High School Students' Social Jetlag, Lifelong Competency, and Academic Stress During the COVID-19 Pandemic: A Cross-Sectional Study

Soo Yeon Lee, RN, MSN[1] and Sun Joo Jang, RN, PhD[2] ⓘD

Abstract

With the prolongation of non-ordinary situations such as school closures due to the coronavirus disease 2019 (COVID-19) pandemic, high school students have experienced irregular sleep-wake cycles and elevated academic stress resulting from reduced academic achievement and widened gaps in academic performance. This cross-sectional study aimed to investigate the associations among chronotype, social jetlag, lifelong learning competency, and academic stress in high school students during the COVID-19 pandemic. Data were collected through an online survey from May–June 2021. The mean social jetlag was found to be 2 h and 9 min, and multiple regression analysis revealed that social jetlag and lifelong competency affected academic stress. Thus, measures to minimize social jetlag and improve lifelong learning competencies should be implemented to reduce academic stress among high school students. School nurses should identify students with severe social jetlag and provide guidance and interventions to promote sleep hygiene and regular lifestyles.

Keywords

COVID-19, social jetlag, stress, sleep, students

Introduction

With the prolongation of non-ordinary situations, including lockdowns, online schooling, and social distancing practices, to prevent the spread of infection during the coronavirus disease 2019 (COVID-19) pandemic for more than two years, adolescents have grown distant from pre-pandemic school-based structured daily life (Saxvig et al., 2022). Consequently, adolescents have been encountering several problems, including irregular sleep-wake cycles (Saxvig et al., 2022) and diminished academic achievement, while the gap in academic performance among students has broadened (Hammerstein et al., 2021). In addition, uncertainty associated with COVID-19 is likely to magnify heightened academic stress among high school students (Zhou et al., 2020). Moreover, under the social restrictions implemented to control the pandemic, adolescents' academic stress has increased to a severe level (Mahapatra & Sharma, 2021). Murdhiono et al. (2021) emphasize the urgent need for governmental effort and policymaking interventions to relieve students' academic stress.

Academic stress is an outcome of academic demands imposed beyond an individual's available adaptive resources (Wilks, 2008), and manifests as academic overload and social, familial, and psychosocial challenges in an academic context (Quincho et al., 2021). In addition to its adverse impact on academic performance, academic stress can engender health problems, such as issues with emotional well-being, highlighting the importance of alleviating academic stress and mitigating its adverse effects (Joshi & Kiran, 2020; Quincho et al., 2021). Thus, it is crucial to identify the factors affecting academic stress.

Individuals are broadly classified into morning and evening chronotypes based on their preferred time of activity, depending on their circadian rhythm (Cespedes Feliciano et al., 2019). As children transition to adolescence, morning chronotypes gradually shift to evening chronotypes due to biological changes and environmental factors, whereas evening chronotypes peak in the late teens (Crowley et al., 2018; Fischer et al., 2017). Thus, evening chronotypes in their late teens start school earlier than their biological clock, substantially disrupting their circadian

[1] Red Cross College of Nursing, Department of Nursing, Graduate School, ChungAng University, Seoul, Republic of Korea - 06974
[2] Red Cross College of Nursing, ChungAng University, 84 Heukseok-ro, Dongjak-gu, Seoul, Republic of Korea - 06974

Corresponding Author:
Sun Joo Jang, PhD, Red Cross College of Nursing, ChungAng University, 84 Heukseok-ro, Dongjak-gu, Seoul, Republic of Korea – 06974.
Email: icedcoffee@cau.ac.kr

rhythm (Crowley et al., 2018). Evening chronotypes have shown poorer grades than morning chronotypes (Zerbini et al., 2017), presumably because of the discrepancy between the socially-forced sleeping time and an individual's actual biological rhythm (Haraszti et al., 2014).

A discrepancy between one's internal biological and social clock, that is, the misalignment between one's circadian rhythm and sleep-wake cycle, is known as social jetlag (Wittmann et al., 2006). It is known to impact students' cognitive abilities and academic achievements (Díaz-Morales & Escribano, 2015). Approximately 40–68% of high school students have a high social jetlag of two hours or longer, and those with an evening chronotype typically have a larger social jetlag (Malone et al., 2016). As high school students are subject to more severe adverse impacts of social jetlag, because evening chronotypes peak in the late teens (Roenneberg et al., 2019), it can be a potential predictor of academic stress.

