OmniaScience

Journal of Technology and Science Education
JOTSE, 2024 – 14(2): 607-621 – Online ISSN: 2013-6374 – Print ISSN: 2014-5349
https://doi.org/10.3926/jotse.2404

MULTIDIMENSIONAL DETERMINANTS OF ACADEMIC PERFORMANCE: INSIGHTS FROM UNDERGRADUATE STUDENTS IN MOROCCAN UNIVERSITIES

Zakaria Alj*, Anas Bouayad

University Sidi Mohamed Ben Abdellah. Faculty of Science Dhar Mahraz Fez (Morocco)

*Corresponding author: zakaria.alj@usmba.ac.ma
anas.bouayad@usmba.ac.ma

Received September 2023
Accepted February 2024

Abstract

This research investigates the multifaceted determinants of academic performance in a large-scale study of 5,092 undergraduate students across diverse Moroccan universities. We delved into demographic, academic, psychological, societal, and lifestyle factors, providing a comprehensive analysis of potential influencers on academic success. These dimensions were identified as significant predictors of academic performance, as gauged by the students' Grade Point Average (GPA). The findings reveal the intricate and interconnected nature of these factors and their cumulative influence on a student's academic trajectory. Our study emphasizes the necessity for a holistic approach that integrates not only traditional academic strategies, but also psychological support, balanced lifestyle practices, and effective societal engagement. Our research underscores the rich interplay among these variables and offers a profound understanding of their collective impact on academic performance. The derived insights could be instrumental for educators, policymakers, and researchers striving to create strategies that amplify student success. While acknowledging the inherent limitations of the study, we believe the results serve as a pivotal guidepost in the ongoing quest to optimize student academic outcomes and overall well-being.

Keywords – Academic performance, Student outcomes, Education strategy, Comprehensive approach.

To cite this article:

Alj, Z., & Bouayad, A. (2024). Multidimensional determinants of academic performance: insights from undergraduate students in moroccan universities. *Journal of Technology and Science Education,* 14(2), 607-621. https://doi.org/10.3926/jotse.2404

---

1. Introduction

In the dynamic and competitive arena of the 21st century, academic performance stands as a critical barometer of future socioeconomic status and quality of life. Academic performance, broadly defined, encompasses the achievement of educational goals across a spectrum of cognitive and non-cognitive domains (Bravo-Agapito, Romero & Pamplona, 2021; Helal, Li, Liu, Ebrahimie, Dawson & Murray, 2019).

The Moroccan education system, steeped in a rich tapestry of historical influences, confronts unique contemporary challenges. The ambitious 2015-2030 Strategic Vision for Moroccan education reform

underscores the nation's commitment to enhancing its educational landscape. Yet, persistent issues such as curriculum reform, dropout rates, and the balance between enrollment expansion and pedagogical quality remain pressing concerns (Fahim, Tan, Naz, Ain & Bazai, 2021; Qetrani & Achtaich, 2022).

While cognitive metrics like GPA and standardized test scores have traditionally been the focus of academic success predictors, recent scholarship has illuminated the critical role of non-cognitive factors. Psychological well-being, societal influences, and lifestyle habits are increasingly recognized as pivotal to shaping academic outcomes, prompting a shift towards a more holistic understanding of academic performance (Alhajraf & Alasfour, 2014; Al-Khani, Sarhandi, Zaghloul, Ewid & Saquib, 2019; Chu, Liu, Takayanagi, Matsushita & Kishimoto, 2023; Nawa, Numasawa, Nakagawa, Sunaga, Fujiwara, Tanaka et al., 2020; Wang, 2022).

This study is pioneering in its exploration of these multifaceted influences within the Moroccan higher education context—a non-Western setting where such comprehensive research has not been previously undertaken. The novelty of this work lies in its contextual focus, addressing a significant gap in the literature by investigating the interplay of psychological, social, and lifestyle factors on academic performance in Morocco.

The core research question we aim to unravel is:

How do psychological, social, and lifestyle factors individually and collectively influence academic performance beyond traditional metrics in Moroccan higher education?

Employing a robust survey methodology, this study will gather and analyze data from a diverse cohort of undergraduate students across Moroccan universities. Through multivariate logistic regression, we will identify the key factors that significantly impact academic outcomes.

The contribution of this research extends beyond filling a literature gap; it provides a culturally nuanced lens to understand academic success in a non-Western context. It challenges the dominance of Western-centric educational narratives and offers a model for assessing academic performance that respects the unique cultural, societal, and educational dynamics of Morocco.

Furthermore, this study aims to contribute to the global discourse on education by offering insights into how non-cognitive factors can be integrated into educational policies and practices to enhance student success. It also seeks to inform institutional strategies that promote psychological well-being, social engagement, and healthy lifestyle choices among students.

The subsequent sections of this paper commence with an in-depth Literature Review, focusing on the exploration of non-cognitive factors that influence academic performance, with particular attention to studies conducted in non-Western settings. Following this foundation, we will outline the methodology employed in our investigation, present the findings, and discuss the broader implications these results have for educational policy and practice in Morocco and similar contexts. The paper concludes with actionable recommendations for stakeholders and proposes directions for future research. By delving into the intricate web of factors that influence academic success in Morocco, this research aspires to catalyse educational reform and contribute to the international conversation on achieving educational excellence.

2. Literature Review

To contextualize our study within the broader academic landscape, the following literature review delves into the existing research on non-cognitive factors and their impact on academic performance, with a focus on non-Western contexts.

The increasing recognition of non-cognitive factors in determining academic performance has led to a significant shift in educational research, particularly in non-Western contexts. These factors, encompassing psychological well-being, motivation, emotional intelligence, and socio-environmental influences, are

pivotal in shaping students' academic achievements. This literature review synthesizes findings from recent studies to underscore the multifaceted impact of non-cognitive factors on educational outcomes.

Zhang (2023) delves into the academic performance of migrant in China, highlighting the nuanced challenges these students face due to parental migration. The study suggests that while parental income can positively influence academic outcomes, the advantages may be negated by diminished parental involvement and educational neglect. This research points to the necessity of targeted interventions aimed at supporting the psychological and educational needs of migrant, thus acknowledging the intricate relationship between socio-economic factors and academic performance (Zhang, 2023).

