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Social networks and sleep quality of university students: analysis of cognitive and emotional variables

Redes sociales y calidad del sueño de los estudiantes universitarios: análisis de variables cognitivas y emocionales

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ABSTRACT

The impact of social media and sleep quality of university students in the academic context is a topic of growing interest in educational research. In this sense, its impact hinders the ability to concentrate on all types of academic tasks, so that the university stage plays a crucial role, being a stage full of new challenges and academic demands that students do not always know how to face. Therefore, the study aimed to know and evaluate the relationship between sleep quality, the use of social media, anxiety and executive functions in higher education students. The methodology used is framed within a quantitative design with an associative, descriptive and comparative strategy with a sample of 586 students from the Faculty of Education and Psychology of the University of Extremadura selected from a non-random, non-probabilistic convenience sampling. The Hamilton Anxiety Rating Scale (HARS) and the Scale for Evaluation of Executive Functions in Everyday Contexts (EFECO) were used as instruments for data collection. The results show positive and significant correlations between the dimensions of the two scales, highlighting the influence of social networks and sleep quality on student performance. In addition, significant differences were found based on sex, academic degree and type of residence. Finally, the conclusion is that there is a significant relationship between anxiety and executive functions, highlighting the importance of addressing sleep quality and academic work through specific interventions that improve university education and the general well-being of students pursuing higher education.

Keywords: anxiety, sleep quality, college students, executive functions, social networks

RESUMEN

El impacto de las redes sociales y la calidad del sueño de los estudiantes universitarios en el contexto académico es un tema de creciente interés en la investigación educativa. En este sentido, su impacto dificulta la capacidad de concentración para todo tipo de tareas académicas, de manera que la etapa universitaria juega un papel crucial, al ser una etapa repleta de nuevos retos y demandas académicas que los estudiantes no siempre saben cómo afrontar. Por ello, el estudio tuvo como objetivo conocer y evaluar la relación existente entre la calidad del sueño, el uso de las redes sociales, la ansiedad y las funciones ejecutivas en el alumnado de educación superior. La metodología empleada se enmarca dentro de un diseño cuantitativo con una estrategia asociativa, descriptiva y comparativa con una muestra de 586 estudiantes de la Facultad de Educación y Psicología de la Universidad de Extremadura seleccionada a partir de un muestreo no probabilístico por conveniencia, no aleatorio. Se utilizó como instrumentos la Hamilton Anxiety Rating Scale (HARS) y la Escala de Evaluación de las Funciones Ejecutivas en Contextos Cotidianos (EFECO) para la recolección de datos. Los resultados muestran correlaciones positivas y significativas entre las dimensiones de las dos escalas, destacando la influencia de las redes sociales y la calidad del sueño sobre el desempeño de los estudiantes. Además, se encontraron diferencias significativas en función del sexo, el grado académico y el tipo de residencia. Finalmente, se concluye con la relación

significativa entre la ansiedad y las funciones ejecutivas, subrayando la importancia de abordar la calidad del sueño y el trabajo académico a partir de intervenciones específicas que mejoren su formación universitaria y el bienestar, en general, de los estudiantes que cursan educación superior.

Palabras clave: ansiedad, calidad del sueño, estudiantes universitarios, funciones ejecutivas, redes sociales

INTRODUCTION

Building upon the findings of Ávila-Toscano et al. (2021), university students face a wide range of challenges and stressors throughout their academic journey. Managing diverse tasks and fulfilling multiple roles can significantly impact both their academic performance and psychological well-being. These stressors often lead to various disruptions —mostly autonomous and specific— that must be understood to grasp the academic consequences face by students (Capuozzo et al., 2024; Merchán-Villafuerte et al., 2024). Among these disruptions, anxiety emerges as a common manifestation in both cognitive and behavioral process (Ávila-Toscano et al., 2021; Toh et al., 2024), along with executive functions, defined as a set of high-level cognitive processes responsible for regulating, controlling, and mediating the brains most complex activities (Robles & Ortiz, 2024).

Anxiety can significantly affect both academic outcomes and students' overall quality of life (González et al., 2022; Kessler et al., 2015). It is often triggered by academic overload, social pressure, lifestyle changes, and uncertainty about the future (Ashshawareb et al., 2024; Martínez et al., 2023). Recent studies show that anxiety has a marked impact on academic performance and students' mental health (López et al., 2023).

Anxiety symptoms are common and may present in various forms, including extreme nervousness, excessive worry about academic activities, difficulty concentrating, and trouble falling or staying asleep (Carrión-Pantoja et al., 2022; Estrada-Araoz et al., 2023; Song et al., 2023). These symptoms may be exacerbated by academic stress, constant pressure to achieve high grades, overwhelming workloads, and uncertainty about prospects (Cancino & Terán-Mendoza, 2023; Goselin & Rickert, 2022). Accordingly, addressing these symptoms is essential, as they can negatively impact both academic functioning and mental health. Students must therefore be provided with appropriate resources and support systems to manage anxiety and enhance their wellbeing during university (Díaz et al., 2022; Ramadhan et al., 2024).

Several studies emphasize the detrimental effects of anxiety on academic performance, highlighting that students with high anxiety levels may experience

memory impairments that negatively affect their test performance (Esquivel-Gámez et al., 2020). According to these authors, elevated anxiety levels reduce executive control before, during, and after assessments, requiring increased cognitive effort to achieve comparable performance. Executive control assessed by examining its three core components: the inhibition of inappropriate responses, the activation of appropriate ones, and the ability to switch rules or strategies.