Lifelong learning is a concept that encompasses formal learning in educational facilities, such as schools, as well as informal learning, such as unintended learning from voluntary social interactions (Organization for Economic Co-Operation and Development [OECD], 2021). Lifelong learning competency refers to the ability to learn throughout one's lifetime and continuously improve one's competencies while keeping abreast of societal changes (Sung et al., 2015), and it encompasses competencies to engage in meta-cognitive thinking, such as the ability to think, learn, use knowledge, and accept information (Chang et al., 2018). Thus, it is imperative that students strive to improve their lifelong learning competencies (Sung et al., 2016). Lifelong learning competency enhances self-directed learning and problem-solving skills (Noh, 2020) and positively affects academic achievement (Chang et al., 2018).

For individuals living in a society influenced by mega trends such as digitalization, globalization, and the aforementioned COVID-19 pandemic, lifelong learning competency is pivotal (OECD, 2021). During the pandemic, the educational school environment changed, and adolescents were subject to the impact of such changes. As a result, active lifelong learning competency has become increasingly important to enable individuals to adapt to these unprecedented changes in mega trends (Kim & Kim, 2021). According to a previous study (de la Fuente et al., 2021), self-initiated and self-regulated learning has influenced academic stress during the COVID-19 pandemic. Thus, considering the competency model for studying, learning, and performing under stress (de la Fuente, 2021), lifelong learning competency is expected to affect academic stress in high school students. In this context, we thus hypothesize that chronotype, social jetlag, and lifelong learning competency affect high school students' academic stress. Therefore, this study aimed to investigate the associations between chronotype, social jetlag, lifelong learning competency, and academic stress and to identify the factors affecting academic stress in high school students during the COVID-19 pandemic.

Methods

Study Design and Ethical Consideration

This cross-sectional study was approved by the Institutional Review Board of the authors' affiliated C University (approval number: blinded for review). Participants and their legal guardians were given an information sheet explaining the study's purpose and method, and were assured that anonymity would be maintained. The participants who provided informed consent proceeded with the survey. Participants were also informed that they could withdraw from the study at any time.

Participants and Data Collection

Students from six high schools (three general high schools, two specialized high schools, and one vocational high school) located in three major cities in Korea were enrolled in the study. The vocational high school primarily disseminates education aimed at acquiring skills for specific occupations. The specialized high school provides specialized subjects (i.e., foreign languages, sciences, or annexed subjects to industrial enterprises) in addition to the general high school curriculum. However, high school graduates from the various school types receive the same educational level qualification. The minimum sample size was calculated using G*Power 3.1.9.4 Version. For a multiple regression with 14 predictor variables, a significance level of .05, power of .95, and effect size (f^2) of 0.15 (medium) were set, and the minimum sample size was 189. With a 25% potential withdrawal rate, data were collected from May–June 2021, with a target sample size of 250. An online survey was conducted during the COVID-19 pandemic. To minimize missing values, an alarm was raised if the question was unanswered but the respondent attempted to advance to the next one. We used online social networks, and an announcement of the survey was posted on school bulletin boards using QR codes. After excluding students whose legal guardians did not share their consent and responses from duplicate Internet Protocol addresses (n = 37), 213 questionnaires were included in the final analysis.

Measurement

Participants' sex, age, grade level, height, body weight, living arrangement, religion, type of high school, health status, subjective academic performance, and depressive mood (in the previous week) were assessed using a self-reported questionnaire. The major study parameters—chronotype, social jetlag, lifelong learning competency, and academic stress—were assessed using the following instruments.

Chronotype. The chronotype was assessed using the Korean version of the Morningness-Eveningness Questionnaire

(Lee et al., 2014). This is a 19-item self-reported questionnaire. Items 11 and 19 are rated on a scale of 0–6, and item 12 is rated on a scale of 0–5. The remaining items are rated on a scale of 1–4, and the total score ranges from 16–86. A higher score indicates resemblance to a morning chronotype. The scoring criteria are as follows: definite evening (16–30), moderate evening (31–41), neither (or intermediate; 42–58), moderate morning (59–69), and definite morning (70–86) types. Cronbach's α was .82 for the instrument (Lee et al., 2014) and .62 in this study.