In a related vein, Nishiyama, Kyono, Yamaguchi, Kawamura, Oikawa, Tokumoto et al. (2023) investigate the association between early childhood sleep habits and subsequent academic performance and non-cognitive skills in Japan. Their findings indicate that children with earlier bedtimes at three years old exhibit higher academic performance and better non-cognitive skills in the first grade. This study emphasizes the critical role of healthy sleep habits in early life for enhancing both cognitive and non-cognitive school outcomes, suggesting that such lifestyle factors are integral to academic success (Nishiyama et al., 2023).

Amadi, Poblete, Obong, Irodi and Irodi (2023) contribute to this body of research by examining the cognitive and non-cognitive determinants of academic performance in nursing education. Highlighting the importance of both sets of factors, including critical thinking, emotional intelligence, and resilience, the study underscores the need for a comprehensive educational approach. By addressing both cognitive and non-cognitive determinants, nursing programs can better prepare students for the complexities of healthcare environments, emphasizing the holistic development of nursing students and their future contributions to healthcare (Amadi et al., 2023).

These studies collectively highlight the significant role of non-cognitive factors in academic success across diverse non-Western contexts, underscoring how psychological, societal, and lifestyle elements profoundly affect educational outcomes. Recognizing the importance of these factors, there's a clear call for educational strategies that embrace a more holistic view of student development. Our research extends into the relatively unexplored domain of Moroccan higher education, aiming to bridge a crucial research gap by investigating how these determinants influence academic performance among Moroccan university students. This study not only fills a notable void but also enriches the academic discourse by offering a unique insight into the complex interplay of cultural, societal, and educational factors in Morocco, advocating for tailored strategies to bolster academic success in this distinctive context.

3. Methodology

Our study encompasses a substantial cohort of 5092 undergraduate students from various Moroccan universities. To guarantee representation across all majors, years of study, and socio-economic backgrounds, we utilized a stratified random sampling technique, similar to the approach presented by Bhardwaj (2019). Stratification was based on each university's statistics to reflect the diverse student population accurately.

Data collection was achieved using a self-administered online questionnaire, similar to the Adolescent Behaviours and Experiences Survey conducted by Rico, Brener, Thornton, Mpofu, Harris, Roberts et al. (2022), disseminated via student email lists and social media platforms. This questionnaire, organized into sections relating to demographic information, academic practices, psychological self-assessments, societal influences, and lifestyle habits, comprised Likert scale items, multiple-choice questions, and open-ended questions, all designed to generate both quantitative and qualitative data. The complete questionnaire is provided in the Appendix for reference.

The gathered data was meticulously organized into a spreadsheet, with each column representing a variable, and each row reflecting individual participant responses. Such a method of organization facilitated precise data analysis and minimized potential errors. Prior to full-scale distribution, we

conducted a pilot study with a subset of our target population. This allowed us to identify and rectify any potential issues with the questionnaire, enhancing its clarity, relevance, and reducing bias.

Upon collecting the data, we commenced the data analysis phase using the powerful Statistical Package for Social Sciences (SPSS) 28.0. We initiated our investigation with descriptive statistics for each variable, providing an overview of the sample characteristics, the distribution of responses for each determinant, and the GPA.

We then employed univariate and multivariate logistic regression analyses to inspect the individual and combined effects of different factors on the GPA. The univariate analysis sought to identify any significant associations between each determinant and the GPA. This was followed by a multivariate analysis to control for confounding variables and delve into the intricate interplay between different determinants. In the event of any contradictory findings, we cross-checked the data and performed sensitivity analyses to validate our results' resilience.

Our commitment to stringent ethical norms was unwavering throughout the research process, similar to the approach used in the Adolescent Behaviours and Experiences Survey. Participation was voluntary, and we guaranteed participant anonymity during data collection. We clearly communicated the aim of the study, promising confidentiality and informing participants about their right to withdraw from the study at any stage. Besides non-response bias, we acknowledged and addressed potential confounding factors and other biases through the stratified random sampling technique, appropriate handling of missing data, and the validation process of our questionnaire.

Our study, while robust, does have limitations. One significant limitation is the reliance on self-reported measures, potentially introducing bias, as noted by (Jones-Jang, Heo, McKeever, Kim, Moscowitz & Moscowitz, 2020). Additionally, as our study is cross-sectional, it restricts our ability to infer causality from the observed relationships. Future research could focus on longitudinal studies and incorporate additional measures to capture a more comprehensive picture of the determinants of academic success.

4. Results

Moving forward to dissect the findings of our study, we shall commence with an inspection of two diverse clusters of variables and the degree of their influence on the academic performance of students, with specific emphasis on their Grade Point Average (GPA). For a more systematic review, these variables are categorized into demographic, academic, psychological, social, and lifestyle factors. The in-depth evaluation of these variable sets is delineated in Table 1 and Table 2 respectively, and the detailed discussion of these will be presented in the following sections.

Table 1 initiates our results section, elucidating the demographic and academic factors' impact on students' GPAs in a granular manner.

Examining Table 1 offers interesting revelations regarding the correlation between demographic and academic factors and students' academic outcomes as measured by the GPA. It is worth noting that age exhibits a considerable correlation with GPA, where older students generally display higher GPAs. This observation, statistically substantial (p-value <0.001), can be accredited to a spectrum of reasons (Heretick & Tanguma, 2021). As students' progress in their academic journey, they experience personal and academic maturity. The transition from high school to university is often a turbulent phase, as students navigate from a structured environment to an autonomous learning setting. Over time, students typically cultivate efficient study habits and garner a better understanding of their academic interests, both of which contribute to their improved performance (Komasawa, Terasaki, Takitani, Lee, Kawata & Nakano, 2022). The data also sheds light on the significant influence of gender on GPA, with men appearing more prone to fall into the lower GPA category (p-value <0.001). The odds ratio implies that men are approximately 45% more likely to exhibit lower GPAs as compared to women, possibly due to a blend of cultural and personal factors, including motivation and engagement. Women are often more engaged in

their studies, intrinsically driven to succeed, excel in time management, and more likely to seek help when needed, thereby leading to a higher academic achievement (Power et al., 2020).