The relationship between anxiety and executive functions is complex and multifaceted. On the one hand, anxiety can hinder executive functioning by causing distractions and reducing students' ability to focus (Fernández-Romero et al., 2023; Ge et al., 2023). On the other hand, executive functions can serve as regulatory mechanisms for emotional responses (Robles & Ortiz, 2024; Živković et al., 2022).

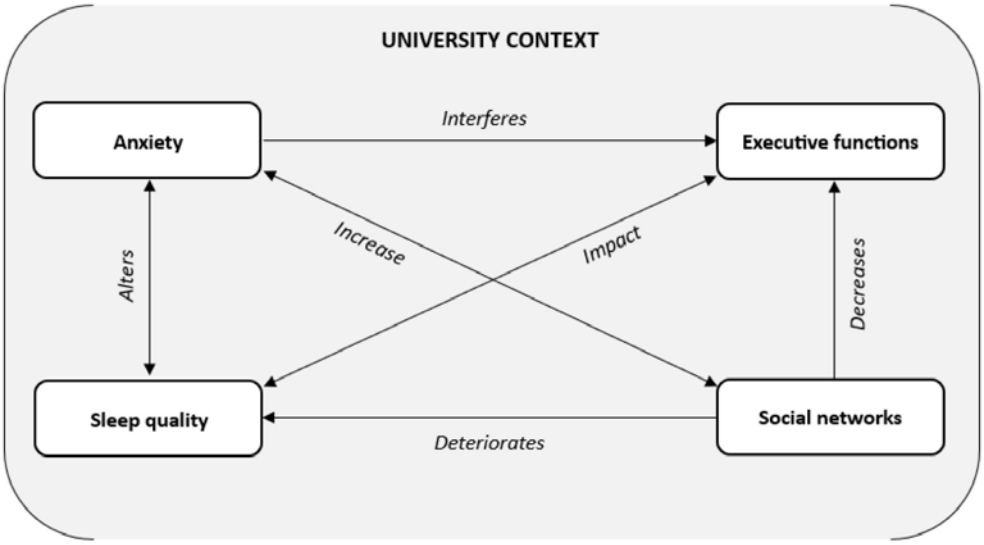
Prior studies have consistently demonstrated a significant association between anxiety symptoms and executive functioning among university students across various disciplines. Elevated anxiety levels have been linked to substantial difficulties in key domains of executive functioning, such as working memory, cognitive flexibility, and inhibitory control (Gutiérrez et al., 2021; Romero et al., 2023; Zhang, 2024). Other research suggests that anxiety can impair theses cognitive domains, thereby reducing students' ability to effectively manage academic tasks and responsibilities (Díaz et al., 2022; Martínez et al., 2023; Robles & Ortiz, 2024). Consequently, anxiety may undermine students' capacity to solve complex problems, reduce cognitive flexibility, and limit their ability to adapts to new situations or generate creative solutions (Garces et al., 2023; Gómez et al., 2023).

Recent literature calls for an integrated approach to studying the link between anxiety and executive functioning in university populations. This includes not only individual analysis of each variable but also an exploration of their interaction and underlying mechanisms. Studies such as García & Pérez (2020) have shown that anxiety can interfere with students' self-regulation and cognitive control, directly affecting executive skills. Similarly, empirical findings indicate that anxiety- related symptoms —such as excessive worry, restlessness, and tension— adversely impact executive functioning (Ge et al., 2023; Wang & Lyu, 2024).

The influence of social media on anxiety and executive functioning in university students has also garnered increasing attention in recent years. Excessive use of theses global digital platforms is associated with heightened anxiety levels (Aryal & Rajbhandari, 2024; Dong, 2024; Yildiz & Cengel, 2023; Zafar & Bin, 2024), detrimental effects on mental health and cognitive abilities (Jie et al., 2024), and impairments in executive functions such as attentional control (Zhu, 2025). In this context, interpersonal sensitivity plays a key mediating role between internet addiction and psychological well-being (Zhu et al., 2024).

Figure 1 shows a theoretical model to determine the relationship between each variable.

Figure 1
Theoretical model that integrates the variables under study



In summary, the theoretical model suggests a bidirectional relationship between sleep quality and executive functions: good sleep quality supports optimal executive functioning, while poor sleep negatively affects attention, working memory, and decision making (Jiménez, 2025). Conversely, a well- functioning executive process may promote healthy sleep habits. Similarly, sleep quality is bi-directionally linked to anxiety, with poor sleep exacerbating anxiety and vice versa (Armas & Saltos, 2024; Comas et al., 2023). Furthermore, social media usage appears to deteriorate sleep quality, particularly when platforms are accessed before bedtime, potentially worsening mental health outcomes (Aldhawyan et al., 2020).

Scientific evidence also indicates that excessive social media use diminishes executive functioning, especially working memory, sustained attention, and concentration (Ali et al., 2024). Moreover, a unidirectional relationship is observed between social media use and anxiety, as excessive or problematic engagement with digital platforms is associated with increased levels of anxiety, depression, and stress among university students (Cortez et al., 2024).

Anxiety and executive functions interact in a mutually disruptive manner: higher anxiety levels are linked to diminished executive performance, especially in planning, decision-marking, organization, and cognitive flexibility (Conner et al., 2024).

Finally, the academic context is identified as a moderating factor that shapes the relationships among all variables, influencing stress levels, sleep habits, social media use, and cognitive demands faced by students (Jiménez, 2025).

