The impact of sport participation on academic performance among Maltese secondary school students

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Abstract: Existing research suggests that smaller class sizes, diverse teaching methods, and engagement in sports yield positive returns on students' educational outcomes. This paper investigates whether students participating in sports when preparing for their Secondary Educational Certificate, a pivotal milestone in their life, exhibit higher academic performances in English language and Mathematics than their non-participating counterparts. Utilising online self-completion questionnaires from students who underwent exams in the past two years, these findings reveal a statistically significant positive correlation between the frequency of sports participation and academic performance regarding improved grades. Furthermore, the study highlights that this positive influence of sports is more evident in Mathematics than in English. Additional insights from this study indicate that students in private schools generally achieve higher grades than state school students, and academic marks vary according to the students' residential district due to diverse cultural backgrounds.
Keywords: Sports; Marks; Secondary Educational Certificate; Grades

Introduction

Certain students struggle to cope and approve time for physical activity, attributing their lack of practice to a perceived 'lack of free time', whilst others consistently engage in sports at a professional level (European Commission, 2022). The positive externalities of sports participation extend to third parties, as outlined by the Centres for Disease Control and Prevention (2020), emphasising that parents benefit directly from their children's improved health and development of healthy habits. Indeed, De Greeff et al. (2018) discovered that students who regularly participate in physical activity perform better academically, are more productive, and have longer sustained attention spans.

The need to devise policies to improve students' academic performances arises following the observed disparities in their Ordinary level examination scores,

particularly in the English Language and Mathematics Secondary Education Certificate (SEC) (Table 1) (L-Universita' ta' Malta, 2023).

SEC marks for Main session of 2023		
Grade	Total Candidates (English Language)	Total Candidates (Mathematics)
1	4.24%	7.61%
2	12.61%	8.01%
3	17.80%	11.64%
4	17.92	13.81%
5	20.40%	10.01%
6	6.13%	10.03%
7	3.80%	7.99%
8	0%	0%
U	13.09%	22.72%
Absent	4.01%	8.17%
Number of students	4241	4295

Table 1: Comparing students' marks; Source: L-Università ta' Malta (2023)

The comparatively low scores achieved in SEC results contradict Malta's substantial budget dedicated to education, positioning it as the European Union's (EU) 5th highest spender on education (Eurostat, 2021). In particular, Eurostat (2021) data reveals that the government allocates 34.78% of the budget to secondary education. Notably, this allocation persists even in light of the relatively underwhelming performance of 15-year old students in their Programme for International Student Assessment (PISA) assessments (PISA, 2018).

Review of past studies

The initial phase of effective assessment is planning, as it aids in selecting and implementing suitable evaluation methodologies to assess the achievement of a certain aim or purpose (Anwar et al., 2012). Mavis (2010) underscores the significance of end-of-year assessments in providing students with valuable feedback on their academic performance, shedding light on their strengths and weaknesses. These assessments incorporate 21st century competencies, including problem-solving, decision-making, invention and creativity, respect, responsibility, organisational skills, initiative, and perseverance (Daggett, 2005). The technique as to how an assessment should be based, according to Felder and Brent (2003), consists of the average class accomplishment level (for example, 70% marks or a grade C) and a percentage of the students' predicted achievement (for example, 50% of the students are expected to obtain a grade B or lower).

Despite the widely acknowledged role of physical activity in promoting overall health and wellbeing, Bailey et al. (2015) argue that its full range of benefits is often underestimated. Physical activity contributes to reducing cardiovascular diseases and various chronic conditions, including obesity, hypertension, bone and joint disorders, and depression (Warburton et al., 2006). Recognising its role as a cost-effective preventive measure against the global obesity epidemic, sports and physical exercise gather significant attention from policymakers and politicians (Bonow et al., 2002). The American College of Sports Medicine (2011) reinforces the perspective by asserting that "Exercise is Medicine". Beyond physical health, Bailey (2006) emphasised the benefits of sports and physical exercise, which influence psychological and social well-being, academic success, and future employment prospects. Additionally, the World Health Organisation reports a lower incidence of teenage pregnancies and anti-social behaviour among young people involved in organised sports, along with a reduced likelihood of drug use and smoking compared to non-participants (Stead and Nevill, 2010).