Social Jetlag and Sleep Duration. The Korean version (Suh et al., 2018) of the Munich Chronotype Questionnaire (MCTQ) by Roenneberg et al. (2003) was used to measure social jetlag and sleep duration over the previous four weeks. The self-reported MCTQ measures participants' sleep onset, sleep latency, sleep inertia, wake-up time, and get-up time on weekdays and weekends. According to Santisteban et al. (2018), the MCTQ was valid and reliable as the results measured by it were strongly correlated with those of the wrist actigraphy. Social jetlag is calculated as the absolute difference between students' midsleep on weekends and weekdays.

Lifelong Learning Competency. Lifelong learning competency was assessed using the Lifelong Learning Competency Scale for adolescents, developed by Sung et al. (2016). This 37-item scale comprises three subdomains (thinking, use of intellectual tools, and learning adaptability), and each item is rated on a four-point Likert scale ranging from 1 (strongly disagree) to 4 (strongly agree). The total score ranges from 37–148, with higher scores indicating higher lifelong learning competency. Cronbach's α was .75–.91 at the time of development (Sung et al., 2016) and .91 (.62–.91) in this study.

Academic Stress. The Academic Stress Scale developed by Park and Park (2012) was used. This 15-item tool comprises three domains (grades, classes, and study) for academic stress using a six-point Likert scale ranging from 1 (definitely not true) to 6 (definitely true). The total score ranges from 15–90, with higher scores indicating greater academic stress. Cronbach's α was .73–.86 at the time of development (Park & Park, 2012) and .87 (.74–.87) in this study.

Data Analysis

The collected data were analyzed using SPSS version 26.0 program. The differences in academic stress according to participants' general characteristics were analyzed using an independent t-test and ANOVA, followed by the Scheffé test for post-hoc comparison of the differences between groups. The relationships among the major variables were analyzed using Pearson's correlation coefficients. Normality was tested using the Kolmogorov-Smirnov test, and the homoscedasticity of the residuals was tested using the Breusch-Pagan test. Factors affecting participants' academic stress were analyzed using multiple linear regression analysis. There were no missing data.

Results

General and Health-Related Characteristics

The mean age was 16.41 (SD = 0.98) years. A total of 173 (81.2%) participants were men, and 87 (40.8%) were 10th graders. The mean body mass index (BMI) was 22.83 (SD = 3.99), with 85 (39.9%) having a normal BMI. The majority (n = 199, 93.4%) lived with their families, and 180 (84.5%) attended a general high school. Most (n = 185, 86.9%) rated their academic achievement as "low," and 190 (89.2%) perceived themselves as healthy. A total of 138 (64.8%) participants did not have depressive mood (Table 1).

Sleep Related Parameters, Lifelong Learning Competency, and Academic Stress. Regarding chronotype, most participants (n = 118, 55.4%) reported themselves as neither type, followed by the moderate evening type (n = 84, 39.4%), moderate morning type (n = 6, 2.8%), and extreme evening type (n = 5, 2.3%). No participants reported themselves as an extreme morning type. The mean social jetlag was 2 h and 9 min (SD = 58 min), and the mean lifelong learning

Table 1. General and Health-Related Characteristics (N = 213).

Variables	Categories	N (%)	M(SD)
Sex	Male	173 (81.2)	
	Female	40 (18.8)	
Age			16.41(0.98)
Grade level	10th grade	87 (40.8)	
	11th grade	75 (35.2)	
	12th grade	51 (23.9)	
Body mass index	Underweight (<18.5)	32 (15.0)	22.83(3.99)
	Normal (18.5–22.9)	85 (39.9)	
	Overweight (23–24.9)	31 (14.6)	
	Obese (≥25)	65 (30.5)	
Residence type	Living with family	199 (93.4)	
	Living alone	3 (1.4)	
	Dormitory	11 (5.2)	
Religion	No	134 (62.9)	
	Yes	79 (37.1)	
School type	General high school	180 (84.5)	
	Specialized high school	8 (3.8)	
	Vocational high school	25 (11.7)	
Subjective academic performance	High	28 (13.1)	
	Low	185 (86.9)	
Health condition	Good	190 (89.2)	
	Bad	23 (10.8)	
Depressive mood	No	138 (64.8)	
	Yes	75 (35.2)	

competency score and academic stress score were 106.17 (SD = 13.69) and 55.15 (SD = 12.44), respectively (Table 2).