Accordingly, this study aimed to: (1) Analyze anxiety levels in university students; (2) Identify potential correlational patterns among social media use, anxiety, and executive functioning; and (3) Determine the impact of sleep quality on both anxiety and executive functioning.

METHOD

Design

Given the nature of the variables under study, this research is situated within the quantitative paradigm, as it addresses the research objectives through inferential data analysis (Ato et al., 2013). In line with this classification, the methodological strategies employed were associative, comparative, and cross- sectional, as the study is non-experimental and aimed at comparing groups and analyzing variable relationships at a single point in time.

Participants

The sampling method used was non-probabilistic based on convenience and non-random selection. The final sample consisted of 586 students enrolled in the Faculty of Education and Psychology at the University of Extremadura (Badajoz, Spain). Of the participants, 79.4% (n=465) were women and 20.6% (n=121) were men, with a mean age of 21 years (M = 20.60 ± 3.29). Specifically, 43.7% (n=256) were pursuing a degree in Primary Education, 22.4% (n= 131) in Early Childhood Education, 24.7% (n=145) in Psychology, and 9.2% (n=54) were enrolled in master's programs associated with the faculty.

Instruments

Initially, an ad hoc questionnaire was designed to gather sociodemographic data, including sex, age, degree program, academic year, and other relevant variables. Sleep quality was assessed using a 6-point item with the following response options: (1) Very good; (2) good; (3) Average; (4) Sometimes I have trouble resting; (5) I sleep poorly; and (6) I have serious difficulty sleeping. For analysis purposes, responses 1,2, and 3 were recoded as "adequate sleep quality" while responses 4,5, and 6

were categorized as "poor sleep quality." The following validated instruments were employed to address the study's main research objectives:

Hamilton Anxiety Rating Scale (HARS)

This self- report tool, originally developed by Hamilton (1959) and later adapted into Spanish by Lobo et al. (2002), consists of 14 items assessing the intensity of anxiety symptoms. Examples of items include (1) "Anxious mood: worries, anticipation of the worst, apprehension, irritability" and (2) "Insomnia: difficulty falling asleep, interrupted or unsatisfying sleep, and tiredness upon waking." Responses are rated on a Likert-type scale ranging from 0 (Never) to 4 (Always). Internal consistency for the present sample reached α = .88. In its original version, the scale demonstrated sound psychometric properties, supporting a two- factor structure (psychological and somatic anxiety). In Lobo et al. (2002) study, internal consistency was also high (α = .89), supporting a one- factor structure.

Executive Function Assessment Scale in Everyday Contexts (EFECO)

Developed by García-Gómez (2015), the EFECO is composed of 67 items evaluating executive functions from an ecological perspective, based on self-reported daily behavior. It includes subscales monitoring (e.g., "I make careless mistakes"), inhibition (e.g., "I act without thinking"), cognitive flexibility (e.g., "I have troubles switching from one task to another"), emotional control (e.g., "I get upset when I lose something"), organization of materials (e.g., "I leave my belongings scattered everywhere"), initiative (e.g., "I have difficulty making even simple decisions"). Working memory (e.g.,) I have trouble following instructions"), and planning (e.g., "I find it hard to plan things"). Items are rated on a 4-point Likert scale from 0 (Never) to 3 (very frequently). In the current study, internal consistency values reached up to α = .61. García-Gómez (2015) reported excellent psychometric properties for the full scale, with an overall reliability coefficient of α = .96.

Procedure

The first step involved selecting the most appropriate instruments to address the study objectives. Afterwards, the final evaluation questionnaire was assembled. A brief description of the study's aims and procedures was included at the beginning of the instrument to ensure informed consent. Ethical approval was obtained from the Bioethics Committee of the University of Extremadura (Approval No.

110/2024). Researchers then contacted faculty members across different degree programs to schedule data collection during class hours, contingent upon receiving consent from instructors and participants. Data collection was conducted in person, with the lead researcher preset to assist participants and ensure compliance with the ethical guidelines outlined in the Declaration of Helsinki (World Medical Association, 2013).

At the time of application, participants were informed that their participation was voluntary and anonymous, by Spain's Organic Law 3/2018, of December 5, on the Protection of Personal Data and Digital Rights. In addition, the purpose of the survey was explained, and it was made clear that the time required to complete it would not exceed 15 minutes. The questionnaire was completed in person, with the principal investigator present at the time of data collection. No students reported difficulties completing the questionnaire, and a 100% response rate was achieved.

Statistical Analysis

Both descriptive and inferential analyses were conducted. Descriptive statistics included percentages, means, and standard deviations. Inferential analyses were conducted using t-test, one way ANOVA, Pearson's r correlations, and $\chi 2$-test. Additionally, two-way multivariate analyses MANOVA and ANCOVA were applied. Statistical analyses were performed using SPSS 29.0 and Jamovi 2.3.28. The significance level was set at .05. However, for analyses involving 10 simultaneous comparisons, a Bonferroni correction was applied to control for Type I error, adjusting the significance threshold to .005.

RESULTS

As we can see in table 1, the sample consisted of n = 586 subjects being 79.4% female and 20.6% male. Their average age was 20.60±3.29. Participants pursued a degree in Elementary Education, Early Childhood Education, Psychology and Master in a rate of 43.7%, 22.4%, 24.7% and 9.2%, respectively. 34% of them were students of first curse, 33.4% of second curse, 23.4% of third or fourth and 9.2% of Master. Just 9.9% of them had a job. 7.8% resided in University Hall, 53.2% in shared apartments and 38.9% with their family. 53.4% and 60.2% of subjects acknowledged social networks abuse and bad sleep quality, respectively. Global scores average in EFECO and Hamilton scales were 140.41±13.83 and 11.66±9.5, respectively. Thus, a positive moderate skew was observed in Hamilton scores, although it didn't imply no linear correlations with other variables. Opposite to this, the eight dimensions of EFECO scale fitted well enough to a normal distribution.

