# Video Gaming Patterns and Academic Performance in University Students

10-27-24

## Contribution:

The development of this report was a collaborative effort between both students. Each student took primary responsibility for specific sections while maintaining active involvement throughout the entire project. Student 1 focused mainly on sections 1 and 2 of the analysis section while also making substantial contributions to the advanced analysis, introduction, and conclusion. Additionally, Student 1 reviewed sections 3, 4, 5, and 6. Student 2 concentrated on reviewing sections 1 and 2, while working on sections 3, 4, 5, and 6 in the analysis section. Student 2 also looked over Student 1's sections and contributed to the advanced analysis sections. Both students were responsible for writing R code, methods, and conclusions for their respective sections. Throughout the project, both students consistently reviewed each other's work and made iterative improvements to ensure the report's quality and coherence.

Use of GPT: The report utilized ChatGPT to enhance the clarity and readability of our analysis, specifically in refining the language of method and conclusion sections to be more concise and professional. While all underlying analysis, code development, and interpretations were conducted independently by the students, GPT served as a writing aid to improve the presentation of our findings and maintain consistency in technical writing style throughout the report.

# 1. Introduction

Video gaming has become an increasingly significant aspect of student life over the past few decades, despite ongoing debates about its impact on academic performance. Research shows that 70% of college students report playing video, computer or online games at least occasionally, with many integrating gaming into their daily routines between classes or as a break from studying(1). While gaming can provide valuable stress relief and social connection, with students reporting feelings like "pleasant" (36%) and "exciting" (34%), concerns exist about its academic impact - 48% of student acknowledge that gaming keeps them from studying "some" or "a lot"(1). The relationship between gaming habits and academic success remains particularly relevant computer lab designers seeking to optimize campus computing resources.

The main goal of this analysis is to investigate video gaming patterns among university students and provide useful information to computer lab designers. In this analysis, we first estimate the proportion of students who played video games in the week prior to the survey and the number of hours playing video games using both point and interval estimates. Our analysis includes numerical summaries such as mean gaming hours and confidence intervals constructed through bootstrapping methods to account for the skewed nature of our data. We also investigate student attitudes toward video games, analyzing both preference patterns and motivations for gaming. Through demographic comparisons, we explore differences between players and non-players across gender, work status, and computer ownership. Finally, we examine grade expectations within the context of gaming habits and compare them against the target grade distribution. By combining all evidence above, we determine whether the observed patterns and relationships can meaningfully inform computer lab design and resource allocation.

### Data

The data comes from a survey examining video gaming patterns at UC Berkeley during Fall 1994. The target population consisted of 3,000-4,000 students enrolled in statistics courses. Using simple random sampling to ensure each student had an equal chance of selection, 95 students were chosen from a class of 314 in Statistics 2, Section 1, with 91 completing the survey. The survey data is split across two files: videoMultiple.txt and videodata.txt. The videodata.txt file contains the main survey responses, including the primary variable like which contained the student's position about gaming (1=never played, 2=very much, 3=somewhat, 4=not really, 5=not at all), along with demographics, gaming habits, and academic information. The videoMultiple.txt file contains follow-up survey responses about gaming preferences and attitudes, where students could select multiple answers for questions about what types of games they play and why.

While our findings represent the Statistics 2 class, generalizability is limited due to sampling from only statistics students, during a post-exam period, and our small sample size (91 from 3,000-4,000 students). Though random sampling helps ensure representativeness within the class, statistics students may differ from other majors in their study and gaming habits.

# 2. Basic Analysis

## 2.1 Point and Interval Estimates

### Method

The video game data was initially loaded and processed using R. During the data cleaning phase, we removed observations where the time spent playing was coded as 99, indicating invalid responses. Initially, we also removed rows with missing values across any columns. However, this led to the removal of too many rows, so we revised the process to only remove rows where the time spent playing was coded as 99.The dataset was assumed to be collected through simple random sampling, where each member of the student population had an equal chance of selection and all observations were independent and identically distributed (IID). To estimate the proportion of students who play video games, we classified students as "players" if they reported any positive amount of time spent playing games in the previous week (time $> 0$). A point estimate was calculated as the ratio of players to total students in the cleaned dataset. To assess the uncertainty in this estimate, a 95% confidence interval was constructed using the normal approximation method since we have a large sample size. The interval was bounded between 0 and 1 to ensure valid probability estimates. This approach allows us to make inferences about the true proportion of video game players in the student population while accounting for sampling variability.

### Analysis

From our analysis, we found that approximately 0.37 of students in our sample played video games during the week prior to the survey. The 95% confidence interval suggests that the true population proportion of students who play video games lies between 0.27 and 0.47. The data cleaning process retained all 91 original observations, indicating that there were complete responses for the key variables of interest, time spent playing videos prior.

### Conclusion

Based on the analysis above, we find that the proportion of students who played video games in the previous week is lower than those who did not play, with approximately 0.37 of students engaging in gaming activities. Our point estimate appears reliable given the assumptions of simple random sampling, though the relatively wide confidence interval (0.27 to 0.47) reflects some uncertainty due to our small sample size of 91 students. From our analysis, we see that while video gaming is fairly common among students, it's not something the majority of students engage in. While these findings give us useful insights into gaming habits among students, we should be careful about assuming these patterns apply to all students, given our limited sample size and other factors that might affect gaming behavior.

