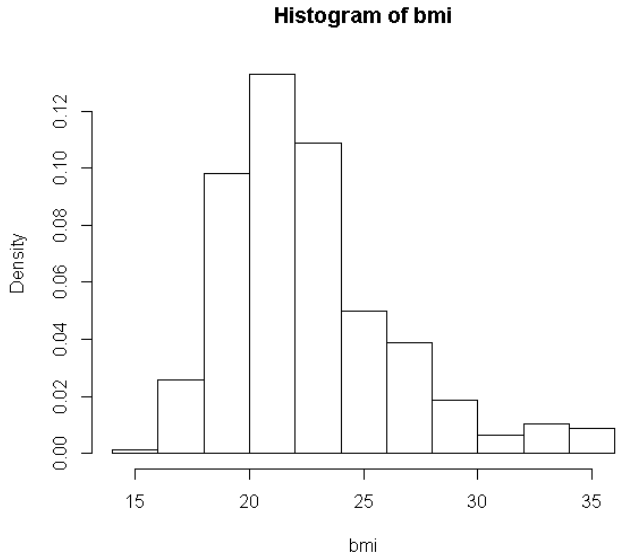
Standard errors and design effects for “weight” and “height” variables are calculated for both methods. The raked psudo design out performs the cell weighted psudo design with respect to “1.1922” to “1.5256” standers error in “weight” and “0.55308” to “0.88016” standard error in height variable. Also, the design effect of raked design is less for both variables. Thus, the Raking weighting technique has chosen to have an inference about population estimation.



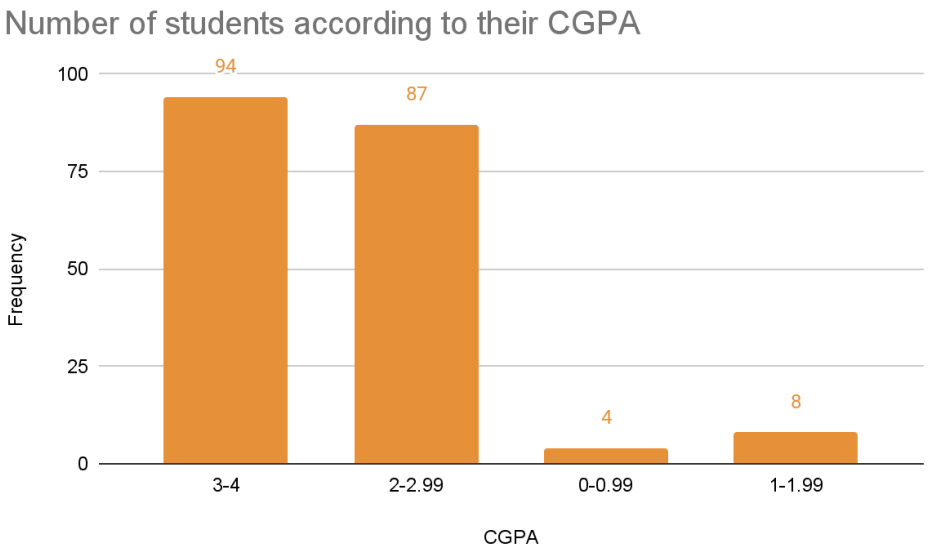

The majority of the participants of the survey are females. With most of them having the age between 20-24.




The population BMI (body mass index) has estimated as the following



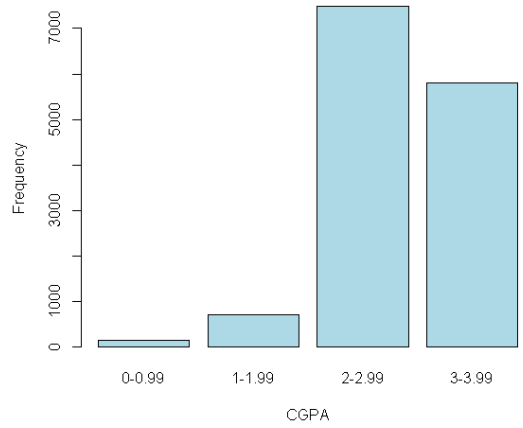

The majority of the students in the Middle East Technical University has estimated to have normal weight. (BMI 18.5, 24.9) The overall BMI of the METU students has estimated to be 22.48970 with 0.32233 standard error.