Table 1

Descriptive analysis of sample characteristics and scale scores

		Frequency (%) / Mean±SD
Gender	Female	465 (79.4%)
	Male	121 (20.6%)
Age		20.60±3.29
Academic degree	Elementary Education	256 (43.7%)
	Early Childhood Education	131 (22.4%)
	Psychology	145 (24.7%)
	Master	54 (9.2%)
Academic year	1º	199 (34.0%)
	2º	196 (33.4%)
	3º-4º	137 (23.4%)
	Master	54 (9.2%)
Current job	No	528 (90.1%)
	Yes	58 (9.9%)
Residence	University hall	46 (7.8%)
	Shared apartment	312 (53.2%)
	Family residence	228 (38.9%)
Social networks abuse	No	273 (46.6%)
	Yes	313 (53.4%)
Bad sleep quality	No	233 (39.8%)
	Yes	353 (60.2%)
EFECO	**Total**	**140.41±13.83**
	Monitoring	17.07±3.23
	Inhibition	18.71±3.23
	Cognitive flexibility	13.06±1.97
	Emotional control	15.54±2.78
	Planning	15.92±2.21
	Organization of materials	19.20±1.90
	Initiative	20.53±3.17
	Working memory	20.38±3.00
Hamilton	**Total**	**11.66±9.52**
	Somatic	7.39±5.19
	Psychologic	4.27±4.89

Note. SD: Standard deviation. EFECO: *Scale for the Evaluation of Executive Functions in Everyday Contexts*.

Table 2 displays Pearson correlation coefficients between the EFECO subscales and Hamilton dimensions. Most correlations were positive and most of them are significant, ever under a conservative Bonferroni correction. The "Organization of Materials" dimension showed the weakest and, in some cases, non-significant correlations. The strongest correlation corresponds to Hamilton dimensions.

Table 2

Pearson's coefficient between EFECO and Hamilton's dimension and Pearson's correlation test

	2	3	4	5	6	7	8	9	10
1. Monitoring	.419**	.368**	.438**	.263**	.040	.443**	.581**	.450**	.351**
2. Inhibition		.371**	.384**	.323**	.055	.432**	.378**	.392**	.323**
3. Cognitive flexibility			.293**	.224**	.103*	.380**	.398**	.356**	.268**
4. Emotional control				.309**	.067	.404**	.308**	.503**	.370**
5. Planning					.249**	.302**	.258**	.317**	.263**
6. Organization of materials						.152**	.129**	.073	.035*
7. Initiative							.362**	.425**	.320**
8. Working memory								.365**	.281**
9. Hamilton somatic									.784**
10. Hamilton psychologic									

Note. *$p < .05$; ** $p < .01$

On the other hand, Table 3 shows the results of association study between the rest of socio-demographic variables in terms of p-value. $\chi 2$-test, t-test or one way ANOVA were applied according to the type of variable. Let's point out the most significant results. Gender is related to academic degree since women represent 96.9% of students in Early Childhood Education. Age is correlated with the academic degree since master's students are older and is in the same sense correlated with academic year and current job. Academic degree correlates with academic year and current job because master is considered here as a fifth course. It also correlates with Sleep. Namely, 49.7% of Psychology students found it hard to sleep versus

34.8% of Elementary Education or 33.3% of the masters. Academic degree also correlates with residence since 61.1% of master student lived with their parents versus less than 41% for the grades. This also implies a correlation with Residence and Sleep in the same way. Finally, we observed the association between Residence and Sleep because 63.0% of students in university halls acknowledge bad sleep quality versus 38.8% of those who shared apartment and 36.4% of subjects who lived with their parents.

Table 3
P-values of the association test

	2	3	4	5	6	7	8
1. Gender	.107	**.001**	.617	.489	.346	.160	.154
2. Age		**.001**	**.001**	**.001**	.641	.297	.589
3. Academic degree			**.001**	**.001**	**.001**	.160	**.022**
4. Academic year				.141	**.005**	.084	**.006**
5. Curret job					.396	.575	.266
6. Residence						.805	**.003**
7. Social network abuse							.348
8. Bad sleep quality							

Note. Significant results are indicated in bold.

The next step is crossing both types of variables to analyze whether or not variables in Table 3 influence response in EFECO or Hamilton scale. Due to the high dimension of the problem, hardly significant results were considered as possible type I error. Namely, according to a Bonferroni correction, results $p < .005$ were considered significant. The results in terms of Mean±SD are shown in Tables 4 and 8.