Comparison of Differences in Academic Stress According to Participants' Characteristics

Table 3 shows the differences in the participants' academic stress according to their general characteristics. Academic stress differed according to the type of high school and depressive mood. Academic stress was higher among students in a specialized high school than among those in a vocational high school (F = 3.83, p = .023). Further, academic stress was higher among students with a depressive mood than those without (t = 4.14, p < .001).

Relationships among major Parameters

Chronotype was found to be negatively correlated with social jetlag (r = -.38, p < .001). Academic stress was positively correlated with social jetlag (r = .18, p = .010) and negatively correlated with chronotype (r = -.27, p < .001), sleep duration (r = -.22, p = .001), and lifelong learning competency (r = -.26, p < .001) (Table 4).

Factors Affecting Academic Stress

Multiple regression analysis was performed to identify the factors affecting academic stress. General and health-related parameters (school type and depressive mood), which significantly differed in relation to academic stress in the univariate analysis, and sleep duration, which significantly correlated with academic stress, were entered as control variables. Chronotype, social jetlag, and lifelong competency were entered as independent variables using the enter method. The variance inflation factor (VIF) ranged from 1.04–1.35, confirming the absence of multicollinearity among the independent variables. The Durbin-Watson statistic was 2.06, confirming the absence of autocorrelation in the

dependent variable. The standardized residuals were tested using the Kolmogorov-Smirnov test (Z = 0.05, p = .632) and were confirmed to be normally distributed. The Breusch-Pagan test (χ^2 = 7.91, p = .340) confirmed the satisfaction of the homoscedasticity assumption. The most potent factors affecting academic stress were lifelong learning

Table 2. Sleep-Related Parameters, Lifelong Learning Competency, and Academic Stress (N = 213).

Variables	Categories	N (%)	Mean (SD)
Chronotype	Extreme evening type	5 (2.3)	43.47 (7.29)
	Moderate evening type	84 (39.4)	
	Neither type	118 (55.4)	
	Moderate morning type	6 (2.8)	
	Extreme morning type	0 (0)	
Social jetlag (hour:minute)			2:09 (0:58)
Sleep duration (hour:minute)			6:12 (1:04)
Lifelong learning competency			106.17 (13.69)
Academic stress			55.15 (12.44)

Table 3. Comparison of Differences in Academic Stress According to Participant Characteristics (N = 213).

Variables	Categories	Academic stress M (SD)	Academic stress t/F (p)
Gender	Male	55.22 (12.24)	0.17 (.866)
	Female	54.85 (13.42)	
Grade level	10th grade	53.24 (13.52)	2.38 (.095)
	11th grade	57.48 (11.16)	
	12th grade	54.98 (11.93)	
Body mass index	Underweight (<18.5)	57.47 (12.56)	0.67 (.570)
	Normal (18.5–22.9)	55.54 (10.85)	
	Overweight (23–24.9)	54.45 (13.77)	
	Obese (≥25)	53.83 (13.70)	
Residence type	Living with family	55.40 (12.27)	1.17 (.329)
	Living alone	56.33 (0.58)	
	Dormitory	50.36 (16.46)	
Religion	No	54.49 (12.03)	1.01 (.316)
	Yes	56.27 (13.10)	
School type	General high school	55.74 (11.76)	3.83 (.023)[†]
	Specialized high school	60.38 (9.61)	Specialized >Vocational
	Vocational high school	49.24 (16.09)	
Subjective academic performance	High	51.04 (11.19)	1.89 (.060)
	Low	55.77 (12.52)	
Health condition	Good	55.08 (12.72)	0.24 (.811)
	Bad	55.74 (10.02)	
Depressive mood	No	52.64 (11.97)	4.14 (<.001)
	Yes	59.76 (12.03)	

[†]Scheffe's post-hoc test.

competency (β = -.26, p < .001), followed by depressive mood (β = .22, p < .001), school type (β = .16, p = .022), and social jetlag (β = .15, p = .035). This regression model explained the 23.0% variance (Table 5).