## 2.2 Comparing Time Spent Playing vs Week Prior by Frequency

### Method

To analyze gaming frequency and time relationships, we examined summary statistics and created visualizations of the data. We categorized frequency (1=daily, 2=weekly, 3=monthly) and calculated mean time, median time, and student counts for each category. We created two visualizations: a boxplot showing time distribution with outliers for each frequency category, and a bar chart displaying average gaming time by frequency. To assess the impact of the prior week's exam on gaming patterns, we analyzed the "busy" variable after removing outliers (values of 99) and visualized the results with a boxplot.

### Analysis

Table 1: Average time spent by frequency

| Frequency | Mean Time | Median Time | Count |
|---|---|---|---|
| Daily | 4.44 | 2 | 9 |
| Weekly | 2.54 | 2 | 28 |
| Monthly | 0.06 | 0 | 18 |
| semesterly | 0.04 | 0 | 23 |

The analysis reveals distinct patterns in gaming frequency and duration (see Figures 1a and 1b in the Appendix). The data shows several outliers, particularly among daily and weekly players, which are explored further in the boxplot visualization. The bar chart demonstrates a clear decreasing trend in average time spent as reported frequency decreases, with daily players spending nearly twice as much time gaming as weekly players. The relationship between gaming frequency during busy periods and regular periods is further examined in Figure 2 of the Appendix, which illustrates how academic commitments affect gaming patterns.

### Conclusion

Based on the analysis above, we observe that daily players spend significantly more time gaming (mean = 4.44 hours) compared to weekly players (mean = 2.54 hours), while monthly and semesterly players show minimal gaming activity (less than 0.1 hours). This trend indicates that reported frequency aligns with actual time spent gaming. However, if the survey was conducted just one week after an exam, this would likely influenced the results, leading to lower gaming hours than usual. As shown in Figure 2, during busy periods, students tend to prioritize academic responsibilities over leisure activities, with most players—regardless of their typical frequency—reducing or stopping gaming altogether. This is particularly evident among less frequent players, with semesterly players completely avoiding gaming during such times. Interestingly, even daily players exhibit a nearly equal split between those who continue to game and those who pause their gaming activities when busy. Thus, our estimates of gaming time are likely more conservative than what would typically be observed during a regular academic week, especially for frequent players who may have temporarily reduced their gaming hours due to exam preparation.

## 2.3 Average Point and Interval Estimates of Time Spent Playing

**Method**

Due to the highly skewed nature of our sample distribution and our relatively small sample size, traditional parametric methods may produce unreliable estimates. While the limited sample size constrains the precision of our estimates and the generalizability of our findings, we implemented bootstrapping with 1,000 resamples to better estimate the sampling distribution without assuming normality. Using the bootstrap samples, we calculated mean gaming hours and constructed a 95% confidence interval using the 2.5th and 97.5th percentiles, providing more reliable estimates despite our dataset's skewness and size limitations.