In this sense, Age, Academic year and Current job didn't correlate significantly with any of the ten dimensions. However, gender provided significant results for Monitoring ($t[584] = 3.401$, $p < .001$, $d = 0.350$) and Working memory ($t[584] = 4.557$, $p < .001$, $d = 0.471$). Men showed worse results in both variables (see Table 4). Academic degree provided a significant result just for Initiative ($F[3.582] = 8.297$, $p < .001$, $\eta^2 = 0.041$). The worst results after Post Hoc comparison corresponded to Psychology (see Table 5). Residence gave significant results for Monitorization ($F[2.583] = 6.645$, $p < .001$, $\eta^2 = 0.022$), Initiative ($F[3.582] = 8.591$,

$p < .001$, $\eta^2 = 0.029$), Working memory ($F[2.583] = 5.965$, $p = .003$, $\eta^2 = 0.020$) and Hamilton somatic ($F[2.583] = 5.811$, $p = .003$, $\eta^2 = 0.020$). The worst results after Post Hoc comparison corresponded to University hall (see Table 6). Subject who acknowledged social networks abuse showed (Table 7) results significantly worse for Monitoring ($t[584] = 4.361$, $p < .001$, $d = 0.361$), Emotional control ($t[584] = 6.01$, $p < .001$, $d = 0.499$) and Initiative ($t[584] = 3.645$, $p < .001$, $d = 0.302$). Finally, as we can see in Table 8, participants who acknowledged bad sleep quality showed significant worse results for Monitoring ($t[584] = 5.180$, $p < .001$, $d = 0.437$), Inhibition ($t[584] = 3.123$, $p = .002$, $d = 0.264$), Cognitive flexibility ($t[584] = 2.925$, $p = .004$, $d = 0.247$), Emotional control ($t[584] = 4.551$, $p < .001$, $d = 0.381$), Initiative ($t[584] = 3.475$, $p < .001$, d = 0.293), Working memory ($t[584] = 4.197$, $p < .001$, $d = 0.354$), Hamilton somatic ($t[584] = 11.724$, $p < .001$, $d = 0.990$) and Hamilton psychology ($t[584] = 9.176$, $p < .001$, $d = 0.775$).

Table 4

Mean±SD of EFECO and Hamilton dimensions by gender

	Female (n=465)	**Male (n=121)**	*t*	**d Cohen**	**p-value***
1. Monitoring	16.84±3.10	**17.95±3.58**	-3.401	-0.347	< .001
2. Inhibition	18.59±3.09	19.18±3.70	-1.792	-0.183	.074
3. Cognitive flexibility	12.95±1.88	13.45±2.26	-2.506	-0.256	.012
4. Emotional control	15.54±2.84	15.58±2.56	-0.152	-0.015	.880
5. Planning	15.95±2.22	15.79±2.19	0.705	0.072	.481
6. Organization of materials	19.23±1.91	19.07±1.89	0.844	0.086	.399
7. Initiative	2.51±3.14	2.60±3.28	-0.296	-0.030	.767
8. Working memory	20.10±2.73	**21.47±3.70**	-4.557	-0.465	< .001
9. Hamilton somatic	7.51±5.14	6.92±5.37	1.127	0.115	.260
10. Hamilton psychologic	4.36±4.94	3.91±4.69	0.911	0.093	.363

Note. n= sample size; *t*: t-test with $p < .005 = .050/10$ in bold.

Table 5

Mean±SD of EFECO and Hamilton dimensions by academic grade

	Elementary Education (n=256)	Early Childhood Education (n=121)	Psychology (n=145)	Master (n=54)	*F*	η^2	p-value*
1. Monitoring	16.91±3.19	17.00±2.75	17.28±3.60	17.41±3.46	0.610	0.003	.609
2. Inhibition	18.72±3.12	18.61±3.18	18.83±3.56	18.63±3.05	0.116	0.001	.951
3. Cognitive flexibility	12.98±1.94	12.89±1.88	13.24±1.96	13.31±2.31	1.178	0.006	.317
4. Emotional control	15.40±2.57	15.74±2.93	15.65±2.97	15.48±2.85	0.528	0.003	.663
5. Planning	15.86±2.07	16.12±2.36	15.80±2.37	16.06±2.07	0.645	0.003	.586
6. Organization of materials	19.09±1.83	19.11±1.91	19.30±1.99	19.61±1.96	1.357	0.007	.255
7. Initiative	20.19±2.85	19.86±2.99	**21.48±3.55**	21.19±3.30	8.297	0.041	.000
8. Working memory	2.46±3.08	2.18±2.57	2.41±3.41	2.41±2.50	0.250	0.001	.861
9. Hamilton somatic	6.91±4.84	7.47±5.37	8.21±5.70	7.30±4.69	1.985	0.010	.115
10. Hamilton psychologic	3.71±4.70	4.55±4.92	4.93±5.09	4.46±4.97	2.185	0.011	.089

Note. n= sample size; *F*= F-statistic; η^2: effect size; univariate ANOVA with $p < .005 = .050/10$ in bold.

Table 6

Mean±SD of EFECO and Hamilton dimensions according to residence

	University hall (n=46)	Shared apartment Education (n=312)	Family residence (n=228)	*F*	η^2	p-value*
1. Monitoring	**18.61±3.80**	16.78±3.13	17.15±3.17	6.645	0.022	.001
2. Inhibition	20.00±4.14	18.57±3.02	18.65±3.27	4.038	0.014	.018
3. Cognitive flexibility	13.20±2.23	12.85±1.94	13.32±1.94	3.902	0.013	.021

	University hall (n=46)	Shared apartment Education (n=312)	Family residence (n=228)	*F*	η^2	p-value*
4. Emotional control	15.93±2.74	15.50±2.78	15.53±2.80	0.497	0.002	.608
5. Planning	16.11±2.46	15.86±2.19	15.96±2.20	0.332	0.001	.718
6. Organization of materials	19.61±2.24	19.20±1.91	19.11±1.83	1.293	0.004	.275
7. Initiative	**22.35±3.04**	20.31±3.20	20.45±3.03	8.591	0.029	.000
8. Working memory	**21.74±4.42**	20.13±2.78	20.45±2.89	5.965	0.020	.003
9. Hamilton somatic	**9.87±5.88**	7.22±5.20	7.13±4.91	5.811	0.020	.003
10. Hamilton psychologic	5.89±5.31	4.12±4.82	4.15±4.85	2.768	0.009	.064

Note. n= sample size; *F*= F-statistic; η^2: effect size; univariate ANOVA with $p < .005 = .050/10$ in bold.