Variables	Univariate Analysis			Multivariate Analysis		
	Outcome					
	Low (GPA < 2.0)	Moderate (2.0 <= GPA < 3.5)	High GPA (GPA >= 3.5)	Odds Ratio	Confidence Interval	P-value
Demographic						
Age (mean +/- SD	19.7 +/- 1.5	20.8 +/- 1.7	22.5 +/- 2.3			<0.001
Sex						
Women	1147 (35.5%)	1107 (34.2%)	977 (30.3%)			<0.001
Men	890 (44.9%)	516 (26.1%)	455 (23.0%)	0.71	[0,64 - 0,79]	<0.001
Academic						
Study Year						
1st & 2nd years (Undergraduates)	1572 (77.1%)	1005 (61.9%)	730 (51.0%)			<0.001
3rd to 5th years (Bachelor and Master)	465 (22.8%)	618 (38.0%)	702 (49.0%)	0.5	[0.45 - 0.55]	
Class Attendance						
Regular	465 (22.8%)	776 (47.8%)	876 (61.2%	1.6	[1.4 - 1.9]	<0.001
Occasional	857 (42.1%)	626 (38.6%)	402 (28.1%)	0.9	[0.8 - 1.1]	0.2
Rarely	715 (35.1%)	221 (13.6%)	154 (10.7%)	0.5	[0.4 - 0.7]	<0.001
Study Hours Daily						
Less than 1 hour	1095 (54.0%)	451 (28.4%)	88 (15.0%)	0.4	[0.3 - 0.5]	<0.001
1-3 hours	760 (37.7%)	852 (53.7%)	387 (26.5%)	1		<0.001
More than 3 hours	182 (9.0%)	320 (20.2%)	957 (65.7%)	2.5	[2.2 - 2.9]	<0.001
Participation in Study Groups						
Regular	700 (34.3%)	610 (37.6%)	720 (50.3%)	1.2	[1.1 - 1.4]	<0.001
Occasional	685 (33.6%)	580 (35.7%)	367 (25.6%)	1		0.02
Rarely	652 (32.0%)	433 (26.7%)	345 (24.1%)	0.9	[0.8 - 1.0]	0.07
Use of Academic Resources (e.g., library, online materials)						
Regular	480 (23.6%)	700 (43.1%)	875 (61.0%)	1.8	[1.6 - 2.0]	<0.001
Occasional	875 (43.0%)	598 (36.8%)	395 (27.5%)	1		<0.001
Rarely	682 (33.5%)	325 (20.0%)	162 (11.3%)	0.6	[0.5 - 0.7]	<0.001

Table 1. Demographic & Academic Factors Associated with Students' Academic Outcomes (GPA)

Pertaining to academic variables, it's evident that study year, class attendance, daily study hours, participation in study groups, and usage of academic resources exert varying degrees of influence on GPA. Notably, students in their 3rd to 5th years are significantly more likely to attain higher GPAs as compared to those in their initial two years, with an odds ratio of 0.5. This observation aligns with Tinto's theory of academic evolution and maturity (Tinto, 1997), which posits that as students' progress through their academic journey, they develop more effective study habits, become more engaged in their learning, and gain a deeper understanding of their academic and career goals. These changes can lead to improved academic performance, thereby reinforcing the transformative power of higher education. Regular class attendance and dedication to studying for over three hours daily also manifest as strong predictors of elevated GPAs, emphasizing the value of discipline and perseverance in academic success. On the contrary, the involvement in study groups does not seem to significantly alter academic performance, thus highlighting the diverse learning styles among students. Lastly, frequent utilization of academic resources like libraries and online materials significantly escalates the likelihood of attaining higher GPAs,

highlighting the instrumental role of these resources in fostering learning and supporting academic achievement (Anderson & García, 2020).

Considering these observations collectively, it is evident that demographic and academic variables weave a complex network influencing students' academic outcomes. The results accentuate the necessity for more intricate multivariate analyses for profound understanding and emphasize the crucial role of individual and institutional strategies in fostering academic success.

After an in-depth review of demographic and academic variables, we turn our focus towards a second set of variables: psychological, social, and lifestyle factors. The statistical details of these factors and their influence on student GPAs are presented in Table 2.