**Analysis**

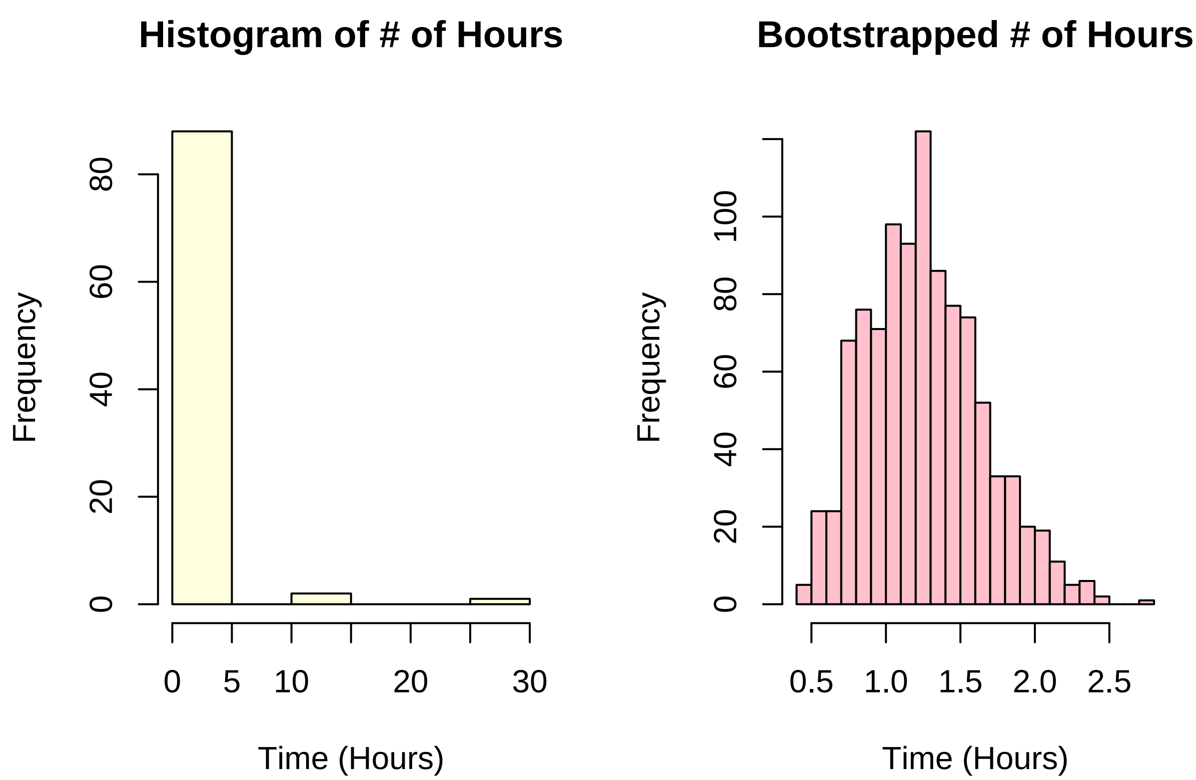



Figure 3: Observed Hours Distribution (left) and Bootstrap Resampling Distribution (right)

**Conclusion**

From our analysis, we found the point estimate to be 1.24 hours per week, and after applying our bootstrap procedure, we obtained a 95% confidence interval of [0.63, 2.14] hours.The bootstrap distribution demonstrates that our average estimate remains stable even when resampling from our original dataset, indicating the robustness of our findings despite having some students report significantly higher gaming hours.

## 2.4 Student Attitudes Towards Video Games

### Method

To analyze student attitudes towards video games, we examined responses from the survey's "like" column. We first removed entries where the "like" value was 99, which indicated non-responses. We then categorized students based on their reported preferences: those who had never played (1), those who liked playing very much (2), those who responded with somewhat, which were neutral about gaming (3), and those who disliked video games (4 and 5). Additionally, we calculated the percentage of each category to assess what students, in general, enjoy about playing video games.

### Analysis

Our analysis of students' attitudes towards video games revealed that only a small minority (1.11%) reported never playing video games. The majority of students showed positive or neutral feelings, with 76.67% actively enjoying video games or expressing a neutral stance. A relatively small proportion (22.22%) either disliked video games or had never played them. These findings suggest that students generally have a favorable or at least accepting attitude toward video games, with over three-quarters of students either liking or being neutral about gaming, while only about one-fifth expressed negative feelings toward the activity.

| relax | coord | challenge | master | bored | other | graphic |
|---:|---:|---:|---:|---:|---:|---:|
| 0.6666667 | 0.045977 | 0.2413793 | 0.2873563 | 0.2758621 | 0.091954 | 0.2643678 |

Among those who play games, relaxation emerged as the dominant motivation with 66.67% of respondents citing this reason. This was followed by feelings of mastery (28.74%), boredom (27.59%), and appreciation of graphics/realism (26.44%). Notably, eye-hand coordination was the least commonly cited reason at 4.60%.

### Conclusion

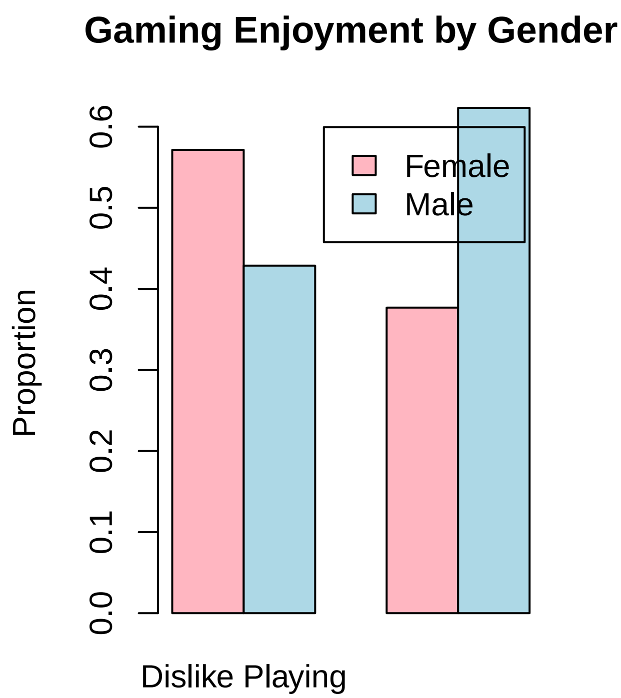
Based on the analysis above, we find that video games are generally well-received among students, with only a fraction (22.22%) expressing a dislike or no experience with gaming. The primary motivation for playing appears to be relaxation, with two-thirds of players citing this reason. Additionally, many students report a feeling of mastery as a significant motivator, indicating that they enjoy the sense of achievement that comes from overcoming challenges within games. Conversely, some students also play due to boredom, using video games as an engaging way to fill their free time. These findings indicate that students primarily view gaming as a leisure activity for relaxation rather than a means of skill development, as evidenced by the low percentage of respondents citing coordination benefits. Furthermore, the low rate of non-responses and the strong emphasis on relaxation suggest that gaming plays a significant recreational role in students' lives.