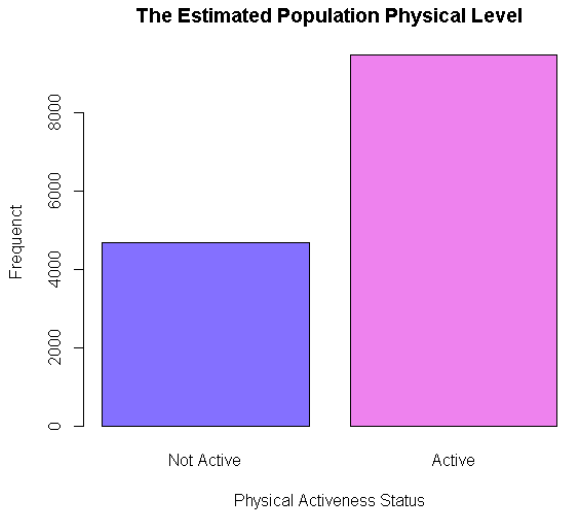



The great proportion of the questionnaires have the CGPA > 2. When the table above was investigated the number of people who has CGPA between 2-2.99 is quite close to the number of people who has CGPA 3-4 in the sample. Respectively total number of 88 to 94.

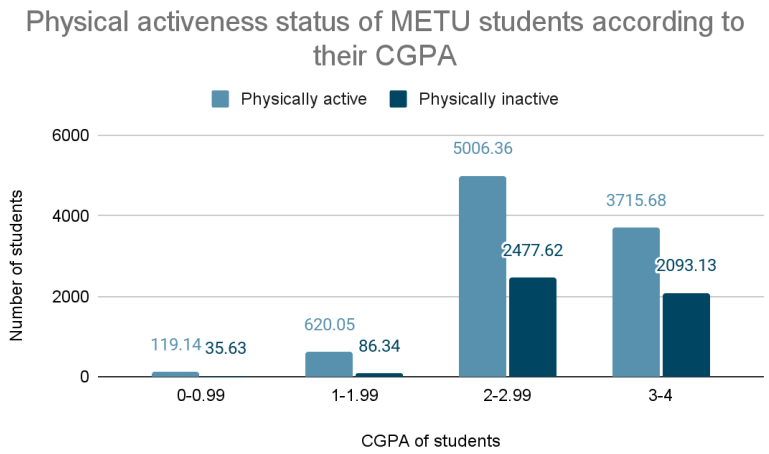
Conversely, the estimated CGPA of the population is quite different than the sample. As investigated in the table below, the estimated number of people whose CGPA is between

2-2.99 is more than the people whose CGPA is between 3-4 in contrast to the sample. Respectively the numbers are estimated as 7483.99(for 2-2.99) and 5808.83(for 3-4) for the population. Thus, the calibration of psudo design weights might be aiding the problem with the sample not reflecting the population.




The %66.8 Of the population is estimated to be physically active. Furthermore, in table below the relation between physical activeness and CGPA in the population is examined.

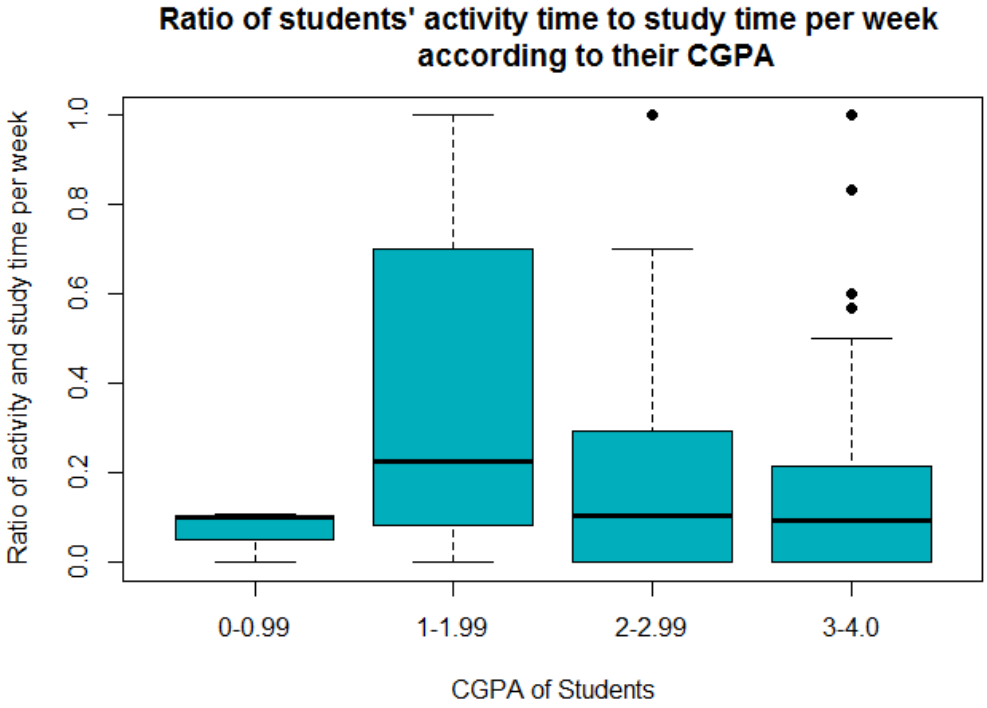



The ratio of physical active people number in lower CGPA categories is significantly greater than rest. As CGPA increases, less percentage of people are inclined to do physical activity. METU student's tendency toward physical activity is estimated to gradually increase as CGPA decreases.