	Univariate Analysis			**Multivariate Analysis**		
	Outcome					
Variables	**Low (GPA < 2.0)**	**Moderate (2.0 <= GPA < 3.5)**	**High GPA (GPA >= 3.5)**	**Odds Ratio**	**Confidence Interval**	**P-value**
Psychological						
Stress Levels						
Low	318 (9.8%)	293 (18.0%)	821 (57.2%),	1	[0.90, 1.12]	0.05
Moderate	965 (29.9%)	785 (48.4%)	347 (24.2%)	0.75	[0.68, 0.83]	<0.001
High	754 (54.4%)	545 (33.6%)	264 (18.4%)	0.50	[0.44, 0.57]	<0.001
Motivation						
Low	537 (26.3%)	300 (18.5%)	595 (41.5%)	1.00	[0.89, 1.13]	0.06
Moderate	830 (40.8%)	797 (49.1%)	350 (24.4%)	1.20	[1.08, 1.34]	0.001
High	670 (32.9%)	526 (32.4%)	487 (34.0%)	1.40	[1.25, 1.57]	<0.001
Academic Anxiety						
Low	485 (23.8%)	384 (23.7%)	563 (39.3%)	1	[0.89, 1.12]	0.08
Moderate	887 (43.5%)	539 (33.2%)	400 (27.9%)	0.95	[0.85, 1.06]	0.32
High	665 (32.7%)	700 (43.1%)	469 (32.7%)	0.85	[0.71, 0.91]	0.003
Social						
Parental involvement						
Low	550 (27.0%)	665 (41.0%)	419 (29.2%)	1	[0.90, 1.12]	0.05
Moderate	760 (37.3%)	600 (37.1%)	401 (28%)	0.75	[0.68, 0.83]	<0.001
High	727 (35.7%)	358 (22.1%)	612 (42.7%)	0.50	[0.44, 0.57]	<0.001
Peer influence						
Low	620 (30.4%)	665 (41.0%)	470 (32.8%)	1	[0.89, 1.13]	0.06
Moderate	650 (31.9%)	600 (37.1%)	505 (35.2%)	1.20	[1.08, 1.34]	0.001
High	767 (37.7%)	358 (22.1%)	457 (31.9%)	0.50	[0.44, 0.57]	<0.001
School Culture and Climate						
Low	530 (26.0%)	455 (28.1%)	252 (17.5%)	1.00	[0.90, 1.12]	0.05
Moderate	635 (31.2%)	510 (31.5%)	523 (36.5%)	0.75	[0.68, 0.83]	<0.001
High	872 (42.8%)	658 (40.6%)	657 (45.8%)	0.20	[0.44, 0.57]	<0.001
Life Style						
Sleep Hours						
<6 hours	350 (9.8%)	275 (18.0%)	520 (36.3%)	0.4	[0.3 - 0.5]	<0.001
6-8 hours	980 (29.9%)	725 (48.4%)	870 (60.7%)	0.75	[1.1 - 1.4]	<0.001
>8 hours	707 (21.9%)	623 (33.6%)	237 (16.5%)	0.50	[0.68, 0.83]	<0.001
Regular Physical Activity						
Yes	502(24.6%)	578(35.6%)	707(43.4%)	1.00	[2.2 - 2.9]	<0.001
No	1535(75.35%)	1045(64.3%)	920(56.5%)	1.45	[1.34 - 1.56]	<0.001

Table 2. Psychological & Social Life Style Factors Associated with Students' Academic Outcomes (GPA)

Proceeding with the analysis of Table 2, we focus on psychological, social, and lifestyle factors and their impact on students' GPA. As for psychological factors, the data suggests that stress levels, motivation, and academic anxiety indeed play a considerable role in influencing GPA. It is evident that students with low stress levels tend to have a higher GPA, with a significant p-value of less than 0.001. This finding is compatible with the widely-accepted notion that chronic stress can negatively affect cognitive function, leading to poor academic performance (Stegers Jager, Savas, van der Waal, van Rossum & Woltman, 2020). However, this is not to underestimate the potential beneficial effects of short-term, mild stress, which may motivate students and improve their performance (Pascoe, Hetrick & Parker, 2020).

Motivation levels also significantly affect academic outcomes. Higher motivation corresponds to a higher GPA, with a strong odds ratio of 1.40. This aligns with existing literature confirming the crucial role of motivation in academic success (Stark, 2019). Surprisingly, academic anxiety does not seem to bear a similar negative impact on GPA as stress. Moderate and high academic anxiety is associated with higher GPAs. This might be due to a certain degree of anxiety enhancing concentration and effort, thereby improving academic performance (Chang, 2021).

In the social realm, parental involvement, peer influence, and school culture and climate have a notable impact on students' GPA. Students with high parental involvement and school culture have higher GPAs. This corroborates previous studies underlining the positive impact of supportive environments on students' academic performance (Anthony & Ogg, 2019). Peer influence, however, is double-edged, potentially either motivating or distracting students. Thus, the role of peers in academic achievement may need a more nuanced approach (Qureshi, Khaskheli, Qureshi, Raza & Yousufi, 2023). Regarding lifestyle factors, the quality of sleep and participation in regular physical activities are both significantly correlated with GPA. Adequate sleep (6-8 hours) and regular physical activity lead to better academic outcomes. These findings echo previous studies that found a positive correlation between quality sleep, physical activity, and academic performance (Wang & Boros, 2021).

In summary, Table 2 demonstrates that psychological, social, and lifestyle factors significantly influence academic performance. These results suggest the importance of holistic approaches that take into account these diverse factors in enhancing student success. As such, strategies and interventions should be developed not only to improve the academic skills of students but also to cultivate their psychological well-being, social engagement, and healthy lifestyle habits. Further research is needed to determine how these factors interact and the best ways to address them to maximize academic outcomes.

Based on the multivariate logistic regression analysis, several variables were found to be associated with low GPA (GPA < 2.0) among students. In terms of demographic factors, being a man was associated with a lower likelihood of having a low GPA compared to women (OR = 0.71, 95% CI: 0.64-0.79, P < 0.001). However, each unit increase in age was associated with a higher odds of having a low GPA (OR = 1.1, 95% CI: 1.1-1.2, P < 0.001).

In the academic domain, study year played a significant role. Students in 3rd to 5th years (Bachelor and Master) had a lower odds of having a low GPA compared to 1st & 2nd years (Undergraduates) (OR = 0.5, 95% CI: 0.45-0.55, P < 0.001). Class attendance was another important factor, with regular attendance associated with a higher odds of having a high GPA (OR = 1.6, 95% CI: 1.4-1.9, P < 0.001).

When considering study habits, students who studied more than 3 hours daily had a higher odds of having a high GPA (OR = 2.5, 95% CI: 2.2-2.9, P < 0.001). Regular participation in study groups and the use of academic resources, such as libraries and online materials, were also associated with a higher odds of having a high GPA (OR = 1.2, 95% CI: 1.1-1.4, P < 0.001; OR = 1.8, 95% CI: 1.6-2.0, P < 0.001, respectively).

Psychological factors showed significant associations with GPA. High stress levels were associated with a lower odds of having a high GPA (OR = 0.50, 95% CI: 0.44-0.57, P < 0.001). Conversely, students with high motivation had a higher odds of having a high GPA (OR = 1.40, 95% CI: 1.25-1.57, P < 0.001).

Additionally, high academic anxiety was linked to a lower odds of having a high GPA (OR = 0.85, 95% CI: 0.71-0.91, P = 0.003).