Research undertaken by Steed and Nveill (2010) at the university level establishes a positive correlation between children's participation in physical activity and academic achievement. Further investigation confirmed this hypothesis, whereby Hollar et al. (2010) demonstrated significant improvement in elementary school children's Mathematics grades following a two-year physical exercise programme. Shephard et al. (1994) observed higher academic achievement among children who received extra physical education compared to a control group without such additional education. Coe et al. (2006) further emphasise that children engaging in more strenuous physical exercise outside school achieve better test results. Dwyer et al. (2001) corroborate these findings, asserting that increased physical activity, physical capacity, and fitness are associated with higher ratings of scholastic competence. To complement the findings produced by the previously cited authors, research by Dollman et al. (2006) and Sallis et al. (1999) suggest that children can spend less time on academic learning during the school day without compromising academic performance or growth when engaging in physical activity.

Materials and Methods

This study investigated whether there is a statistically significant relationship between sports participation and the academic performance of secondary school students in Malta. Data was collected directly from students who underwent the University of Malta's Secondary Education Certificate (SEC) examinations in two core subjects, Mathematics and English Language, in 2021 and 2022. These two core subjects were selected based on their universal inclusion in educational curricula among state and private schools, and their common undertaking by all students preparing for SEC examinations.

Research Aim and Hypothesis

The rationale behind this study was to assess whether engaging in sports outside the school environment significantly influences Year 11 (Form 5) students' educational achievements during their SEC Mathematics and English Language examinations. The hypotheses being tested by this study are as follows:

H_o : Participation in sports has no statistically significant impact on the academic performance attained by secondary school students in English and Mathematics

H_A : Participation in sports has a statistically significant impact on the academic performance attained by secondary school students in English and Mathematics

Research Design

The core interpretation sought by this research was based on whether sports participation impacts academic performance among secondary school students in Malta. Therefore, post-positivism was adopted to produce an objective conclusion to test the set hypothesis scientifically. Deductive reasoning was applied, involving hypothesis testing based on existing theories. Convenience sampling was employed to reach participants through an online self-completion questionnaire distributed via online platforms, particularly Facebook. Considering the 2021 SEC statistical report, 4086 participants enrolled for the English Language exam, of whom 48% were males, and 52% were females, while 4162 individuals enrolled for the mathematics exams, of which 52.4% were females and 47.6% were males, a required sample size of 352 was determined at a 95% confidence level and 5% margin error. The questionnaire addressed variables identified in the literature by past authors that have a proven impact on academic performance (Table 2).

Data analysis

After cleaning and transforming the raw dataset, statistical tests were performed to answer the research question. The analyses included a normality test to examine data distribution. As the data was found not to be normally distributed, non-parametric tests (Spearman correlation, Mann-Whitney U-test, and Kruskall-Wallis test) were produced using the Statistical Package for Social Sciences (SPSS) software version 29, chosen for its simplicity and effectiveness in statistical analyses. The Shapiro-Wilk test confirmed the non-normal distribution of the data for all the analyses by testing the following hypothesis:

$$H_0: Sample\ belongs\ to\ a\ data\ that\ is\ normally\ distributed$$
$$H_A: Sample\ belongs\ to\ a\ data\ that\ is\ not\ normally\ distributed$$

Variable	Role in model	Description	Quantification of Variable
ENGLISH MARK	Dependent Variables	The grade obtained by the student in English language	Range from 1 (highest grade) and 8 (unclassified grade).
MATHS MARK		The grade obtained by the student in Mathematics	Range from 1 (highest grade) and 8 (unclassified grade).
MARK AVERAGE		The average grade obtained by the student in English language and Mathematics	Unweighted average of the grade obtained in English and Mathematics
GENDER	Independent Variables	The gender that the student identifies as	1 – Male 0 – Female
SCHOOL		Type of school attended by the student	1 – Private school 0 – State school
RESIDENCE		The district that the student resides in	Northern district Northern Harbour district Southern Eastern district Southern Harbour district Western district
EXAMS		Number of SEC exams attempted by the student	Number inputted by the participant
FREQUENCY EXERCISE		Degree of sports participation	1 – Never 2 – Seldom 3 – With some regularity 4 - Regularly

Table 2: Dependent and Independent Variables

Results

The collected data was summarised in Table 3, offering a statistical descriptive overview of the key factors identified in Table 2. The results indicate that participants received an average grade in Maths of 3.300, signifying a favourable performance, where '1' represents the highest grade and '8' is the lowest. In comparison, the average mark obtained in the English language suggests a slightly better performance of 3.009. Interestingly, the median marks for both subjects converge at the same grade of 3.000.