Discussion

This study investigated the associations among chronotype, social jetlag, and lifelong learning competency on academic stress among high school students after adjusting for the participants' school type, depressive mood, and sleep duration. The major findings are discussed below.

The mean social jetlag of high school students was 2 h and 9 min (latitude: 37° North). Previous studies identified a social jetlag of 2 h and 10 min (latitude: 39° North) among Turkish students (Uslu et al., 2021) and 2 h and 13 min (latitude: 52° North) among Dutch students (Zerbini et al., 2017). Our results support previous findings that social jetlag is greater among those who live in higher latitudes, which delay individuals' sleep-wake cycle due to sunshine duration (Polugrudov et al., 2016). However, in a study conducted in Germany, which is geographically close to the Netherlands, the mean social jetlag was found to be 2 h and 42 min (52° N) (Vollmer et al., 2017). This may be attributable to the fact that the average school start time in Germany was earlier (7:47 am) at the time of the study than that in other countries (Vollmer et al., 2017). A study conducted during the lockdown period in Norway reported a mean social jetlag of 1 h and 53 min among high school students, approximately 44 min shorter than the pre-pandemic social jetlag of 2 h and 37 min (Saxvig et al., 2022). This is presumed to be due to the longer sleep duration among high school students (Korman et al., 2020) along with delayed bedtime and waking time as a result of the elimination of social structure due to the COVID-19 pandemic (Genta et al., 2021).

In the multiple regression analysis, chronotype was not indicated as a significant factor affecting academic stress. Genta et al. (2021) compared chronotypes among high school students before and after the COVID-19 pandemic, and reported that students' chronotypes shifted toward the evening type overall. During the COVID-19 pandemic, there were periods during which students were not allowed to be physically present in school, which removed their social structure (Korman et al., 2020). Considering that none of our participants were extreme morning types, it is possible that social distancing measures implemented during the COVID-19 pandemic temporarily altered the sleep-wake cycle of high school students, for whom school had been a predominant part of their daily lives. This might have contributed to the insignificance of chronotype as a predictor of academic stress. Further, simply classifying individuals based on chronotype to understand circadian rhythm disruption has been criticized (Adan et al., 2012), and studies have recommended the use of social jetlag, a sensitive indicator of misalignment between the sleep-wake cycle and circadian rhythm (Roenneberg et al., 2019). Therefore, subsequent studies should also examine social jetlag along with individuals' chronotypes to gain a detailed and tailored understanding of the asynchrony between external and internal clocks (Choi et al., 2019).

Social jetlag was identified as a factor affecting academic stress. According to previous studies, social jetlag has a negative effect on total nighttime sleep during weekdays (McMahon et al., 2018) and on school performance, as more than 40% of high school students nap in school because of nighttime sleep deprivation caused by social jetlag (Malone et al., 2016). This may be relevant to the finding that academic achievement and cognitive abilities decline with increasing social jetlag (Díaz-Morales & Escribano, 2015), thereby leading to lower scores in morning exams (Haraszti et al., 2014). In addition, watching TV on bed or spending time using the computer and cell phone before sleeping were found to increase social jetlag among high school students (Uslu et al., 2021). Reducing blue light exposure in the evening advanced melatonin secretion and thus promoted quicker sleep onset, which in turn reduced social jetlag (Zerbini et al., 2017). Therefore, to reduce social jetlag, it is necessary to increase awareness regarding its adverse effects and educate high school students about sleep hygiene. This includes, for example, structuring a regular sleep-wake schedule, increasing light exposure in the mornings, and reducing blue light exposure in the evenings (Arns et al., 2021).

