Student Achievement in Relation to Time Spent Studying and Playing Video Games: A Gender Perspective

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Abstract **– The results of previous studies showed that male students have a lower average grade than female students. Men are also reported to play more video games than women. We were interested in whether male students maintain the same pattern of behavior in relation to playing games during the exam period and how this affects their average grade compared to female students. If male students spend more time playing video games compared to female students, their academic performance may decrease as time spent on academic activities is replaced by video game play. In a survey of 400 university students, the authors focused on the gender characteristics of students and their achievements. Our results showed that female students studied more and played video games less during the exam periods compared to male and non-binary students, which is the reason for a higher total average grade in contrast to others.**

Keywords **– gender, academic performance, studying, video games.**

DOI: 10.18421/TEM122-28
https://doi.org/10.18421/TEM122-28

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Received: 09 February 2023.
Revised: 08 May 2023.
Accepted: 16 May 2023.
Published: 29 May 2023.

1. Introduction

Research on the gender gap in education over the years has focused on the gender gap and the reasonswhy female students seem to get higher grades than male students on average. Although studies have shown and, in most instances, established the reasons for existing differences, changes in the environment create new differences that must be examined.

The effect of information technology has been one of the most significant shifts that civilizations have experienced. Information technology has had an impact on many aspects of people's lives throughout the world, from commerce, communication, and manufacturing to how we spend our leisure time. Since the video game industry has evolved into the world's largest source of entertainment, playing video games has emerged as the favorite hobby among youngsters. Players commonly incorporate video games into their daily leisure activities and spend a substantial amount of time playing since they are so engaging.

Since university students are not mostly supervised by parents and have usually very flexible schedules, studies show that they play video games most actively. Although studies identify that males embark into the world of video games from early childhood and devote more time to playing them compared to females, it is evident that nowadays more girls are absorbed into the world of video games. There has been significant discussion and controversy in recent years regarding the growing gender discrepancy in both enrolment and graduation rates in higher education. The percentage of girls continuing their education at universities has increased over the years and currently, more females are studying at universities than males. Moreover, female students have higher GPAs than male students.

Therefore, the aim of this study is to discover differences in gender among players of video games in academic settings. The present study aims to identify whether there are differences in academic achievements between male and female students in terms of time spent studying and playing video games. For this purpose, a research question was created: "How the gender differences of students in time spent studying and playing video games affect student achievement?" In this quantitative survey participated 400 Serbian students.

2. Literature review

The twentieth century came to be known as the century of women's education. After nine centuries of university existence in France, in 1900 only 624 female students attended the university, compared to 27,000 male students, while in 1990 the number of female students reached 520,000, which is 70,000 more than male students [14]. Today, women are not only more numerous in French universities, but also more successful. At several Chinese universities, Zhang et al. [40] discovered that female students perform better in social science topics than males. Furthermore, other studies identified that female students achieve better grades than males on average and that it is due to the fact that females put in more effort than their male counterparts [32]. Chen and Kelly [7] discover that the time that a person spends at work during their lifetime has a considerable influence on attendance at college for both females and males. However, US census data from 1950 to 2000 and the American Community Survey conducted in 2010 show that it has a higher influence on females than on males. The larger difference between genders in expected lifetime work hours is, there is the larger difference in attendance at college. Most of education research show that that woman are better in schools. However, it is still not well understood why female students outperform male students in academic achievement [4]. In the gender spectrum, non-binary students experience significantly more burdens than others [3].

Several studies have found gender differences in video game usage time. [25], [31], [37]. Over time, research findings have revealed that boys not only start playing video games from the earliest childhood, but they also spend more time doing so than girls [5], [25]. However, the most recent studies identify that around half of the players of all ages are women [12], [23]. We need to understand motivation and behavior of females playing video games since their number is rapidly increasing over the years. [25]. Winn and Heeter's [38] study, which included 276 undergraduate students from the United States, is the first to provide academic findings about the relationship between an amount of leisure time a person has and the time they spend playing digital games. The study discovers that not only that females have less free time than males but they also play less video games during their free time compared to males. According to Kneer et al. [24], non-binary students played video games more frequently than binary students.