VARIABLE	VALID	MISSING	MEAN	MEDIAN	MINIMUM	MAXIMUM
MATHS MARK	213	3	3.300	3.000	1.0	8.0
ENGLISH MARK	214	2	3.009	3.000	1.0	8.0
MARK AVERAGE	215	1	3.160	3.000	1.0	6.5
GENDER	213	3	.465	.000	.0	1.0
SCHOOL	215	1	.605	1.000	.0	1.0
FREQUENCY EXERCISE	215	1	2.986	3.000	1.0	4.0
EXAMS	214	2	9.607	8.000	2.0	12.0

Table 3: Descriptive statistical table

Furthermore, Table 3 provides a synopsis of the participants' profiles. The mean score for GENDER is 0.465, indicating that more females than males completed the questionnaire. Notably, the questionnaire predominantly attracted respondents from private secondary school settings, evidenced by the mean score of 0.605, skewed towards the 1 (private school). Moreover, with a mean score of 2.986 for exercise frequency, it can be concluded that most respondents engage in regular exercise or sports activities. The respondents,

on average, registered for more than nine SEC exams, achieving a combined average score of 3.160 in English and Maths.

Preliminary Analysis

Figure 1 illustrates the average marks achieved in Maths and English exams, segregated by the type of school attended and the number of exams students took.
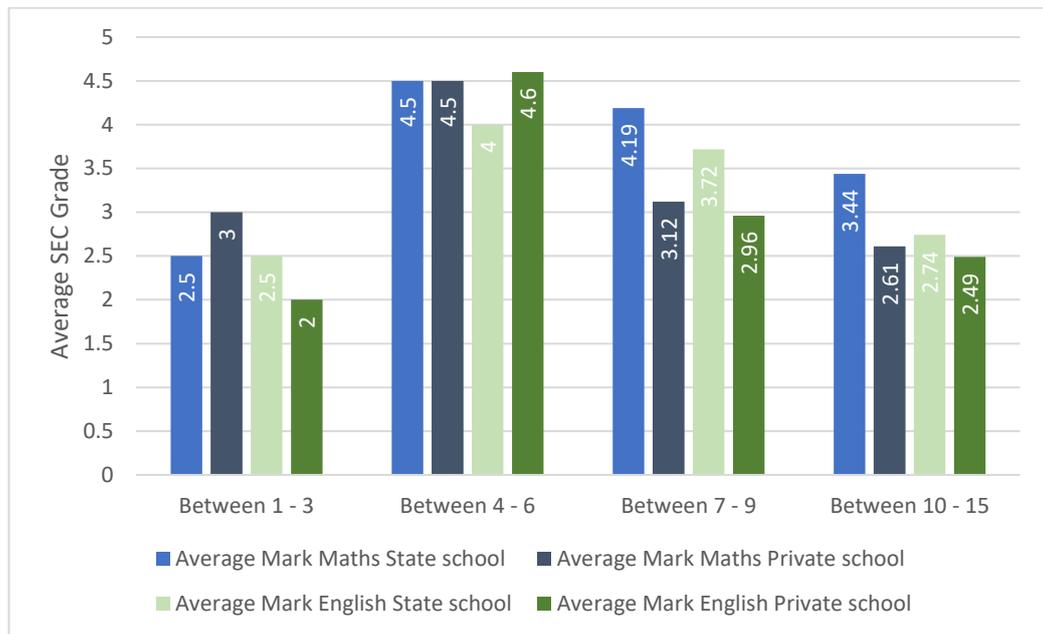