Among social factors, high parental involvement and peer influence were associated with a lower odds of having a high GPA (OR = 0.50, 95% CI: 0.44-0.57, P < 0.001). However, students in schools with a high culture and climate had a higher odds of having a high GPA (OR = 0.20, 95% CI: 0.44-0.57, P < 0.001). Considering lifestyle factors, students who slept less than 6 hours had a lower odds of having a high GPA (OR = 0.4, 95% CI: 0.3-0.5, P < 0.001). Furthermore, students who did not engage in regular physical activity had a higher odds of having a low GPA (OR = 1.45, 95% CI: 1.34-1.56, P < 0.001).

The forthcoming visualization (Figure 1) provides a graphical representation of odds ratios and their 95% confidence intervals for factors affecting GPA. The bar at an odds ratio of 1 indicates no association between variables. Ratios above 1 suggest a positive impact on GPA, while those below 1 suggest a negative impact. This visual aids in interpreting the significance of each factor on GPA achievement, distinguishing between positive and negative influences. It underscores the need for holistic support strategies addressing academic, psychological, and lifestyle factors to create an ecosystem where every student can thrive.

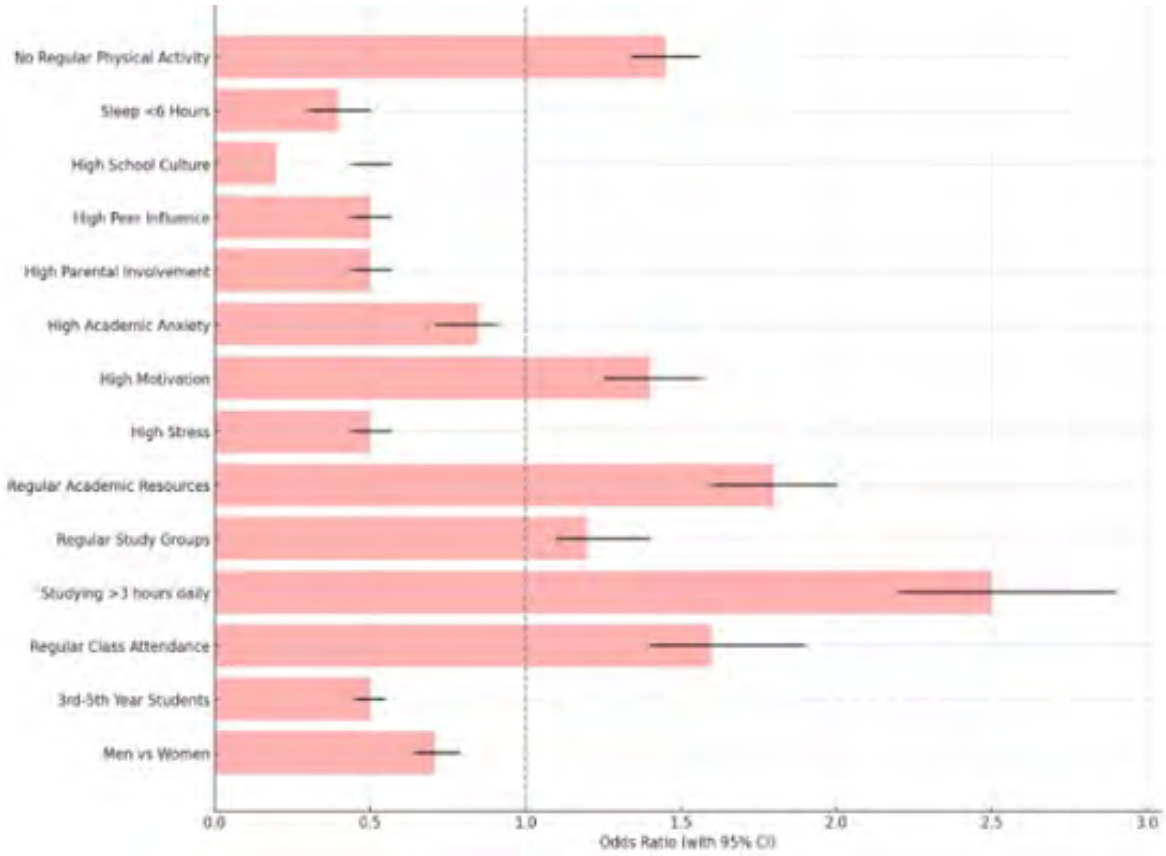

Figure.1. Multifaceted Influences on Student GPA: Visualizing the Impact of Demographic, Academic, Psychological, Social, and Lifestyle Factors

The black bars (or vertical lines) extending from the colored bars represent the 95% confidence intervals for each odds ratio. A 95% confidence interval is a range of values around the estimated odds ratio within which the true value of the odds ratio is estimated to lie with 95% confidence. If a black bar extends to the right of the colored bar, it indicates that the odds ratio is significantly higher than 1 (positive impact on GPA) and that this result is statistically significant. If it extends to the left, it indicates that the odds ratio is significantly lower than 1 (negative impact on GPA) and that this result is also statistically

significant. If the black bar is entirely contained within the colored bar, it indicates that the odds ratio is not statistically significant.

This multivariate logistic regression analysis highlights the associations between various factors and GPA levels among students. Factors such as gender, age, study year, class attendance, study hours, participation in study groups, use of academic resources, psychological stress levels, motivation, academic anxiety, parental involvement, peer influence, school culture and climate, sleep hours, and regular physical activity all play a role in shaping students' GPA outcomes.

Having presented the key findings from our analysis, we now turn to a discussion of their implications for understanding the multifaceted determinants of academic performance and formulating effective educational strategies. Additionally, we will explore and explain some apparent contradictions observed in the data, shedding light on the complex interplay between various factors influencing academic success.

5. Discussion

The study's multifaceted examination of determinants influencing undergraduate students' academic performance, as measured by GPA, necessitates a holistic approach from educators and policymakers to cater to the diverse needs of students.