Contrary to popular belief, playing video games actually fosters a wide variety of cognitive skills, making them less sedating and cognitively lazy. Following a number of inclusion and exclusion criteria, a systematic review of 32 studies identified the cognitive benefits of playing video games [27]. The study showed that over the years of empirical research on cognitive benefits underlined tree specific skills: subsecond time perception [9], attentional control [6], [33] and task switching [29]. Nuyens et al. [27] concludes that paying video games can have a positive effect on our cognitive processes, i.e. it can have positive impact on processing speed and attention control. Moreover, Griffiths et al. [19] claims that it can postpone cognitive impairment. According to the Entertainment Software Association, 90% of players confirm that playing video games is fun. Numbers show that games can inspire (79%), stimulate the mind (87%), and reduce stress (87%) [11]. Video game motivational benefits are based on mass communication theory, which emphasizes the factors that affect player motivation. Yee [39] proposed three categories of gaming motives based on prior empirical findings. Achievement, Social, and Immersion are the first three. In order to predict player behavior, Sherry et al. [34] applied the Uses and Gratification Scale (USG) to video games. The video game uses and gratifications (VGUG) scale was designed to assess different reasons for playing video games [18]. The 6 motivational categories are: playing to reach a goal, to relax, to compete with other players, playing because video games stimulates and enable us to be engaged in situations that are not realistically possible and, playing to have interaction with other individuals. The scale has been used to identify different sources of motivation among video game players as well as variations within genres [18], [34]. The scale The Motives for Online Gaming Questionnaire (MOGQ) was created by Demetrovics et al. [8]. It consists of seven gaming motives: escape, social, competition, coping, skill development, recreation, and fantasy. Recent research focused on personality characteristics [17], gaming motives, and time spent playing video games [22]. The results of decades of research on the correlation between the frequency of playing video games and emotional well-being have been in collision.

A negative relationship was found between playing video games and emotional well-being [26], [36], while a great deal of research has discovered that people who play video games are experiencing a higher level of emotional well-being. It seems especially relevant to discuss the impact that video games might have on social behavior. This is due to the fact that modern video games are more social in nature than those from just two decades ago. Some researchers focus their attention on predicting progress that video games have on prosocial behaviors [28], [36]. For example, according to Ewoldsen et al. [13], many games designed for playing with more participants have cooperative game modes that encourage collaboration between players.

So far, studies have identified several possibilities through which computer gaming may influence academic achievement. According to Drummond & Sauer [10], more time students play video games, it will have more negative effect on their academic performance. Hartanto et al. [20] emphasizes that computer gaming replaces the time that students should spend on academic activities According to Hawi et al. [21], more time students spend on playing video games, less time they spend on studying, doing homework and completing assignments. Time invested in playing video game have a negative effect on their academic achievement. On the other hand, Adžić et al. [1] conducted research at a Saudi Arab public university and revealed that, although students spend the same amount of time playing video games and studying, they get high grades.

The sleep displacement theory states that playing computer games affects both the quality and quantity of sleep [2]. Poor academic performance can result from lack of sleep, which also affects cognitive processing and attention. A study of 2,097 students in Lebanon found that students who play video games and sleep less had lower grade point averages (GPAs) than those who play video games and sleep more [21]. As the attention displacement theory states, playing video games can negatively affect attention, reduce self-control, and increase impulsivity [15]. Students have attention deficit difficulties if they spend more time playing video games. In contrast to research studies that found negative effects, several studies have discovered positive effects [30].

Video games can have a positive effect on the development of various skills, such as: leadership skills, teamwork, strategic thinking and problem solving [35]. Playing video games can enhance cognitive functions like attention control and processing speed while also delaying cognitive decline [19].

The prevalence of cross-sectional research designs is one of the shortcomings of current research studies, which limit the ability to synthesize and interpret data effectively. Gnambs et al. [16] carried a longitudinal research in German schools and identified that playing video games did not have a significant effect on respondents' achievement in schools. Despite the growing body of studies about the connection between academic achievement and playing video games, the findings are still open to interpretation.