Figure 1: Marks segregated by type of school and number of exams

Participants who opted for the minimum number of SEC tests tended to achieve higher grades, especially when compared to those who sat between four to six SEC examinations. However, overall, those who registered for seven to nine SEC tests and attended private schools outperformed their counterparts in public schools. Conversely, there were no significant disparities among those who registered for four to six exams, although participants in state schools exhibited slightly better performance. This aligns with the National Center for Education Statistics (NCES, 2019) results, which report that private school students often outperform their counterparts in standardised tests, potentially attributed to greater resources and smaller class sizes. Specifically, when focusing on Mathematics, Figure 2 reveals an unequivocal difference in the marks obtained by the respondents from private versus state schools.
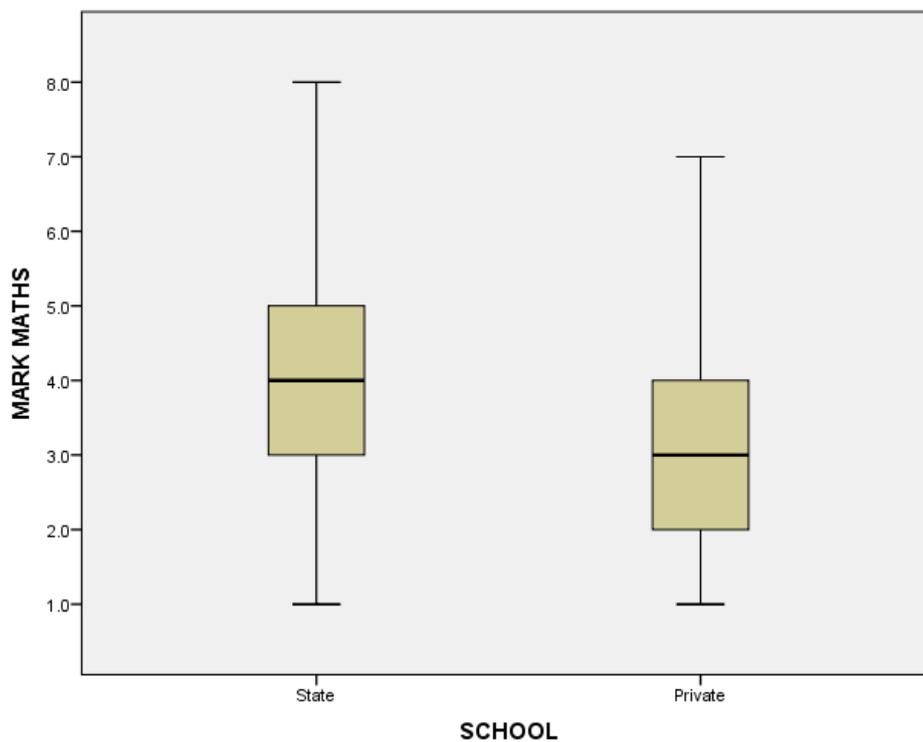
Figure 2: comparing the type of schools against marks in maths

While most private school participants tend to attain grades ranging between 2 and 4, their counterparts in state school grades typically achieve grades between 3 and 5. This observation aligns with the findings of Martinez (2015), who cited a study by Lubienski and Lubienski (2013) comparing mathematics grades among private and public school students.