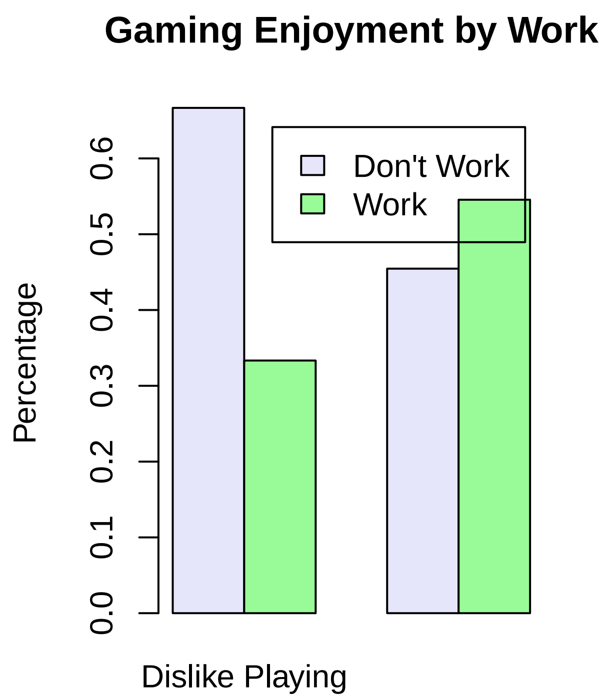
### 2.5 Analyzing Differences Between Players and Non-Players

**Method**

To analyze the differences between students who enjoy playing video games and those who don't, we first categorized students into two groups based on their gaming preferences: "Enjoy Playing" (those who reported liking or somewhat liking video games) and "Dislike Playing" (those who reported never playing, disliking, or strongly disliking video games). For each demographic variable, we created contingency tables and calculated proportions to examine the distribution of preferences. We visualized these relationships using side-by-side barplots, with different color schemes for easy distinction between categories. The analysis included both raw counts and proportions to provide a comprehensive view of the relationships between gaming preferences and demographic characteristics.

**Analysis**



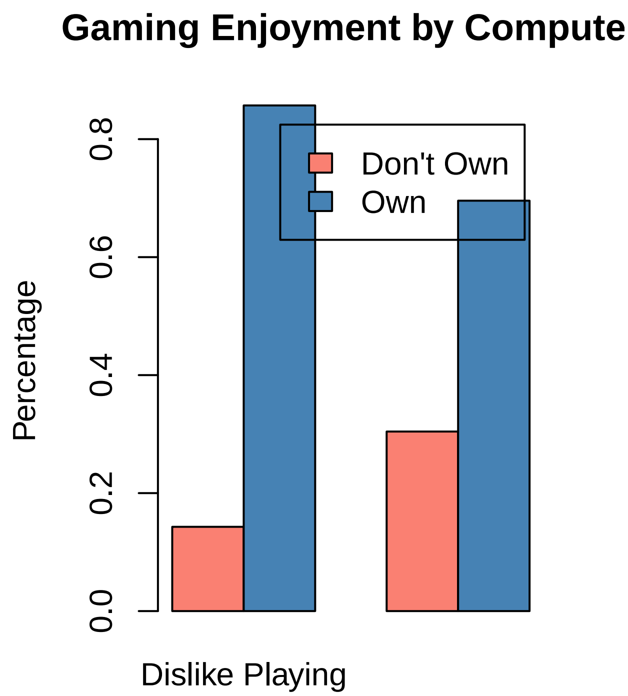



Figure 4: Gaming Enjoyment by Different Attributes: Gender (top left), Work (top right), Computer ownership (bottom left)

**Conclusion**

Our analysis revealed distinct patterns in gaming preferences across different demographic groups. Regarding gender, male students showed a stronger tendency to enjoy gaming, with 62% of males reporting enjoyment compared to 38% of females. Conversely, females were more likely to dislike playing, with females making up 57% of those who dislike gaming compared to 43% for males. Work status also showed interesting patterns, with working students more likely to enjoy gaming, comprising 55% of those who enjoy gaming, compared to 45% for non-working students. However, among those who dislike playing, non-working students formed a larger proportion at 67%. Computer ownership demonstrated the strongest relationship with gaming preferences, where 86% of those who dislike playing and 70% of those who enjoy playing owned computers. These proportions can be seen in Appendix Table 3. This high percentage of computer ownership across both groups suggests that access to technology is not a primary barrier to gaming engagement. These findings indicate that gaming preferences are influenced by a complex interplay of demographic factors, with gender and work status playing particularly notable roles in shaping students' attitudes toward video games.