Table 7

Mean±SD of the EFECO and Hamilton dimensions in relation to social network abuse (yes/no)

	Yes (n=313)	No (n=273)	*t*	d Cohen	p-value*
1. Monitoring	**17.60±3.38**	16.45±2.94	-4.361	-0.361	< .001
2. Inhibition	19.03±3.16	18.36±3.29	-2.514	-0.208	.012
3. Cognitive flexibility	13.19±1.95	12.90±1.99	-1.741	-0.144	.082
4. Emotional control	**16.17±2.90**	14.82±2.45	-6.031	-0.499	< .001
5. Planning	15.99±2.30	15.84±2.11	-0.864	-0.072	.388
6. Organization of materials	19.15±1.87	19.25±1.94	0.627	0.052	.531
7. Initiative	**2.97±3.04**	2.02±3.24	-3.645	-0.302	< .001
8. Working memory	2.64±3.04	2.08±2.94	-2.265	-0.188	.024
9. Hamilton somatic	7.81±5.09	6.92±5.27	-2.076	-0.172	.038
10. Hamilton psychologic	4.43±4.74	4.08±5.05	-0.874	-0.072	.382

Note. n= sample size; t: t-test with $p < .005 = .050/10$ in bold.

Table 8

Mean±SD of EFECO and Hamilton dimensions related to poor sleep quality (yes/no)

	Yes (n=353)	No (n=233)	*t*	d Cohen	p-value*
1. Monitoring	**17.90±3.53**	16.52±2.89	5.180	0.437	< .001
2. Inhibition	**19.22±3.59**	18.38±2.93	3.123	0.264	.002
3. Cognitive flexibility	**13.35±2.04**	12.86±1.91	2.925	0.247	.004
4. Emotional control	**16.17±2.77**	15.13±2.71	4.511	0.381	< .001
5. Planning	16.22±2.33	15.72±2.11	2.710	0.229	.007
6. Organization of materials	19.27±2.00	19.15±1.84	0.766	0.065	.444
7. Initiative	**21.08±3.10**	20.16±3.16	3.475	0.293	< .001
8. Working memory	**21.01±3.43**	19.96±2.61	4.197	0.354	< .001
9. Hamilton somatic	**10.18±5.21**	5.55±4.28	11.724	0.990	< .001
10. Hamilton psychologic	**6.40±5.41**	2.86±3.92	9.176	0.775	< .001

Note. n= sample size; *t*: t-test with $p < .005 = .050/10$ in bold.

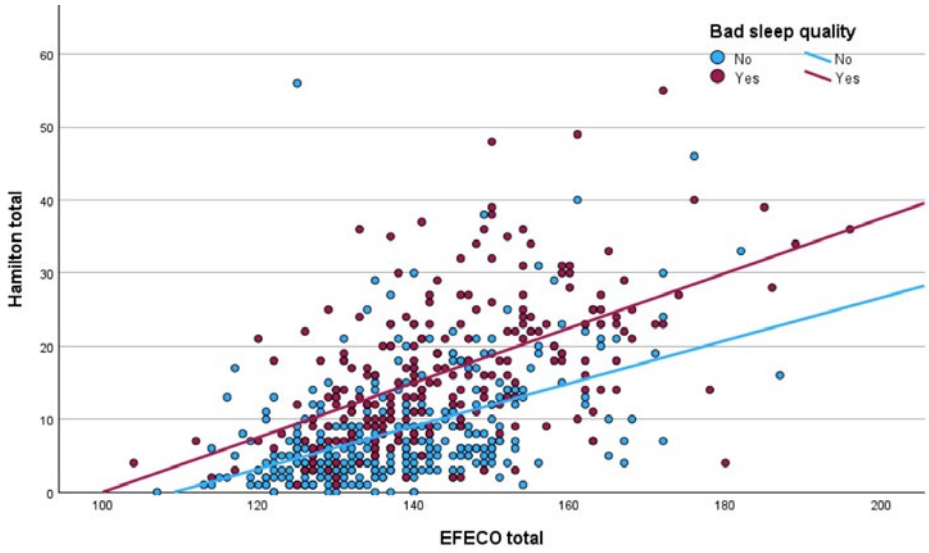
Sleep quality is clearly the factor with strongest influence in EFECO and, specially, in Hamilton' scores. Since Academic degree and Residence correlate significantly with Sleep, we must wonder whether each variable has partial correlation with EFECO or Hamilton controlling Sleep. Again, to control type I probability error a two-way MANOVA (Pillay) was applied for the 10 dimensions. First, we considered as factors Sleep and Academic degree. The result for Academic degree was significant (F[30.1713] = 1.579, p = .024). Second, we considered Sleep and Residence with significant result for Residence (F[20.1114] = 1.862, p = .012). Therefore, both factors (Academic degree and Residence showed significant impact on EFECO and Hamilton beyond influence due to their correlation with Sleep quality.