Moreover, the analyses depicted in Figure 3 reveal that male participants consistently outperform females in Mathematics across all geographical districts, except for the Southern Harbour. Conversely, in English, female participants generally obtained better grades than males in all districts in Malta, except for the Western district. Notably, participants from the Northern district of Malta secured the best overall average mark in Maths, followed by males from the Southern Eastern part. Conversely, the lowest results in Maths and English are recorded by males residing in the Southern Harbour area, followed by females in the Northern Harbour area.
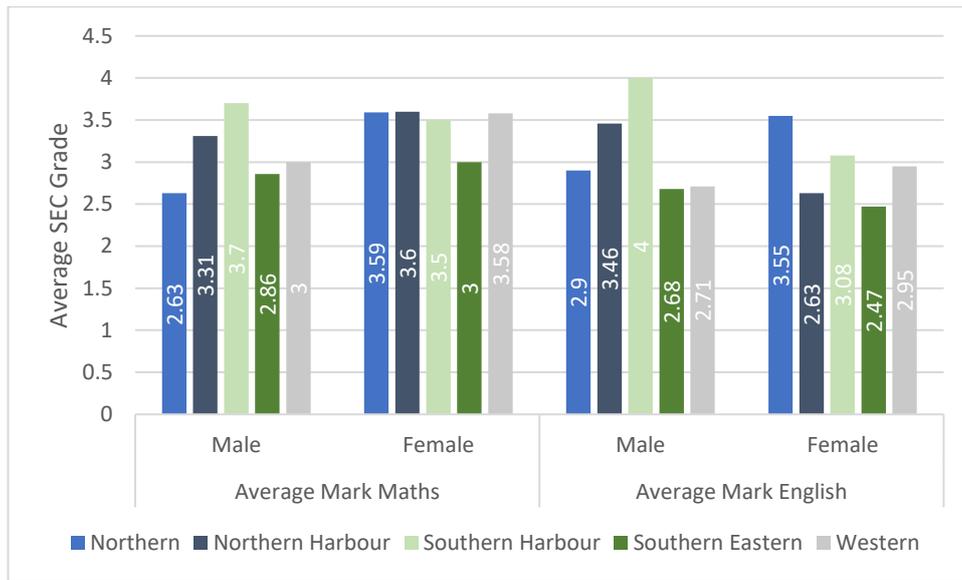
Figure 3: Marks segregated by residence and Gender

The results align with findings from studies conducted by Bowers et al. (2013) and Berenbaum et al. (2008), suggesting that males exhibit a natural proficiency in Mathematics and quantitative subjects. Coskun's (2014) results explain why females often outperform males in English, attributed to females' higher intrinsic motivation for learning English.
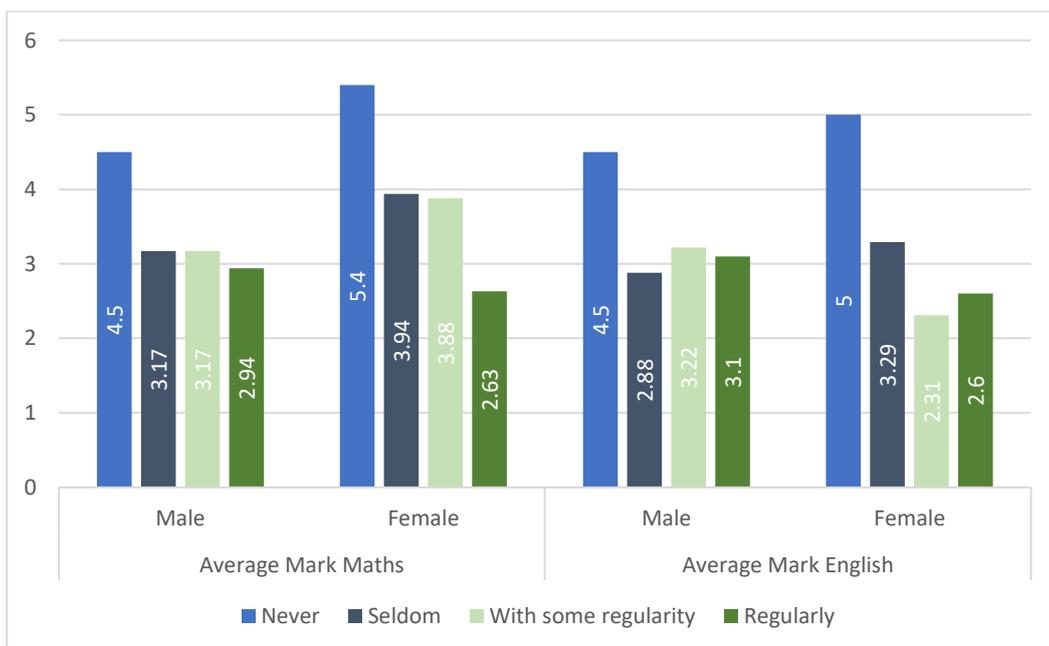

Figure 4: Marks segregated by Exercise Frequency and Gender

In addition to comparing the marks across geographical districts, Figure 4 presents an examination of the participants' grades in relation to their level of physical activity. The results indicate a positive link between exercise frequency and improved academic marks in both SEC exams, especially among females. Those who engage in regular exercise secured the highest overall grades. On the contrary, females who abstain from exercise achieved the lowest marks, a trend also observed among males, albeit with a comparatively better average mark.