3. Materials & Method

This paper analyzes the gender differences between amount of time that male and female students spent studying and playing video games. Moreover, we try to identify the connection between student achievement and gender. From December 2021 to June 2022, primary research was carried out at two Serbian universities, public and private. The research sample was random but purposive, consisting only of students from the universities included in the research. A method of online surveying was used to get the data. Participation in the survey was anonymous and voluntary for students. The online questionnaire was filled out by 400 respondents ($N = 400$). This means that at the 95% probability level the sampling error is below 5%, which is considered the gold standard in research. Therefore, according to Cochran's formula for a representative sample in proportion ($N > 385$), the obtained results should be considered reliable because the research sample was representative.

The first section of the questionnaire asked about the amount of time students spent playing video games as well about other types of fun and entertainment activities, the time students spent studying during the day, and the average student achievement, expressed in total average grade (TAG)[1]. The second part of the questionnaire consisted of descriptive statistical questions about gender, year of study, age, and employment status. Various parametric and non-parametric statistical techniques were applied during the research phase. In order to evaluate the data, IBM's SPSS Statistics v. 25 was used.

In terms of sample distribution, 53.8% (210 participants) were females, 45.1% (176 participants) were males, and 1% (4 participants) were non-binary as they selected the sex option "Others".

[1] A six-point grading scale is used at Serbian universities: excellent or outstanding is 10, excellent is 9, very good is 8, good is 7, adequate or satisfied - the lowest pass score is 6, and not sufficient or not satisfying – failure to grade is 5. When computing total average grade (TAG), two decimals appear, for example, 8.34.

259 students, or 64.8%, played video games, whereas 141, or 35.3%, did not. In terms of (reported) gender, 58.5% of the gamers were male (151), 39.9% were female (103) and 1.6% were non-binary (4). Only 20%, or 25, of the non-gamers, were men, with the remaining 80%, or 107, being women. A minority of responders (35%) were employed. The participants' ages varied from 19 to 59. The majority of students, one-third of the sample, were a second-year undergraduate students, while only 1.5 percent were pursuing Ph.D. studies.

4. Results

The respondents were 23 years old on average (Median 21). The respondents' TAG was 8.47, with a range of 6.00 to a maximum of 10.00. Other respondents said they did not study for the examinations for even a single second, while others studied as much as 15 hours a day. They studied for an average of 4.14 hours, or more precisely 4 hours, 8 minutes, and 24 seconds. The students on average spend under two hours (1.96 hours or 118 minutes to be exact) playing video games during the exam period, starting from zero to 4.14 hours. The participants spent a little more than 3 hours, an average of 192 minutes, on other fun activities besides gaming. The average leisure time, which included the time for gaming and the time for fun, was 4.23 hours.

The first step was to test the valid responses and compare the overall average grades of respondents who played games $(n = 258, M = 8.44)$ and respondents who did not play games $(n = 127, M = 8{,}53)$, using an independent samples t-test to get an answer to the research question "How students' gender differences in time spent studying and playing video games affect student achievement?" The test was not statistically significant, $t(383) = -.970, p = .333$. Moreover, the relationships between TAG and time spent in games as well as between TAG and time spent in fun activities were examined employing the Pearson product-moment correlation coefficient. Both correlations were statistically insignificant, $r = -.029, n = 230, p = .657$ as well as $r = -.027, n = 341, p = .615$.

However, as shown in Table 1, it was revealed the significant correlations at the 0.01 level between TAG and studying time $(r = .291\, n = 377, p = .000)$ and between studying and gaming time $(r = -.206, n = 228, p = .002)$. Although the significance levels are high, according to Cohen's criteria, the observed effect sizes are small $(r < .1)$.

Table 1. Correlation table between the variables TAG, study, play, and fun

	TAG	Studying time	Gaming time	Fun time
TAG	1			
Studying time	.291**	1		
Gaming time	-.029	-.206**	1	
Fun time	-.027	-.091	.037	1

** p<0.01

Furthermore, as shown in Table 2, we used a chi-squared test of independence to examine the connection between the status of video games-playing and respondents' gender (Four non-binary students were excluded from the test, as the test requires at least five frequencies per variable). An investigation of 2×2 $contingency\ table$ identified a significant connection between respondents' gender and their video game-playing activity with a medium impact, $\chi^2(1, n = 386) = 55.84, p = .000, Phi = .386$. Moreover, two more chi-square tests of independence were used to investigate (1) the relation between years of study and video game playing status, and (2) the relation between video game playing status and employment status. Video game playing and years of study were not significantly related $(\chi^2(6, n = 391) = 9.88, p = .130, Cramer's\ V = .159)$, nor were video game playing and employment status $(\chi^2(1, n = 391) = 3.64, p = .056, Cramer's\ V = .096)$.