Moreover, interventions such as light therapy can improve circadian rhythm disruptions by promoting a quicker sleep-wake time (Arns et al., 2021; Gooley, 2008) through appropriate exposure to bright light in the morning (for 30 min, with 10,000 lux light, at a distance of 20–40 cm). Thus, this can be administered to high school students with delayed sleep-wake-up times (Arns et al., 2021). Currently, students have less social jetlag due to the delayed sleep-wake-up time during the COVID-19 pandemic (Genta et al., 2021). However, once school schedules return to normal with an early morning start, social jetlag will be aggravated once again, highlighting the pressing need for interventions. A study on adjusting school start times (Owens et al., 2010) showed that starting high school 30 min later (8:30 a.m.) than usual (8:00 a.m.) improved students' sleep duration and quality, thereby alleviating daytime drowsiness, fatigue, and depressed mood, while improving class attendance rate. In addition, implementing a flexible system in which students can choose to start school at 8 am or 9 am led to an improvement in their cognitive functions as well as sleep duration and quality (Biller et al., 2022). Thus, school nurses should identify students with severe social jetlag and provide guidance and interventions to promote sleep hygiene and regular lifestyles. It is necessary to devise measures to adjust school start times so that students' social jetlag can be minimized at the societal level.

Table 4. Correlation Between Chronotype, Social Jetlag, Lifelong Learning Competency, and Academic Stress (N = 213).

Variables	Chronotype r (p)	Social jetlag r (p)	Sleep duration	Lifelong learning competency r (p)	Academic stress r (p)
Chronotype	1				
Social jetlag	-.38 (<.001)	1			
Sleep duration	.36 (<.001)	-.17 (.015)	1		
Lifelong learning competency	.09 (.188)	-.06 (.392)	-.04 (.576)	1	
Academic stress	-.27 (<.001)	.18 (.010)	-.22 (.001)	-.26 (<.001)	1

In this study, lifelong learning competency was found to be the most powerful factor affecting academic stress. Lifelong learning competency had a positive impact on individuals' academic stress, presumably because it improves the duration of learning and academic achievement (Chang et al., 2018). Individuals with high lifelong learning competency exhibit excellent self-directed learning competence and problem-solving skills (Noh, 2020). Furthermore, this result was in line with a previous finding that problem-focused coping, engagement, positive emotions, academic behavioral confidence, and competency for resilience and self-regulation can lower academic stress (de la Fuente et al., 2021). The current COVID-19 pandemic calls for active learning competencies among students (Kim & Kim, 2021); hence, lifelong learning competency significantly contributes to alleviating academic stress. Hence, measures to enhance lifelong learning competency among high school students should be developed to reduce academic stress.

This study has several limitations. First, more than 80% of the sample was male and reported low subjective academic performance. Thus, these biases may have influenced this study's findings. Therefore, in future research, stratified sampling is recommended in relation to general characteristics (sex, grade, school type, and so forth). Moreover, objective academic achievement scores should be included as a variable rather than subjective academic achievement. Second, since we used a cross-sectional design, causality could not

be established. Third, the study was conducted in a single country; therefore, the findings cannot be generalized globally. Future research should conduct longitudinal studies on high school students in various geographical areas. Finally, the study's parameters were assessed using self-reported data, which are vulnerable to errors due to underestimation or overestimation. Therefore, we propose to conduct further research using a combination of instruments, such as actigraphy, to collect qualitative and quantitative data on sleep-related variables.

Conclusions

This study showed that social jetlag and lifelong learning competencies influenced academic stress in high school students during the COVID-19 pandemic. To manage high school students' academic stress, it is important to implement measures not only at the individual level but also at the school and society levels. A flexible school start system is one alternative that can be considered for minimizing students' social jetlag. Schools should examine students' lifelong learning competency, devise tailored strategies to enhance it, and develop and implement systematic education programs to lower academic stress.

Ethics Approval

This cross-sectional study was approved by the Institutional Review Board of the authors' affiliated C University (approval number:

Table 5. Factors Affecting Academic Stress (N = 213).