Main results

Sports Frequency versus Academic Performance

This study aimed to examine whether there is a statistically significant difference in academic performance, as reflected by the SEC examination marks, between individuals who engage in frequent sports activities and those who do not. A normality test (Table 4) was conducted to assess the distribution of the data, with the following hypotheses under consideration:

H_O: *Sample belongs to a data that is normally distributed*
H_A: *Sample belongs to a data that is not normally distributed*

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Significance	Statistic	df	Significance
MARK AVERAGE	.101	215	<.001	.968	215	<.001
FREQUENCY EXERCISE	.253	215	<.001	.810	215	<.001
a. Lilliefors Significance Correction						

Table 4: Tests of normality: Exercise frequency vs average mark

The significance value of the Shapiro-Wilk test was less than 0.05, and therefore, the null hypothesis was rejected, meaning that the data was not normally distributed. Given the distribution of the data, the Spearman correlation test (Table 5) was performed to test the following hypotheses:

H_O: *No relationship between the frequency of exercise and the average mark attained in Maths and English*
H_A: *A relationship between the frequency of exercise and the average mark attained in Maths and English exists*

Correlations				
			FREQUENCY EXERCISE	MARK AVERAGE
Spearman's rho	FREQUENCY EXERCISE	Correlation Coefficient	1.000	-.273**
		Significance (2-tailed)	.	<.001
		N	215	215
	MARK AVERAGE	Correlation Coefficient	-.273**	1.000
		Significance (2-tailed)	<.001	.
		N	215	215
**. Correlation is significant at the 0.01 level (2-tailed).				

Table 5: Correlation comparing FREQUENCY EXERCISE and MARK
AVERAGE

The results presented in Table 5 demonstrate the rejection of the null hypothesis, indicating that there is a linear relationship between the two variables in question. As depicted in the same table, the Spearman correlation test highlights the significance of the correlation between exercise frequency and the average marks obtained in Maths and English at the 0.01 significance level. This indicates that the margin of error is 1%, implying high accuracy in the obtained outcome. The correlation coefficient is -0.273, meaning that those respondents engaging in frequent exercises tended to achieve higher average marks in Maths and English than those who did not practice sports frequently.

Additional statistical tests were performed to examine potential differences between participants who practiced sports frequently and those who did not, specifically in relation to their respective grades in English and Maltese. Following a normality test that indicated non-normally distributed data, the Spearman correlation test (Table 6) was employed to determine the correlation for non-parametric data, testing the following hypotheses:

H_O: *No relationship between the frequency of exercise and the mark attained in English or Maths*
H_A: *A relationship between the frequency of exercise and the mark attained in English or Maths*

Correlations				
			MARK ENGLISH	MARK MATHS
Spearman's rho	FREQUENCY EXERCISE	Correlation Coefficient	-.159*	-.320**
		Sig. (2-tailed)	.020	<.001
		N	214	213
*. Correlation is significant at the 0.05 level (2-tailed)				
**. Correlation is significant at the 0.01 level (2-tailed).				

Table 6: Correlation comparing FREQUENCY EXERCISE and MARK ENGLISH and MARK MATHS

The outcomes in Table 6 reveal that the null hypothesis is rejected, as the significance values of 0.020 and 0.001 are smaller than 0.05. This indicates that there is a linear relationship between exercise frequency and the marks achieved in English and Maths. The correlation coefficients for the two variables suggest a negative relationship of -0.320 for Maths and -0.159 for English. The results demonstrate that respondents who exercise regularly obtained higher marks in their English and Maths exams. The correlation coefficient is more pronounced between 'MATHS' and 'FREQUENCY EXERCISE', signifying a more influential relationship between the two variables.