## 2.6 Extra Credit

### Method

To assess whether the observed grade distribution significantly differs from the target distribution (20% A's, 30% B's, 40% C's, and 10% D's or lower), we employed a Total Variation Distance (TVD) test using bootstrap resampling. TVD measures the maximum difference between two probability distributions, calculated as half the sum of the absolute differences between corresponding probabilities. Our null hypothesis (H ) states that the observed grade distribution follows the target distribution, while the alternative hypothesis (H ) states that the observed distribution differs from the target. To test this, we first calculated the observed TVD between our sample and target distributions. Then, we used bootstrap resampling (10,000 iterations) to simulate data under the null hypothesis by repeatedly drawing samples of the same size as our observed data from the target distribution. For each bootstrap sample, we calculated its TVD from the target distribution, creating a null distribution of TVD values. The p-value was computed as the proportion of bootstrap TVDs that were greater than or equal to our observed TVD. A small p-value ($< 0.05$) would suggest rejecting the null hypothesis, indicating a significant difference between the observed and target distributions.

### Analysis

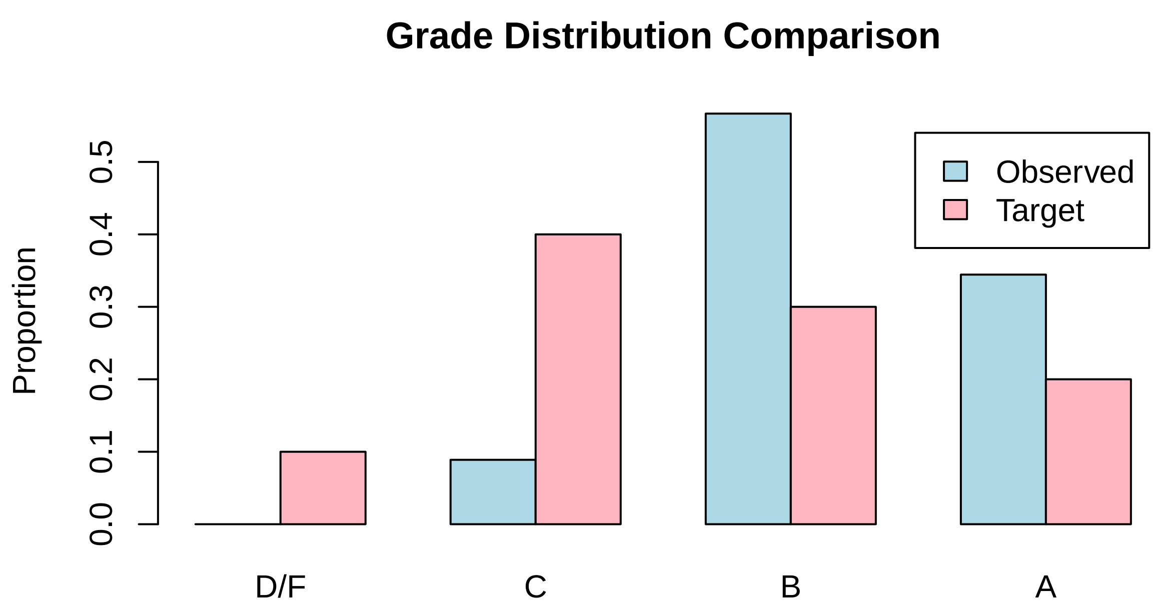



Figure 5: Distribution of Student Grade Expectations versus Target Grades with 56.67% expecting B's, 34.44% expecting A's, 8.89% expecting C's, and none expecting D/F's.

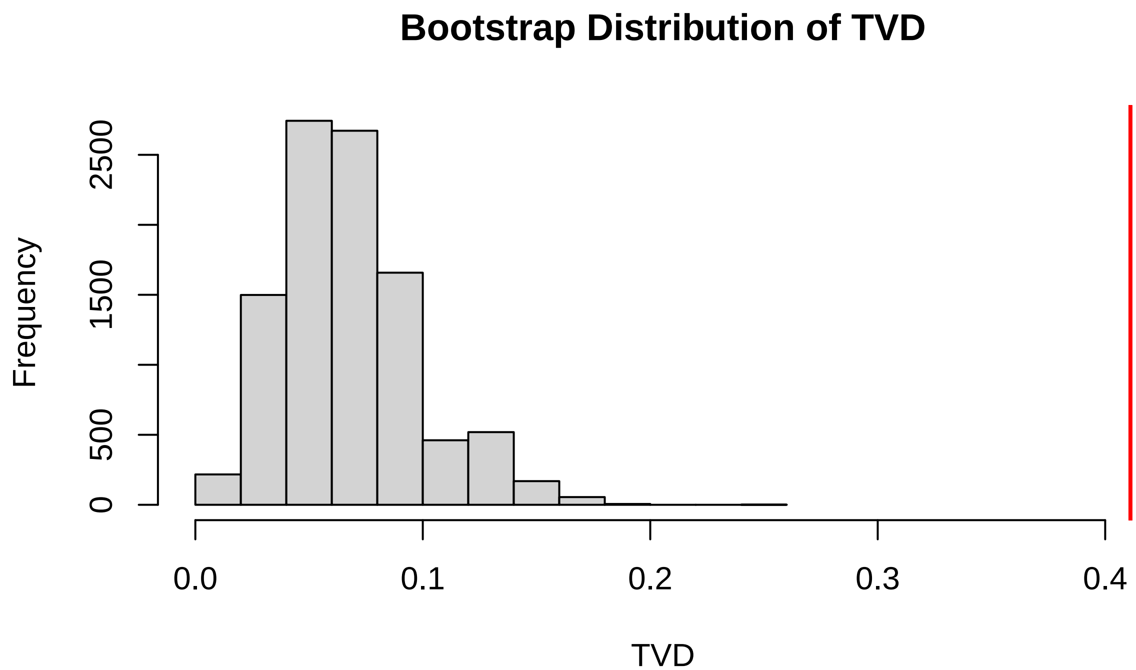



Figure 6: Bootstrap Distribution of Total Variation Distance (TVD) with Observed TVD (red line = 0.4111) Compared to Target Grade Distribution