*Table 2. Do you play games? * What is your sex? Crosstabulation*

			What is your sex? 1 Male	2 Female	Total
Do you play games?	1 YES	Count	151	103	254
		% within Do you play games?	59.4%	40.6%	100.0%
	2 NO	Count	25	107	132
		% within Do you play games?	18.9%	81.1%	100.0%
Total		Count	176	210	386
		% within Do you play games?	45.6%	54.4%	100.0%

Since the only noteworthy relationship was revealed between the respondents' gender and the video game-playing status, the natural final step was to run a series of parametric t-tests to see if there was a statistically significant difference in gender with respect to TAG, average playing time, and average study time. At the $p < .001$ level, the mean difference across all tests was significant. In our study, the average TAG was greater for the females $(M = 8.65, SD = 0.817)$ than for the males $(M = 8.29, SD = 0.870)$, $t(378) = -4.123, p = .000, \eta^2 = .005$.

One of the probable explanations for female students' superior grades relative to male students might be discovered in our sample's study. Female students ($M = 4.69, SD = 2.65$) spent 33% more time studying than male students ($M = 3.52, SD = 2.34$), $t(376) = -4.502, p = .000, \eta^2 = .006$. In contrast, male students ($M = 2.31, SD = 1.80$) played video games 70% more than female students ($M = 1.36, SD = 1.07$), $t(225) = 4.505, p = .000, \eta^2 = .009$. The effect sizes of all the groups were found to be rather small ($\eta^2 < .01$), despite the statistical significance of the differences between the groups.

Finally, since we intend to examine the whole gender spectrum, we included four non-binary students in the further analysis by configuring a new dichotomous B_NONB variable, consisting of whether the student was binary (1) or non-binary (2). Since this group is critically small, we applied the nonparametric Mann-Whitney tests to identify if there was a significant statistical median difference in genders (binary students vs. non-binary students) with respect to TAG ($8.50\ vs\ 7.65$), average study time ($4.00\ vs. 3.75$), and average playing time ($1.50\ vs. 4.00$). The only significant difference was found between the new variable and TAG. Non-binary students recorded a significantly lower TAG ($Md = 8.50, n = 380$) compared to binary students ($Md = 7.65, n = 4$), $U = 279, Z = -2.185$, $p = .029$. The calculated effect size was small to medium ($r = .11$).

The logical last step was to find the reason why non-binary students have a lower TAG and to compare the studying and playing time of those students with female and male students. As we can observe from Table 3, the medians of non-binary students are quite different from other groups. Their TAG median of 7.65 is significantly lower than the TAG median of males (8.25) and females (8.70). Non-binary students studied 3.75 hours, which is more than female students (4 hours) but less than male students (3 hours). Finally, non-binary students spent a massive 4 hours on average gaming time, twice as much as males and four times as much as women. Since we already statistically confirmed the differences between male and female students, we were not surprised that all three Kruskal-Wallis tests were significant in comparing the gender groups and their TAG ($H(2, 384) = 21.05, p < .001$), studying ($H(2, 382) = 21.08, p < .001$) and gaming time ($H(2, 230) = 21.82, p < .001$).

Table 3. Comparing medians of three gender groups

What is your gender?		Average grade	Avg. studying time	Avg. gaming time
1 Male	Median	8,2500	3,0000	2,0000
	N	173	173	137
2 Female	Median	8,7000	4,0000	1,0000
	N	207	205	90
3 Non-binary	Median	7,6500	3,7500	4,0000
	N	4	4	3
Total	Median	8,5000	4,0000	1,5000
	N	384	382	230

However, the established differences between male students and non-binary students in relation to time spent studying ($U = 337.5, Z = -0.084,\ p = .933$) and time playing video games ($U = 157, Z = -0.707,\ p = .480$) were not statistically significant. Moreover, we did not discover statistical differences between female students and non-binary students regarding studying time ($U = 296.5, Z = -0.952,\ p = .341$) and gaming time ($U = 75.5, Z = -1.319,\ p = .187$). The reasons why the results of this Mann-Whitney test differed from Kruskal-Wallis test results are found in the small number of non-binary students. Only four participants in one sample significantly affect the sample sensitivity in terms of test results.