These findings follow the conclusions by Grissom (2005) and De Greeff et al. (2018), who argue that students who allocate more time to fitness tend to achieve better average academic performance. However, Magro et al.'s (2022) findings produce an alternative conclusion, suggesting that sports participation has no direct effect on the academic performance of Maltese students. Instead, it impacts their Body Mass Index, which, in turn, influences the average end-of-course mark. Nelson (2006) also found that pupils who actively participated in school sports activities were likelier to earn higher average grade points in Maths and English. These findings reinforce the results of this study, indicating that respondents who regularly engage in physical exercises tend to achieve a better average mark in Maths and English.

Determinants Contributing to Academic Performance

To identify the factors that lead to better academic achievement among the participants, the determinants identified in past studies were correlated against the dependent variables. The Mann-Whitney U-test was performed to examine

whether there are statistically significant differences in the average marks obtained between the two genders since the data was not normally distributed. The null and alternative hypotheses for the Mann-Whitney U-test (Table 7) are indicated hereunder:

H_O: There are no significant differences in the average marks obtained in Maths and English between male and female participants
H_A: There are significant differences in the average marks obtained in Maths and English between male and female participants

	GENDER	N	Mean Rank	Sum of Ranks
MARK AVERAGE	Females	114	109.91	12529.50
	Males	99	103.65	10261.50
	Total	213		

	MARK AVERAGE
Mann-Whitney U	5311.500
Wilcoxon W	10261.500
Z	-.744
Asymp. Significance (2-tailed)	.457
a. Grouping Variable: GENDER	

Table 7: Correlation comparing gender and average mark

Since the Significance value was 0.457, greater than 0.05, the null hypothesis was not rejected, indicating that there is no discernible relationship between the student's gender and the average mark in English and Maths. This follows the results by Kupczynski et al. (2014), who observed no differences in the average grade points attained by males and females in a distance learning course.

Moreover, to test whether there is a correlation between the type of school and the average mark obtained, the Mann-Whitney U-test (Table 8) was again used to test the hypotheses:

H_O: There are no significant differences in the average marks obtained in Maths and English between students in private and state schools
H_A: There are significant differences in the average marks obtained in Maths and English between students in private and state schools

	SCHOOL	N	Mean Rank	Sum of Ranks
MARK AVERAGE	State	85	127.31	10821.50
	Private	130	95.37	12398.50
	Total	215		

	MARK AVERAGE
Mann-Whitney U	3883.500
Wilcoxon W	12398.500
Z	-3.708
Asymp. Significance (2-tailed)	<.001
a. Grouping Variable: SCHOOL	

Table 8: Correlation comparing SCHOOL and average mark

Since the Significance value was less than 0.05, the null hypothesis was rejected. This indicates a significant difference between the type of school attended and the average mark attained in Maths and English. Table 8 shows the discrepancy, with the mean rank for private schools being 95.37 and the mean rank for state schools being 127.31. Since a lower number indicates a better outcome, private school participants obtained a higher overall average mark in Maths and English vis-à-vis public school students.

Significant differences among students emerge in Mathematics when tested using the Chi-squared test (Table 9) through the following hypotheses:

H_O: *The type of school attended, and the mark obtained in Maths are independent of each other*
H_A: *The type of school attended, and the mark obtained in Maths are not independent of each other*

SCHOOL * MARK MATHS Crosstabulation								
Count								
		MARK MATHS						Total
		1	2	3	4	5	6	
SCHOOL	State	2	16	17	23	17	8	83
	Private	26	25	30	32	10	7	130
Total		28	41	47	55	27	15	213

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	20.105[a]	5	.001
Likelihood Ratio	22.966	5	<.001
Linear-by-Linear Association	14.450	1	<.001
N of Valid Cases	213		
a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 5.85.			

Table 9: Correlation comparing the type of school vs MARK MATHS

The null hypothesis was rejected since the significance of the Chi-square test was less than 0.05. The crosstabulation shows a relationship between the respondents' Maths results and the type of school they attended. The top grades were earned by 26 respondents who attended private schools, while only two respondents who attended state-run schools achieved the highest Math grade.