**Conclusion**

Our analysis reveals a significant disconnect between students' grade expectations and the target grade distribution in the course. Students demonstrated markedly optimistic expectations, with no students anticipating D's or F's, only 8.89% expecting C's, and notably high proportions expecting B's (56.67%) and A's (34.44%). The substantial TVD value of 0.4111 and p-value of 0 provide compelling statistical evidence that this misalignment is not due to chance. The bootstrap distribution visualization clearly shows our observed TVD falling far outside the range of values we would expect if student expectations aligned with course targets.

Addressing the question of non-respondents potentially being failing students, even if we assume nonrespondents were failing students who no longer bothered to come to the discussion section (which would add them to the D/F category), the overall picture would still indicate overly optimistic student expectations. While this adjustment would bring the D/F proportion closer to the target 10%, it wouldn't address the substantial overrepresentation in B grades and underrepresentation in C grades.

# 3. Advanced Analysis

### Method

To explore potential academic influences on gaming behavior, we investigated whether students with a math focus differ in their gaming hours compared to non-math focused students. Using the "math" variable (1 = math focus, 0 = none math focus), we examined if there's a significant difference in gaming hours between the two groups. Due to our small sample size (91 students) and the non-normal distribution of gaming hours, we employed the Wilcoxon-Mann-Whitney U test. We calculated Z-scores to determine the strength and direction of the difference between the two groups, and used the P-value to assess the statistical significance of our findings, with values below 0.05 considered significant.

### Analysis

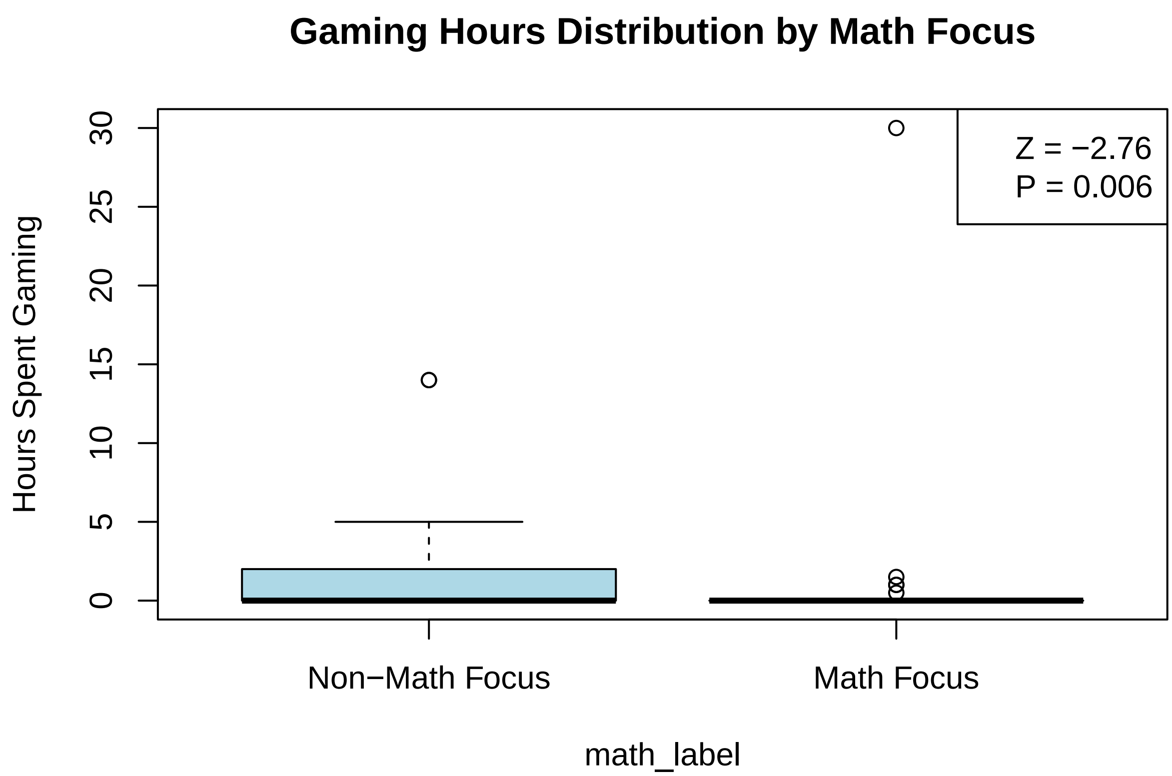



Figure 7: Gaming hours distribution comparison between math-focused and non-math-focused students shown through boxplots. The boxes represent the interquartile range, with the middle line showing the median.