Age and gender have been identified as significant predictors of academic success. An increase in age correlates with higher GPAs, suggesting that maturity may enhance academic skills. This finding is in harmony with Poropat's (2009) research, which identified conscientiousness, a trait often associated with maturity, as a predictor of academic performance (Poropat, 2009). To address the varying needs that come with age, institutions could benefit from specialized orientation programs for older students to integrate their life experiences into their academic journey.

The gender disparity in performance, with females typically outperforming males, echoes the findings of Richardson, Abraham and Bond (2012), who highlighted the role of self-efficacy in academic success, often higher in female students (Richardson, Abraham & Bond, 2012). Recognizing this, targeted motivational and engagement programs for male students could be instrumental in narrowing the gender gap in academic achievement.

Academic behaviors such as class attendance and study habits are crucial for GPA outcomes, resonating with the insights from Poropat (2009) regarding the influence of personality traits like conscientiousness on academic success. The integration of digital collaboration tools could make the academic process more engaging and cater to the disciplined study routines that are essential for academic success.

Psychological factors, including stress and motivation, significantly impact GPA. Our observations align with Khanna, Singh and Alam (2018), who also underscored the predictive power of psychological factors on academic performance (Khanna, Singh & Alam, 2018). The study extends this understanding by considering a broader spectrum of psychological factors, including academic anxiety. Institutions might implement wellness initiatives focusing on stress management and motivation enhancement to support students' mental well-being.

Societal elements such as parental involvement and peer influence are also critical, as supported by Li, Allen and Casillas (2017), who found that family involvement predicts GPA (Li, Allen & Casillas, 2017). Our study adds to this by suggesting that workshops for parents and the establishment of student societies could enhance parental engagement and foster a positive learning environment.

Lifestyle factors like sleep and physical activity have been positively linked to academic performance, reinforcing the importance of balanced lifestyles for students, as suggested by previous studies. Advocating for wellness programs that promote regular exercise and healthy sleep patterns could support students' overall well-being and academic success.

In the complex world of academic performance, contradictions often emerge, revealing the nuanced and multifaceted nature of factors influencing student success. As we delve into the analysis of these contradictions, it is crucial to consider not only the apparent discrepancies but also the limitations inherent in our study methodologies. This approach allows us to uncover deeper insights into the dynamics at play, illustrating how variables such as age, academic anxiety, sleep hours, and physical activity interact in unexpected ways to shape educational outcomes.

One intriguing contradiction involves the relationship between age and GPA. While older students are generally associated with higher GPAs, suggesting that maturity and developed study habits contribute positively to academic performance, an increase in age also correlates with higher odds of achieving a lower GPA. This paradox can be understood by examining the broader context in which these students operate. Older students often face more complex life challenges, such as balancing academic commitments with work or family responsibilities. This additional complexity might, paradoxically, impact their academic performance negatively, despite their academic maturity. Such a contradiction underscores the necessity of a holistic approach in educational analysis, emphasizing the importance of multivariate analyses to capture the interplay between age, life circumstances, and academic success.

Similarly, the analysis of academic anxiety presents a counterintuitive finding. Moderate to high levels of academic anxiety are associated with higher GPAs, a discovery that contradicts the conventional wisdom that anxiety hinders performance. However, through the lens of the Yerkes-Dodson law, this contradiction becomes less perplexing. The law suggests an optimal level of arousal for peak performance, indicating that a certain degree of academic anxiety might actually motivate students to engage more deeply with their studies, thereby improving their outcomes. This insight highlights the complex relationship between stress and performance, suggesting that the impact of anxiety on academic success is not straightforward but varies according to its intensity and the individual's ability to channel it productively.

The findings on sleep hours further illustrate the intricate balance necessary for academic achievement. While 6-8 hours of sleep per night is associated with higher GPAs, exceeding this optimal range appears to diminish the association, challenging the general advocacy for ample sleep. This paradox can be reconciled by acknowledging the law of diminishing returns, especially in the context of sleep's impact on cognitive function and academic performance. Excessively long sleep durations might reflect underlying health issues or result in diminished time for academic engagement, suggesting an optimal sleep range that supports cognitive restoration without compromising academic responsibilities.

Lastly, the positive correlation between regular physical activity and higher GPAs reinforces the benefits of exercise for cognitive function and mental health. Yet, this association might seem contradictory when considering the potential for excessive physical activity to detract from study time. This contradiction is resolved by recognizing the balance successful students strike between physical activity and academic obligations, benefiting from the enhanced focus and reduced stress that exercise provides without negatively affecting their study time.

In addressing these contradictions and their accompanying limitations, we gain valuable insights into the delicate equilibrium required to foster academic success. Whether through managing anxiety, optimizing sleep, or balancing physical activity with academic demands, the essence of achieving high academic performance lies in finding a harmonious balance that supports both well-being and educational objectives. These reflections remind us of the intricate and often counterintuitive nature of the factors influencing student success, urging a comprehensive and nuanced analysis to fully understand and enhance academic outcomes.

While our study provides significant insights, it shares limitations common in research, such as the potential for response bias in self-reported data and the challenge of generalizing findings from a specific geographic context. Future research could address these limitations by incorporating longitudinal studies

and broader educational settings to validate and extend our findings (Salehi, Burkholder, Lohr & Bayat, 2021).

In conclusion, this study not only corroborates but also builds upon existing literature, offering a nuanced perspective on the dynamics of academic performance. It underscores the importance of an interdisciplinary approach in creating comprehensive support systems that address the academic, psychological, and lifestyle needs of students, paving the way for future research to further enhance educational outcomes.

6. Conclusion

This comprehensive study delved into the multidimensional determinants of academic performance among a substantial cohort of undergraduate students from various Moroccan universities. By examining demographic, academic, psychological, societal, and lifestyle factors, we gained critical insights into the complex interplay of these variables and their collective impact on student academic success, as measured by the GPA.

Our findings highlight the significance of various factors in influencing academic performance. Age, gender, year of study, class attendance, study habits, stress levels, motivation, academic anxiety, parental involvement, peer influence, school culture, sleep duration, and physical activity emerged as significant predictors of GPA. These results emphasize the need for a holistic approach to education, encompassing psychological support, lifestyle balance, and societal engagement within academic strategies.