To test whether the physical activity status and CGPA is significantly associated

Chi -square test is applied. The p- value is observed as 2.2e-16 and null hypothesis is rejected. Hence, CGPA and Physical activeness status are indeed significantly correlated.

The further investigation is that, among the people who are physically active, whether the level of the physical activity has an impact on CGPA. To elaborate the problem a ratio of physical activity has been calculated as the amount of time an individual spends on doing physical activities divided by the time spent studying on a weekly base and will be referred as the p/s ratio.

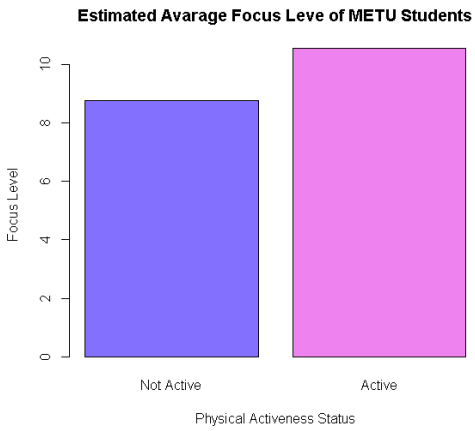



The greater the ratio is the more time the individual spends on physical activity. It is observed that as the CGPA increases students are spending less time on physical activity. With the means constantly decreasing exception of 0-0.99 CGPA's ratio. To test whether this association sis statistically significant Kruskal Wallis test is applied the p value is obtained as 0.3327 which concludes to failing at rejecting. Thus, there is not statistically significant difference between them. It can not be concluded that ratio is associated with decrease in CGPA.

Participants were asked for a time interval of a single studying session and undistracted working period. Both were collected under ordered factor variables with 4 levels. Each level has been assigned to a corresponding number from 1 to 4. The gathered information is used to generate a focus level variable formulated as:

Focus level = Single session study time + Undistracted work period2

It has suspected that single sessions study time variable is prone to get affected from confounding variables. Thus, more emphasis has given to undistracted work period variable with calculating its square.




The average focus level of the METU student who is physically active was estimated as 10.542, the focus level of inactive student on other hand estimated as 8.766. The first assumption is that physical activity leads to more focus level. To test the assumption Mann Whitney U test has been conducted on the estimated population. The p- value was calculated as 0.0158. Which is less than the critical value. Thus, the null hypothesis is rejected. Statistically significant evidence supports that there is a relation between focus level and physical activity status.

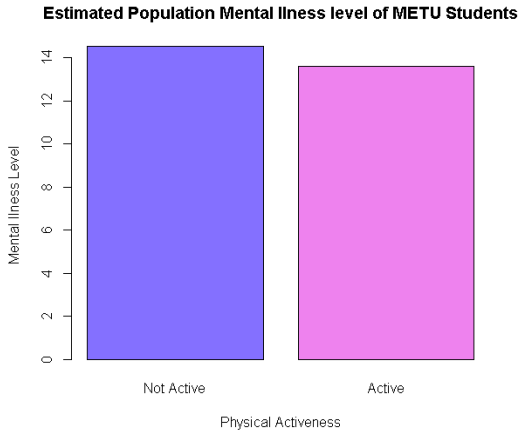
| CGPA | Focus Level |
|---|---|
| 0-0.99 | 6.435962 |
| 1-1.99 | 9.64266 |
| 2-2.99 | 9.128082 |
| 3-4 | 11.148465 |

The table above shows the estimated average focus levels on METU students with respect to 4 different categories of CGPA. As the CGPA increases focus level increases as well. To test whether there is a significant difference of focus levels in between CGPA categories. Kruskal Wallis test has applied.

P-value is obtained as 0.004043. Hence, the null hypothesis is rejected. There is statistical evidence that focus level and CGPA are significantly associated.

In the two researches above it has found that physical activity increases focus level and focus level increases CGPA. Linking the two findings and an assumption can be made the physical activity directly leads to an increase in CGPA. Yet, further evaluations and researches are needed to statistically support the claim.