5. Discussion

Two-thirds of the students in the observed sample played video games during the exam period. Although gamers recorded a lower TAG, it is not statistically significant. Moreover, time spent on gaming and fun activities did not correlate with TAG. These results confirmed prior findings that there is no significant relationship between academic achievements of students and the time they spend playing video games. Playing video games is not bad *per se*. It appears that it has an impact on development of certain skills such as: problem solving, multidimensional thinking, teamwork, leadership skills, etc., and it may offset the adverse effects of time spent playing games (e.g., impulsivity and attention problems, reduced amount and quality of sleep, less time for homework, studying, etc.).

However, a negative correlation between time spent playing games and time spent studying was statistically confirmed. Given that study time is positively connected with TAG, it is clear that students' reckless behavior in terms of excessive gaming might be detrimental.

Therefore, the direction of future studies could be to determine the time level of responsible gaming, as well as the time level of irresponsible gaming, which takes up too much of students' time. Nevertheless, the measured effects of influence are small, and if we did not attribute the difference in TAG only to the intellectual abilities of individuals and their more successful time management, we wondered whether the analysis by gender would provide a better explanation of the difference in success, in relation to the time for studying and playing games.

Primarily, we discovered that the relationship between gender and gaming is statistically significant and that the effect is not small. Not only were there more female non-gamers than others in the overall sample (while there were 6 times more male gamers than non-gamers) but 4 out of 5 non-gamers during the exam period were female students. All non-binary students, who made up 1% of all students in the sample, were gamers. Further tests revealed that women spend more time studying than other genders while spending much less time playing games. Such behavior results in a measurable and statistically significant difference between the study and playtime of women and men, but also a measurable and statistically significant difference between gender and average grades as a measure of academic success. Since they are more dedicated to working for their study obligations and spend less time on non-essential things like playing games, females in our sample achieved an average of 4.3% higher TAG than others. The difference is all the more significant because the average score of women exceeds 8.50, which is the threshold for enrolment in postgraduate studies at Serbian universities. This difference in success could be explained by the different gender behavioral patterns. It should be noted that we did not discover that there was a statistically significant connection between other demographic characteristics and playing video games.

Revealed psychosocial burdens of non-binary students [3] affect their academic performances, as well. Non-binary students in our sample achieved significantly lower TAG than male and female students. Although these students played more hours of video games than others, we did not find statistical significance between their playing time and GTA, nor between their studying time and GTA. Obviously, the burdens that non-binary students go through harm their academic results.

The differences between the female students and male students were statistically significant; however, the effect size between the groups was quite small. A variety of other factors, besides time spent playing video games and studying, can make difference between male and female students and their academic achievement.

There are gender differences recognized, but in the end, the question of intellect, individual effort, and the desire to succeed must not be overlooked.

6. Conclusion

How the gender differences of students in time spent studying and playing video games affect student achievement? Female students learned more hours during the exams compared to male and non-binary students. Furthermore, female students spent less time playing video games than male and non-binary students. Finally, females achieved a higher TAG in comparison to others.

In our research, we proved that gender differences exist, but not in the style of outdated conservative postulates about the stronger and weaker sex. We have proven that women, who make up the majority of students today, are more successful in studying. The reason for this is not only more diligent study but also more responsible management of free time in the sense of wasting less time playing video games during the exam period when it is much more important to devote all energy to studying. We certainly recognize this gender difference and the notable academic success of women, which we see also as one of the reasons for the great progress of human society in the last hundred years. Such progress has certainly contributed to the acceptance of a positive gender difference in our society. These positive differences and the acceptance and respect of women's success will contribute to the acceptance of the equality of all genders in modern democratic societies.

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