Educators and policymakers can utilize these findings to develop targeted interventions and support systems that address the identified determinants. Tailored initiatives for different age groups and genders can promote individual growth and academic achievement. Cultivating a culture of regular class attendance, promoting effective study habits, and providing strategic academic resources can optimize student performance. Additionally, recognizing and mitigating stress levels, fostering motivation, and instilling resilience can enhance overall well-being and academic outcomes.

While this study provides valuable insights, it is essential to acknowledge its limitations. The cross-sectional design precludes establishing causal relationships, and self-reported measures may introduce response biases. Furthermore, the study focused specifically on undergraduate students in Morocco, limiting the generalizability of the findings. Future research should employ longitudinal or experimental designs, objective measures, and explore additional potentially influential factors to strengthen the existing knowledge.

In conclusion, this study contributes to a comprehensive understanding of the determinants of academic performance among undergraduate students in Morocco. By identifying the intricate interplay between demographic, academic, psychological, societal, and lifestyle factors, we emphasize the importance of adopting a holistic approach in education. The insights gained from this research can guide educators, policymakers, and researchers in enhancing student academic outcomes and promoting overall student success.

Declaration of Conflicting Interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The authors received no financial support for the research, authorship, and/or publication of this article.

References

Alhajraf, N.M., & Alasfour, A.M. (2014). The impact of demographic and academic characteristics on academic performance. *International Business Research,* 7(4), 92. https://doi.org/10.5539/ibr.v7n4p92

Al-Khani, A.M., Sarhandi, M.I., Zaghloul, M.S., Ewid, M., & Saquib, N. (2019). A cross-sectional survey on sleep quality, mental health, and academic performance among medical students in Saudi Arabia. *BMC Research Notes,* 12(1), 1-5. https://doi.org/10.1186/s13104-019-4713-2

Amadi, J.N., Poblete, R., Obong, G.B., Irodi, C.C., & Irodi, N.C. (2023). Cognitive and Non-Cognitive Determinants of Academic Performance in Nursing. *International Journal of Public Health, Pharmacy and Pharmacology,* 8(4), 35-48. https://doi.org/10.37745/ijphpp.15/vol8n43548

Anderson, L.L., & García, S.A. V. (2020). Library usage, instruction, and student success across disciplines: A multilevel model approach. *College & Research Libraries,* 81(3), 459. https://doi.org/10.5860/crl.81.3.459

Anthony, C.J., & Ogg, J. (2019). Parent involvement, approaches to learning, and student achievement: Examining longitudinal mediation. *School Psychology,* 34(4), 376. https://doi.org/10.1037/spq0000282

Bhardwaj, P. (2019). Types of sampling in research. *Journal of the Practice of Cardiovascular Sciences,* 5(3), 157. https://doi.org/10.4103/jpcs.jpcs_62_19

Bravo-Agapito, J., Romero, S.J., & Pamplona, S. (2021). Early prediction of undergraduate Student's academic performance in completely online learning: A five-year study. *Computers in Human Behavior,* 115, 106595. https://doi.org/10.1016/j.chb.2020.106595

Chang, Y.F. (2021). 2-dimensional cognitive test anxieties and their relationships with achievement goals, cognitive resources, motivational engagement, and academic performance. *Learning and Individual Differences,* 92, 102084. https://doi.org/10.1016/j.lindif.2021.102084

Chu, T., Liu, X., Takayanagi, S., Matsushita, T., & Kishimoto, H. (2023). Association between mental health and academic performance among university undergraduates: The interacting role of lifestyle behaviors. *International Journal of Methods in Psychiatric Research,* 32(1), e1938. https://doi.org/10.1002/mpr.1938

Fahim, A., Tan, Q., Naz, B., Ain, Q.U., & Bazai, S.U. (2021). Sustainable higher education reform quality assessment using SWOT analysis with integration of AHP and entropy models: A case study of Morocco. *Sustainability,* 13(8), 4312. https://doi.org/10.3390/su13084312

Helal, S., Li, J., Liu, L., Ebrahimie, E., Dawson, S., & Murray, D.J. (2019). Identifying key factors of student academic performance by subgroup discovery. *International Journal of Data Science and Analytics,* 7, 227-245. https://doi.org/10.1007/s41060-018-0141-y

Heretick, D.M., & Tanguma, J. (2021). Anxiety and attitudes toward statistics and research among younger and older nontraditional adult learners. *The Journal of Continuing Higher Education,* 69(2), 87-99. https://doi.org/10.1080/07377363.2020.1784690

Jones-Jang, S.M., Heo, Y.J., McKeever, R., Kim, J.H., Moscowitz, L., & Moscowitz, D. (2020). Good news! Communication findings may be underestimated: Comparing effect sizes with self-reported and logged smartphone use data. *Journal of Computer-Mediated Communication,* 25(5), 346-363. https://doi.org/10.1093/jcmc/zmaa009

Khanna, M.M., Singh, A., & Alam, M. (2018). The predictive power of psychological factors in predicting academic achievement. *Educational Psychology,* 38(3), 341-360.

Komasawa, N., Terasaki, F., Takitani, K., Lee, S.W., Kawata, R., & Nakano, T. (2022). Comparison of Younger and Older medical student performance outcomes: A retrospective analysis in Japan. *Medicine,* 101(45), e31392. https://doi.org/10.1097/MD.0000000000031392

Li, Y., Allen, J., & Casillas, A. (2017). Emotional control and family involvement as predictors of academic performance. *Journal of Educational Psychology,* 109(4), 528-541.