## Conclusion

Our analysis reveals interesting differences in gaming patterns between math-focused and non-math-focused students. The negative Z-score (-2.76) indicates that math-focused students actually spent significantly less time gaming than their non-math focused peers, contrary to what might have been expected. The small P-value (0.006) suggests that this difference is unlikely to have occurred by chance. However, these results should be interpreted cautiously for several reasons. First, our small sample size (91 students) limits the generalizability of these findings. Second, the survey was conducted during a post-exam period, which might not represent typical gaming patterns. Additionally, the large outliers visible in both groups suggest that individual variation in gaming habits might be more important than mathematical inclination. These findings could help inform computer lab resource allocation, though more research would be needed to make definitive recommendations.

# 4. Conclusion

Our comprehensive analysis of video gaming patterns among university students reveals several important findings about gaming habits and their potential implications for computer lab design and academic performance. The numerical analysis shows that approximately 37% of students engaged in gaming during the survey period, with a 95% confidence interval of 27% to 47%. Through bootstrapping analysis, we found students spent an average of 1.24 hours per week gaming (95% CI: 0.63-2.14 hours), though this estimate likely represents a conservative measure due to the post-exam timing of the survey.

The majority of students showed positive or neutral attitudes toward gaming, with relaxation being the primary motivation, followed by feelings of mastery, boredom relief, and appreciation of graphics. Demographic analysis showed that male students and working students were more likely to enjoy gaming, though computer ownership was high across all groups, suggesting technology access isn't a barrier to gaming.

Our study revealed a significant disconnect between students' grade expectations and target grade distributions, with students demonstrating markedly optimistic expectations. The advanced analysis unexpectedly found that math-focused students spent significantly less time gaming than their non-math focused peers.

Several limitations should be considered when interpreting these results. First, our sample size (91 students) represents a small fraction of the target population (3,000-4,000 students), potentially limiting generalizability. Second, the survey's timing immediately after an exam period may have influenced gaming patterns and might not represent typical behavior. Additionally, sampling only from statistics courses may not accurately represent the broader student population, as gaming habits could vary across different majors and academic programs.

The findings have important implications for computer lab design and resource allocation. While gaming is a common activity among students, its self-regulated nature during busy periods and the relatively moderate average time spent gaming (1.24 hours per week) suggest that gaming may not significantly interfere with academic resource availability. However, computer lab designers should consider the distinct usage patterns between daily and occasional players when planning resource allocation. The strong preference for gaming as a relaxation tool might also indicate value in designating specific areas for recreational computing that don't impact academic resource availability.

Future research could benefit from examining gaming patterns across different academic periods, investigating the relationship between gaming habits and actual academic performance (rather than just expectations), and exploring how gaming patterns vary across different majors and academic programs. Such research would provide a more comprehensive understanding of how gaming fits into student life and its potential impact on academic success.

# 5. Work Cited

Citation:

1. Jones, S. (2003). Let the Games Begin: Gaming Technology and Entertainment Among College Students. Pew Internet & American Life Project. https://www.pewinternet.org/