The relationship between EFECO and Hamilton dimensions (Table 2) can be summarized as a significant direct correlation between EFECO total and Hamilton total (t[584] = 15.966, p < .001, r = 0.551), so that we can associate high scores in EFECO with high scores in anxiety (Figure 2). Considering the importance of sleep quality in anxiety scores, as we stated above, it may be interesting to analyze throughout an ANCOVA the joint influence of EFECO total and sleep quality on Hamilton total. As a result, global model gave F[2.583] = 191,368, p < .001, η^2 =

0.396; partial test for EFECO resulted $F[1.583] = 121.187$, $p < .001$, $\eta^2 = 0.267$, while partial test for Sleep quality gave $F[1.583] = 89.284$, $p < .001$, $\eta^2 = 0.133$. Moreover, 95% CI for slope was 0.286 - 0.376 and 95% CI for interception difference was 4.803 - 7.324. So, as is illustrated in Figure 2, bad sleep quality implies an average increase between 4.8 and 7.3 points in Hamilton's score. This effect is independent of EFECO's level since interaction contrast turned out to be no significant ($F[1.582] = 3.127$, $p = .073$, $\eta^2 = 0.005$).

Figure 2

Total Hamilton by Total EFECO and Poor sleep quality (yes/no)



DISCUSSION AND CONCLUSIONS

The main objective of this study was to examine and assess the relationships between sleep quality, social media use, anxiety, and executive functions in higher education students. The results revealed mostly positive and statistically significant correlations, aligning with prior empirical findings (Fernández- Romero et al., 2023; Friedman et al., 2018; Moussa-Chamari et al., 2024). However, some studies have reported less consistent associations between these constructs (López-Vázquez et al., 2024). Notably, the strongest correlation observed was between somatic and psychological anxiety —an association also supported by existing literature (Martínez et al., 2023; Rondang & Ohira, 2024; Zapata & De Lille, 2024).

Regarding the link between anxiety and working memory, students with higher anxiety levels demonstrated poorer performance in tasks requiring this executive function. These results are consistent with previous research that confirms the negative impact of anxiety on working memory (Almarzouki et al., 2022; Esquivel-Gámez et al., 2020; Gutiérrez-Ruiz et al., 2020; Wang et al., 2024). Other variables under investigation in this study also yielded comparable findings in the literature. For instance, Priore & González (2016) indicated that students with better emotional regulation tend to report lower anxiety and adapt more effectively to the university environment. Similarly, Cañas et al. (2022) found that working memory and inhibitory control positively influence academic performance, while cognitive flexibility showed a negative effect. A recent study involving university students found that those with high anxiety levels showed deficits in inhibition and cognitive flexibility, suggesting that anxiety impairs students' capacity to adapt to new situations and manage impulses (Diotaiuti et al., 2024; López et al., 2021). Moral & Pérez (2022) also emphasized the negative influence of anxiety on emotional control, which may lead to increased emotional reactivity and difficulty managing stress.

Following this line of discourse, we can point out that our results showed that there was a relationship between the EFECO and Hamilton dimensions, finding a significant direct correlation between both scales, so that it is possible to associate high scores in EFECO with high scores in anxiety. In contrast to the existing literature, other empirical studies agree with the findings, concluding that students with high levels of anxiety tend to have difficulties in tasks that require executive functions, such as working memory and cognitive flexibility. These deficits can manifest themselves in problems organizing, planning and executing academic tasks, which in turn can increase stress and anxiety levels, creating feedback that affects both their potential performance and the students' overall well-being (Cañas et al., 2022; Gutiérrez et al., 2021; Gutiérrez-Ruiz et al., 2020; Romero et al., 2023; Živković et al., 2022).

Similarly, establishing relationships between socio-demographic variables and the different dimensions of the Hamilton scale and the EFECO underscores that gender provided significant results for Monitoring and Working memory. The study by Niazi & Adil (2021) also showed that working memory was the strongest predictor of academic performance in male college students compared to females. In contrast, other research found no statistically significant differences (Hamza & Helal, 2021).

However, one of the most revealing findings of this research has been the preponderance of sleep quality as the most influential factor in EFECO scores and, especially, in Hamilton scores, highlighting the additive effect it has on the anxiety perceived by the university student. This finding highlights the cumulative impact that sleep quality exerts on the perception of anxiety, finding several empirical

studies where it is observed that poor sleep quality is related to indicators of anxiety in higher education students, since the alteration of sleep patterns has a negative impact on emotional, social and academic performance, so that there is a direct connection between sleep quality and mental health (Almarzouki et al., 2022; Anoosha et al., 2025; Duque, 2022; López et al., 2023; Morales-Sánchez et al., 2024). Likewise, the importance of the quality of sleep and the number of hours dedicated to it favors an improvement in the development of cognitive processes and optimal executive functions (Almarzouki et al., 2022; Duque, 2022; Robles & Ortiz, 2024), hence such factors condition academic performance, encouraging its productivity and the rate of efficiency towards higher performance (Fitzsimmons et al., 2024; Gutiérrez-Ruiz et al., 2020; Rodríguez de Ávila et al., 2023).

In this regard, another aspect to consider with respect to sleep quality is its impact on mental health, since high-quality, restful sleep can help reduce anxiety levels and improve coping capacity in stressful situations (Avila-Toscano et al., 2021; Christodoulou et al., 2024). Lack of adequate sleep can worsen anxiety symptoms and decrease relaxation capacity (Estrada-Araoz et al., 2023). In this regard, a study investigating the relationship between smartphone use, insomnia, stress, and anxiety among college students found that higher scores of addictions on technological devices were significantly associated with higher anxiety and stress scores, as well as higher scores on the insomnia severity index (Al Battashi et al., 2021). This suggests that poor sleep quality, exacerbated by factors such as excessive smartphone use, may lead to increased anxiety.