Variables	B	SE	β	t	p	VIF	95% CI Lower	95% CI Upper
(constant)	81.63	9.66		8.45	<.001		62.59	100.67
School type	10.38	4.51	0.16	2.30	.022	1.31	1.50	19.27
Depressive mood	5.79	1.60	0.22	3.62	<.001	1.05	2.63	8.95
Chronotype	−0.23	0.12	−0.14	1.93	.055	1.35	−0.47	0.01
Social jetlag	0.01	0.01	0.15	2.12	.035	1.30	0.00	0.01
Sleep duration	−0.01	0.01	−0.07	1.14	.257	1.16	−0.01	0.00
Lifelong learning competency	−0.23	0.06	−0.26	4.18	<.001	1.04	−0.34	−0.12
Adjusted R^2 = 0.23 F = 10.00 (p < .001) Kolmogorov-Smirnov (Z = 0.05, *p* = .632) ; Breusch-Pagan (χ^2 = 7.91, *p* = .340)								

Note. Durbin–Watson's d = 2.06; Durbin–Watson's du (lower critical limit) = 1.84, 4-du (upper critical limit) = 2.16.
Dummy variables (reference): school type (vocational), depressive mood (no).
SE: standard error; VIF: variance inflation index; CI: confidence interval.

1041078-202102-HRSB-051-01 [May 3, 2021]). All study participants and their legal guardians provided informed consent for participation in this study.

ORCID iD

Sun Joo Jang (iD) https://orcid.org/0000-0002-7655-1744

References

Adan, A., Archer, S. N., Hidalgo, M. P., Di Milia, L., Natale, V., & Randler, C. (2012). Circadian typology: A comprehensive review. *Chronobiology International*, *29*(9), 1153–1175. https://doi.org/10.3109/07420528.2012.719971

Arns, M., Kooij, J. S., & Coogan, A. N. (2021). Review: Identification and management of circadian rhythm sleep disorders as a transdiagnostic feature in child and adolescent psychiatry. *Journal of the American Academy of Child & Adolescent Psychiatry*, *60*(9), 1085–1095. https://doi.org/10.1016/j.jaac.2020.12.035

Biller, A. M., Molenda, C., Zerbini, G., Roenneberg, T., & Winnebeck, E. C. (2022). Sleep improvements on days with later school starts persist after 1 year in a flexible start system. *Scientific Reports*, *12*, 2787. https://doi.org/10.1038/s41598-022-06209-4

Cespedes Feliciano, E. M. C., Rifas-Shiman, S. L., Quante, M., Redline, S., Oken, E., & Taveras, E., & M. (2019). Chronotype, social jetlag, and cardiometabolic risk factors in early adolescence. *JAMA Pediatrics*, *173*(11), 1049–1057. https://doi.org/10.1001/jamapediatrics.2019.3089

Chang, G. Y., Sung, E. M., Mo, S. H., Jin, S. H., Choi, H. S., Kim, G. H., & Heo, H. J. (2018). A study of measurement of Korean Youth Competency and International Comparative Study V: IEA ICCS 2016 comprehensive report. Study report (pp. 1–839). National Youth Policy Institute.

Choi, H. J., Lee, Y. J., Yoo, Y. J., Cho, Y. W., & Moon, H.-J. (2019). The effects of chronotype and social jetlag on medical students. *Sleep and Biological Rhythms*, *17*(3), 269–276. https://doi.org/10.1007/s41105-018-00198-6

Crowley, S. J., Wolfson, A. R., Tarokh, L., & Carskadon, M. A. (2018). An update on adolescent sleep: New evidence informing the perfect storm model. *Journal of Adolescence*, *67*, 55–65. https://doi.org/10.1016/j.adolescence.2018.06.001

de la Fuente, J. (2021). *Competency for studying, learning and performing under stress: adapted and integrated model* (Vol. 2). University of Navarra.

de la Fuente, J., Pachón-Basallo, M., Santos, F. H., Peralta-Sánchez, F. J., González-Torres, M. C., Artuch-Garde, R., Paoloni, P. V., & Gaetha, M. L. (2021). How has the COVID-19 crisis affected the academic stress of university students? The role of teachers and students. *Frontiers in Psychology*, *12*, 626340. https://doi.org/10.3389/fpsyg.2021.626340