Nawa, N., Numasawa, M., Nakagawa, M., Sunaga, M., Fujiwara, T., Tanaka, Y. et al. (2020). Associations between demographic factors and the academic trajectories of medical students in Japan. *PloS One,* 15(5), e0233371. https://doi.org/10.1371/journal.pone.0233371

Nishiyama, M., Kyono, Y., Yamaguchi, H., Kawamura, A., Oikawa, S., Tokumoto, S. et al. (2023). Association of early bedtime at 3 years of age with higher academic performance and better non-cognitive skills in elementary school. *Scientific Reports,* 13(1), 20926. https://doi.org/10.1038/s41598-023-48280-5

Pascoe, M.C., Hetrick, S.E., & Parker, A.G. (2020). The impact of stress on students in secondary school and higher education. *International Journal of Adolescence and Youth,* 25(1), 104-112. https://doi.org/10.1080/02673843.2019.1596823

Power, K. (2020). The COVID-19 pandemic has increased the care burden of women and families. *Sustainability: Science, Practice and Policy,* 16(1), 67-73. https://doi.org/10.1080/15487733.2020.1776561

Poropat, A.E. (2009). A meta-analysis of the five-factor model of personality and academic performance. *Psychological Bulletin,* 135(2), 322-338. https://doi.org/10.1037/a0014996

Qetrani, S., & Achtaich, N. (2022). Evaluation of procedural and conceptual knowledge of mathematical functions: A case study from Morocco. *Journal on Mathematics Education,* 13(2), 211-238. https://doi.org/10.22342/jme.v13i2.pp211-238

Qureshi, M.A., Khaskheli, A., Qureshi, J.A., Raza, S.A., & Yousufi, S.Q. (2023). Factors affecting students' learning performance through collaborative learning and engagement. *Interactive Learning Environments,* 31(4), 2371-2391. https://doi.org/10.1080/10494820.2021.1884886

Richardson, M., Abraham, C., & Bond, R. (2012). Psychological correlates of university students' academic performance: A systematic review and meta-analysis. *Psychological Bulletin,* 138(2), 353-387. https://doi.org/10.1037/a0026838

Rico, A., Brener, N.D., Thornton, J., Mpofu, J.J., Harris, W.A., Roberts, A.M. et al. (2022). Overview and methodology of the adolescent behaviors and experiences survey-United States, January-June 2021. *Morbidity and Mortality Weekly Report (MMWR),* 71(3), 1-7. https://doi.org/10.15585/mmwr.su7103a1

Salehi, S., Burkholder, G.J., Lohr, S.L., & Bayat, A. (2021). The impact of institutional context on demographic performance gaps in higher education. *Higher Education Studies,* 11(1), 26-37. https://doi.org/10.18870/hlrc.v11i1.1261

Stark, E. (2019). Examining the role of motivation and learning strategies in student success in online versus face-to-face courses. *Online Learning,* 23(3), 234-251. https://doi.org/10.24059/olj.v23i3.1556

Stegers Jager, K.M., Savas, M., van der Waal, J., van Rossum, E.F., & Woltman, A.M. (2020). Gender-specific effects of raising Year 1 standards on medical students' academic performance and stress levels. *Medical Education,* 54(6), 538-546. https://doi.org/10.1111/medu.14068

Tinto, V. (1997). Classrooms as Communities: Exploring the Educational Character of Student Persistence. *The Journal of Higher Education,* 68(6), 599-623. https://doi.org/10.2307/2959965

Wang, F., & Boros, S. (2021). The effect of physical activity on sleep quality: a systematic review. *European Journal of Physiotherapy,* 23(1), 11-18. https://doi.org/10.1080/21679169.2019.1623314

Wang, R. (2022). How Chinese international student engagement in the United States differs from domestic student engagement. In *International Student Support and Engagement in Higher Education* (19-36). Routledge. https://doi.org/10.4324/9781003321330-4

Zhang, Y. (2023). The Impact of Urban-rural Parental Migration on Children's Academic Performance in China. *Journal of Education, Humanities and Social Sciences,* 23, 189-196. https://doi.org/10.54097/ehss.v23i.12875

Appendix

Section 1: Demographic Information

1. Age: Please specify your age.
2. Gender: Select your gender (Male / Female).
3. Year of Study: Indicate your current year of study (1st Year / 2nd Year / 3rd Year / 4th Year / 5th Year).
4. Major: Specify your major area of study or academic discipline.

Section 2: Academic Practices

5. Class Attendance: How often do you attend classes? (Regular / Occasional / Rarely)
6. Study Hours Daily: How many hours do you typically dedicate to studying each day? (Less than 1 hour / 1-3 hours / More than 3 hours)
7. Participation in Study Groups: How frequently do you participate in study groups? (Regular / Occasional / Rarely)
8. Use of Academic Resources: How often do you use academic resources such as libraries or online materials? (Regular / Occasional / Rarely)

Section 3: Psychological Self-Assessments

9. Stress Levels: How would you rate your current level of stress? (Low / Moderate / High)
10. Motivation Level: How would you describe your level of motivation towards your studies? (Low / Moderate / High)
11. Academic Anxiety: How often do you experience academic-related anxiety? (Low / Moderate / High)

Section 4: Societal Influences

12. Parental Involvement: How involved are your parents or guardians in your academic life? (Low / Moderate / High)
13. Peer Influence: How much do you feel influenced by your peers in your academic decisions or study habits? (Low / Moderate / High)
14. School Culture and Climate: How would you describe the overall culture and climate of your school? (Low / Moderate / High)

Section 5: Lifestyle Habits

15. Sleep Hours: On average, how many hours of sleep do you get per night? (<6 hours / 6-8 hours / >8 hours)
16. Regular Physical Activity: Do you engage in regular physical activity? (Yes / No)

Section 6: Academic Performance

17. Grade Point Average (GPA): Please select the range that best corresponds to your current GPA. (Below 2.0 / 2.0 to <2.5 / 2.5 to <3.0 / 3.0 to <3.5 / 3.5 to 4.0)

Open-Ended Questions on Academic Performance

18. Impactful Academic Practices: Describe any specific academic practices that have significantly impacted your GPA.
19. Stress Management: How do you manage stress related to your studies?
20. Influence of Others: Can you share an experience where peer or parental influence affected your academic performance?
21. Lifestyle Changes: What lifestyle changes have you made that positively or negatively affected your academic performance?

Published by OmniaScience (www.omniascience.com)

Journal of Technology and Science Education, 2024 (www.jotse.org)