## 6. Appendix

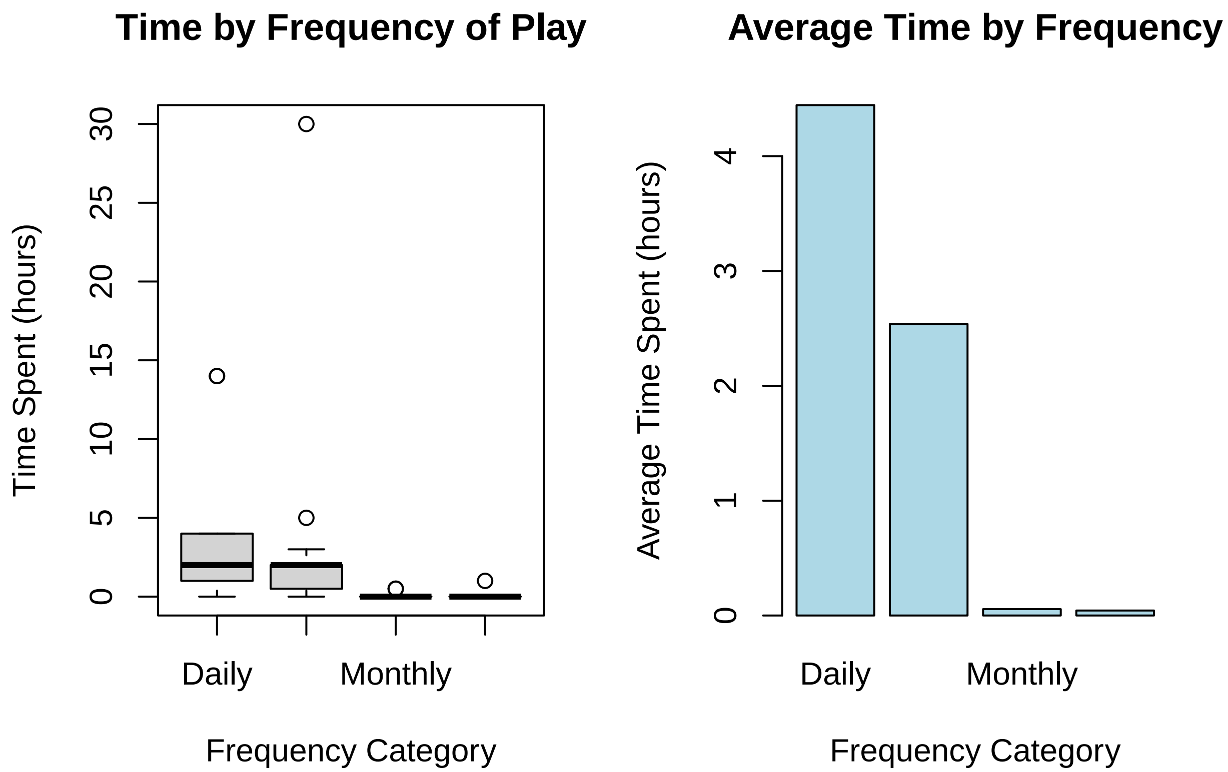



Figure 1: (a) Box Plot of Gaming Hours by Frequency Category, Showing Distribution and Outliers (left), (b) Bar Chart of Average Gaming Hours by Frequency Category (right)

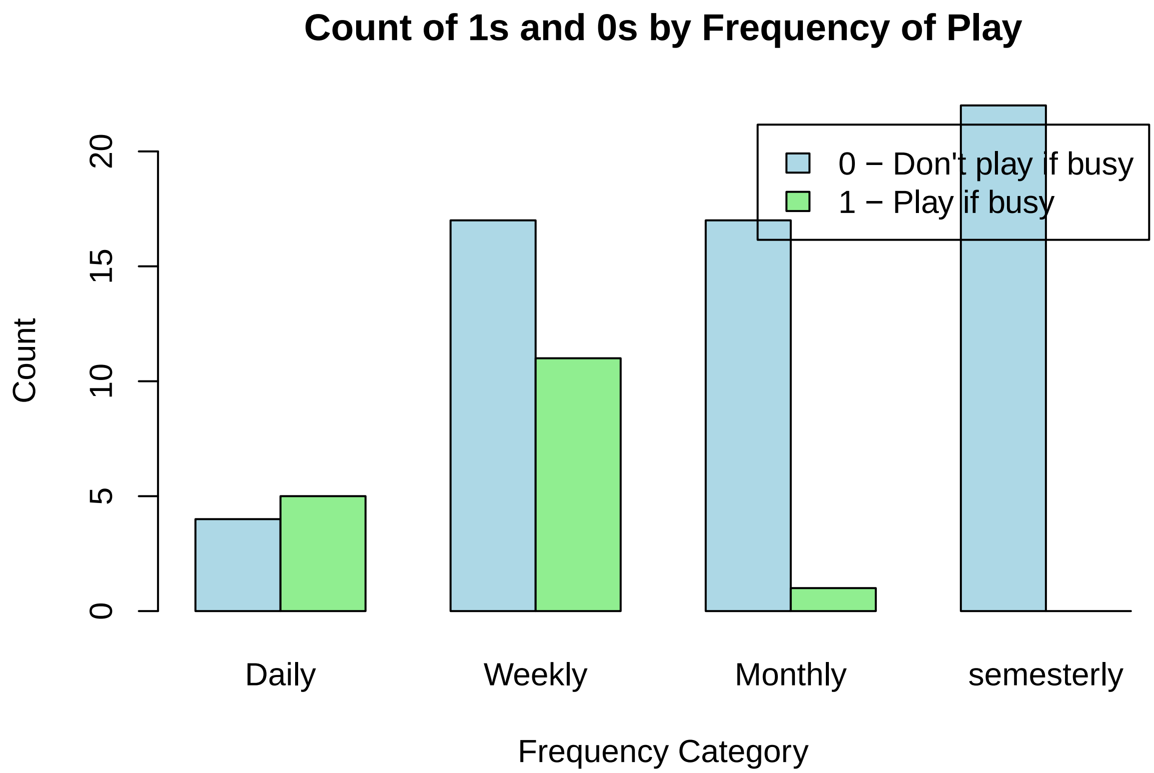



Figure 2: Gaming Behavior During Busy Periods by Frequency Category, Showing People Who Continue (green) versus People Who Stop Gaming When Busy (blue)

```
##
##          Dislike Playing Enjoy Playing
##   Female            0.57          0.38
##   Male              0.43          0.62
```

```
##
##              Dislike Playing Enjoy Playing
##   Don't Work            0.67          0.45
##   Work                  0.33          0.55
```

```
##
##             Dislike Playing Enjoy Playing
##   Don't Own            0.14          0.30
##   Own                  0.86          0.70
```

Table 3: Proportion of Game Enjoyment by Different Attribute Cross-Tabulations