Finally, we can indicate that this research has been able, not only to analyze the anxiety levels of the surveyed university students, but also to generate a correlation pattern as to how the excessive use of social networks, sleep quality, anxiety and executive functions can influence such students in higher education. In this regard, as well as the findings obtained, scientific literature points to a negative relationship between the excessive use of social networks and both psychological variables, finding studies that support the same empirical evidence (Ramirez et al., 2023). Similarly, the theoretical explanatory model of departure, has allowed us to corroborate another factor that influences students within the university environment, so that, if we consider the study of Tafur & Diaz (2021), we can identify that just over a third of students who always made use of social networks showed worse performance in the teaching-learning process than the rest of the participants. Therefore, uninterrupted and excessive exposure to technological access in digital multiplatform conditions the quality of sleep and rest, thus deteriorating some variables measured in the executive functioning of the population under study. Similarly, a higher level of anxiety also impacts the quality of the student's sleep, so it is a process that the academic context feeds back.

In conclusion, regarding the first specific objective (to analyze anxiety levels in university students), the results revealed that anxiety levels in university students presented a significant proportion in the sample. This is evidenced by the scores obtained, showing a positive correlation with executive functions, which confirms the need to address this problem urgently to improve the emotional well-being and quality of life of this population group not only in the university context but also in their daily lives.

The second objective was to identify correlational patterns among social media use, anxiety, and executive functioning. The results revealed significant associations: students with high anxiety levels experienced more difficulties in key executive domains such as Working memory, Cognitive flexibility, and Inhibitory control. The strongest associations were observed between somatic and psychological anxiety and several EFECO dimensions. Consistently, those students who reported greater use of social networks tended to present higher levels of anxiety and greater difficulties in their executive functions, especially in the ability to concentrate on academic tasks. In this sense, the findings suggest that anxiety may interfere with students' ability to organize, plan, and execute academic tasks, which in turn may increase levels of stress and anxiety, creating a cycle that affects students in all spheres of daily life.

The third and last specific objective was to determine the impact that sleep has on anxiety and executive functioning, appreciating that sleep quality was identified as a crucial factor that significantly influences anxiety levels and executive functioning of university students. The data showed that 60.2% of the participants reported poor sleep quality, presenting a positively increased correlation in anxiety levels and a decrease in executive functions. Specifically, students with poor sleep quality showed worse results in monitoring, inhibition, cognitive flexibility, emotional control, initiative and working memory. These results underscore the importance of sleep quality for mental health in the academic context, suggesting that different interventions aimed at improving sleep patterns could have a positive impact on reducing anxiety and improving executive functions.

In sum, these conclusions enrich the literature in educational psychology and stress the importance of implementing targeted interventions that address both anxiety and executive functioning to foster a healthier, more effective learning environment for university students.

Limitations, educational implications, and future research direction

One of the primary limitations of this study lies in the sampling method, which was non-probabilistic, and convenience based. This may affect the representativeness of the sample and, consequently, the generalizability of the findings. Furthermore,

since the data were collected using self- report questionnaires, there is a risk of response bias and limited accuracy. Another limitation concerns the demographic composition of the sample, which consisted predominantly of female participants, making it difficult to compare findings across genders. Additionally, certain potentially influential variables —such as socioeconomic status or pre-existing mental health conditions—were not controlled in the analysis.

In terms of educational applications, the findings highlight the need for institutional policies that provide targeted support to university students. This includes the implementation of psychoeducational programs aimed at promoting healthy sleep habits among higher education students, as well as the development of strategic plans thar encourage responsible and balanced use of social media. Moreover, academic institutions should offer structured resources for managing anxiety, ideally integrated within Tutorial Action Plans. At the same time, it is important to raise awareness of these specific needs through teacher training and guidance services, enabling teacher training in the recognition of signs of somatic and psychological anxiety, as well as the academic consequences of sleep quality and executive functions in students.

As for future research directions, the use of probabilistic sampling and larger sample size is strongly recommended to improve the representativeness and generalizability of the results. Implementing longitudinal designs would also be beneficial, as they would allow researchers to explore whether the observed relationships remain stable over time or evolve in different directions. Additionally, future studies should aim for more balanced samples in terms of gender and educational context to ensure broader applicability of findings. Methodologically, incorporating mixed methods approaches that combine quantitative and qualitative techniques could provide a deeper and more holistic understanding of the factor affecting anxiety and executive functioning in university students. On an applied level, future research could include the design and evaluation of specific interventions aimed at reducing anxiety and improving executive functioning. These interventions may involve stress management techniques —such as relaxation therapies, including music therapy, which has been shown to significantly reduce both somatic and psychological anxiety (Cabrera-Díaz et al., 2023; Chunata-Carrasco et al., 2024)—as well as mindfulness-based programs. Such practices, which cultivate present- moment awareness, have proven effective in reducing symptoms of depression, anxiety, and anger among higher education students (Caycho-Rodríguez et al., 2019). Moreover, implementing strategies to enhance sleep quality can significantly improve decision-making and problem-solving skills, which are essential for academic success (Huarca & Cardenas, 2024). Finally, future investigations should examine how different educational environments, and pedagogical practices influence anxiety levels and executive functioning. This

could inform the design of more inclusive and effective learning environments for university students.

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