The information about participants anxiety, depression and stress levels is collected with likert scale of 5 answers. The answers were transformed to corresponding number respectively from 1 to 5. The total mental illness value is calculated as summation of the corresponding numbers from variable 15 to 18. The lower the number the better the mental health.




The average mental illness level of the METU students who is physically active was estimated as 13.59692, the mental illness level of physically inactive student on the other hand estimated as 14.52066. The initial assumption is the physical activity increases mental health due to comparison of estimated average mental illness level of METU students. Physical active students having the lesser illness level

To test the assumption Mann Whitney U test has been conducted on the estimated population. The p-value is estimated as 0.2286. Hence, the null hypothesis has failed to be rejected. There is no significant evidence that mental health and physical activeness status are related.

## Discussion and Conclusion

The relation between physical activity and academic success has been studied on METU students and found that. Physical activity increases focus level, in addition to this focus level increases academic success. Thus, it can be concluded that physical activity indirectly increases academic success. Also it has found that CGPA and being physically active is statistically associated. Yet, there couldt be significant evidence found between association of mental health and physical activity, as well as , between decrease in CGPA and time ratio which refers to spending time more on physical activity rather than studying.

To conclude, it can be observed that physical activity enhances the academic performance and its impact on physical activity should not be overlooked. And it is a safe to spend spare time on physical activity.

**References**

Grissom, J.B. (2005). Physical fitness and academic achievement. Journal of Exercise Physiology, 8(1), 11-25.

Koch, C.A., & Hasbrouck, L. (2013). Research summary: Exploring the link between physical activity, fitness and cognitive function. Springfield, IL: Illinois Department of Public Health. Retrieved from http://www.isbe.net/EPE/pdf/reports-webinars/iphi-epetfrpt0313.pdf

Prosser, L., & Xiaoli, J. (2008). Relationship between school physical activity and academic performance of children. The International Journal of Learning, 15(3), 11-16.

Sibley, B.A., & Etnier, J.L. (2003). The relationship between physical activity and cognition in children: A meta-analysis. Pediatric Exercise Science,

Taylor, C.B., Sallis, J.F., & Needle, R. (1985). The relation of physical activity and exercise to mental health. Public Health Reports

Bergier, J., Kapka-Skrzypczak, L., Bilinski, P., Paprzycki, P., & Wojtyla, A. (2012). Physical activity of polish adolescents and young adults according to IPAQ: A population based study. Annals of Agricultural and Environmental Medicine

# Appendix

**QUESTIONNAIRES**

**1) What is your gender ?**

a) Male

b) Female

c) Prefer not to say

**2) What is your birth year ?**

**3) What is your height in centimetres ?**

**4) What is your current weight in kilograms ?**

**5) Which university do you go to ?**

**6) What is your faculty ?**

a) Faculty of Architecture

b) Faculty of Art and Science

c) Faculty of Economic and Administrative Sciences

d) Faculty of Education

e) Faculty of Engineering

**7) What is your department ? (STAT, ME, BA…)**

**8) What is your educational level ?**

a) Department of Basic English

b) Undergraduate

c) Master's Degree

d) Doctoral Degree

**9) What is your cumulative GPA ?**

a) 0-0.99

b) 1-1.99

c) 2.-2.99

d) 3-4

**10) Are you physically active ?**

a) Yes

b) No

**11) If the answer is yes, what is the average amount of time you spend doing physical activity in a week ?(in hours)**

**12) What is the average amount of time you spend studying in a week ? (in hours)**

**13) In a single studying session what is the percentage of time that you keep focused and undistracted ?**

a) 0-%25

b) %26-50

c) %51-%75

d) %76-%100

**14) How long a single studying session lasts (in hours) ?**

a) 0-1

b) 1.01-2

c) 2.01-3

d) 3+

**For the following questions please choose which of the following describes you the most.**

**15) I feel stressed during the exams.**

a) Strongly Disagree

b) Disagree

c) Neutral

d) Agree

e) Strongly Agree

**16) I find myself constantly worrying about school.**

a) Strongly Disagree

b) Disagree

c) Neutral

d) Agree

e) Strongly Agree

**17) I feel guilty before/after exams.**

a) Strongly Disagree

b) Disagree

c) Neutral

d) Agree e) Strongly Agree

**18) I find myself unmotivated during exam weeks.**

a) Strongly Disagree

b) Disagree

c) Neutral

d) Agree

e) Strongly Agree

**19) I feel isolated from my friends and family during exam weeks.**

a) Strongly Disagree

b) Disagree

c) Neutral

d) Agree

e) Strongly Agree