One contributing factor to more positive results obtained by private school participants was asserted by Trudeau and Shephard (2008), who argue that private schools allocate more time for physical exercises, contributing to academic success. Furthermore, private schools tend to have smaller class settings, which improves students' academic marks (Zarb, 2021). Moreover, Biswal and Behera (2015), in their book 'Academic Performance of Public and Private Schools', produced similar conclusions when identifying the superior infrastructure, facilities, and teaching and learning processes within private schools compared to state schools.

To assess whether there are statistically significant differences in the average marks obtained by respondents from different districts, the Kruskal-Wallis H test (Table 10) was performed since the data was not normally distributed to test the following hypotheses:

H_O: There are no significant differences between the residence of the participants and the average marks obtained in Maths and English
H_A: There are significant differences between the residence of the participants and the average marks obtained in Maths and English

	RESIDENCE	N	Mean Rank
MARK AVERAGE	Northern district	42	110.07
	Northern Harbour district	44	111.80
	Southern Eastern district	48	86.89
	Southern Harbour district	45	127.34
	Western district	36	104.92
	Total	215	

	MARK AVERAGE
Kruskal-Wallis H	10.331
Df	4
Asymp. Significance	.035
a. Kruskal Wallis Test	
b. Grouping Variable: RESIDENCE	

Table 10: Correlation comparing RESIDENCE and MARK AVERAGE

The significance value of 0.035 was less than 0.05, leading to rejecting the null hypothesis. This indicates a significant difference between the participants' residence and the average mark obtained in Maths and English. The mean rank in Table 10 indicates that those residing in the Southern Eastern region of Malta achieved the best average mark in English and Maths combined. In contrast, those residing in Southern Harbour achieved the lowest average marks.

To assess whether there was a statistically significant relationship between the number of exams sat for by the participants and the average mark attained in Maths and English, the Spearman correlation test (Table 11) was performed given that the data was not normally distributed by testing the following hypothesis:

H_O: *No relationship between the number of exams taken and the average mark attained in Maths and English*
H_A: *A relationship between the number of exams taken and the average mark attained in Maths and English exists*

Correlations				
			MARK AVERAGE	EXAMS
Spearman's rho	MARK AVERAGE	Correlation Coefficient	1.000	-.313**
		Significance (2-tailed)	.	<.001
		N	215	214
	EXAMS	Correlation Coefficient	-.313**	1.000
		Significance (2-tailed)	<.001	.
		N	214	214
**. Correlation is significant at the 0.01 level (2-tailed).				

Table 11: Correlation comparing EXAMS AND MARK AVERAGE

The significance value in Table 11 was less than 0.05, indicating a linear relationship between the two variables, and as a result, the null hypothesis was rejected. According to the Spearman correlation results, the correlation between the number of exams taken and the average score in Maths and English was significant at the 0.01 level. The correlation coefficient for the two variables points to a negative relationship of -0.313, indicating that respondents' average Maths and English test results improved when they opted to take additional SEC examinations, in line with Pope and Fillmore's (2015) findings.

Conclusion

In the context of the Ministry of Education embarking on formulating a new national strategy for education (2024-2030), it is recommended to incorporate more sports programmes akin to successful initiatives in countries like the United Kingdom (Newsroom, 2023). The government's support for physical education programs, such as the 'School Games' initiative, could be a valuable addition to the educational landscape, fostering interschool sports competition among adolescents (Youth Sport Trust, 2023).

This study highlighted the potential benefits of sports participation on academic performance, suggesting that private schools might consider investing more in sports infrastructure. Integrating high-quality sports facilities could enhance the overall appeal of private schools and serve as a

strategic move to attract more students and generate increased revenue. In fact, private schools are known for prioritising extracurricular activities, including sports, alongside academics (Our Kids, 2019). The findings of this study align with the emphasis on extracurricular activities within school settings.

While this study concentrated on secondary school students, a broader research initiative, the Fun Fit 5 pilot project, explored the effects of physical activity programmes on academic, physical, and psychological development among Year 4 children in Maltese government schools (Darmanin et al., 2022). Future quantitative research can further investigate the impact of sports participation on academic performance by extending the focus to post-secondary education.

Therefore, as education policies evolve, integrating sports programs and recognising their potential influence on academic achievement could contribute to a more holistic and effective educational strategy.

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