Díaz-Morales, J. F., & Escribano, C. (2015). Social jetlag, academic achievement and cognitive performance: understanding gender/sex differences. *Chronobiology International*, *32*(6), 822–831. https://doi.org/10.3109/07420528.2015.1041599

Fischer, D., Lombardi, D. A., Marucci-Wellman, H., & Roenneberg, T. (2017). Chronotypes in the US - influence of age and sex. *PLOS ONE*, *12*(6), e0178782. https://doi.org/10.1371/journal.pone.0178782

Genta, F. D., Rodrigues Neto, G. B., Sunfeld, J. P. V., Porto, J. F., Xavier, A. D., Moreno, C. R. C., Lorenzi-Filho, G., & Genta, P. R. (2021). COVID-19 pandemic impact on sleep habits, chronotype, and health-related quality of life among high school students: A longitudinal study. *Journal of Clinical Sleep Medicine*, *17*(7), 1371–1377. https://doi.org/10.5664/jcsm.9196

Gooley, J. J. (2008). Treatment of circadian rhythm sleep disorders with light. *Annals of the Academy of Medicine, Singapore*, *37*(8), 669–676.18797560

Hammerstein, S., König, C., Dreisörner, T., & Frey, A. (2021). Effects of COVID-19-related school closures on student achievement-a systematic review. *Frontiers in Psychology*, *12*, 746289. https://doi.org/10.3389/fpsyg.2021.746289

Haraszti, RÁ, Ella, K., Gyöngyösi, N., Roenneberg, T., & Káldi, K. (2014). Social jetlag negatively correlates with academic performance in undergraduates. *Chronobiology International*, *31*(5), 603–612. https://doi.org/10.3109/07420528.2013.879164

Joshi, A., & Kiran, R. (2020). Determinants of academic stress amongst engineering students. *Work*, *67*(4), 867–879. https://doi.org/10.3233/WOR-203338

Kim, S., & Kim, M. (2021). Development and validation of multidimensional learning competency diagnostic test (MLCT) for university students. *Learner-Centered Curriculum Education Association*, *21*(11), 625–647. https://doi.org/10.22251/jlcci.2021.21.11.625

Korman, M., Tkachev, V., Reis, C., Komada, Y., Kitamura, S., Gubin, D., Kumar, V., & Roenneberg, T. (2020). COVID-19-mandated social restrictions unveil the impact of social time pressure on sleep and body clock. *Scientific Reports*, *10*(1), 22225. https://doi.org/10.1038/s41598-020-79299-7

Lee, J. H., Kim, S. J., Lee, S. Y., Jang, K. H., Kim, I. S., & Duffy, J. F. (2014). Reliability and validity of the Korean version of morningness–eveningness questionnaire in adults aged 20–39 years. *Chronobiology International*, *31*(4), 479–486. https://doi.org/10.3109/07420528.2013.867864

Mahapatra, A., & Sharma, P. (2021). Education in times of COVID-19 pandemic: Academic stress and its psychosocial impact on children and adolescents in India. *International Journal of Social Psychiatry*, *67*(4), 397–399. https://doi.org/10.1177/0020764020961801

Malone, S. K., Zemel, B., Compher, C., Souders, M., Chittams, J., Thompson, A. L., & Lipman, T. H. (2016). Characteristics associated with sleep duration. *Chronotype, and Social Jetlag in Adolescents. Journal of School Nursing*, *32*(2), 120–131. https://doi.org/10.1177/1059840515603454

McMahon, D. M., Burch, J. B., Wirth, M. D., Youngstedt, S. D., Hardin, J. W., Hurley, T. G., Blair, S. N., Hand, G. A., Shook, R. P., Drenowatz, C., Burgess, S., & Hebert, J. R. (2018). Persistence of social jetlag and sleep disruption in healthy young adults. *Chronobiology International*, *35*(3), 312–328. https://doi.org/10.1080/07420528.2017.1405014

Murdhiono, W. R., Fadlilah, S., & Vidayanti, V. (2021). The effect of online learning systems on academic stress during the COVID-19 pandemic among students in Indonesia. *International Medical Journal*, *28*(4), 445–448.

Noh, E. K. (2020). Classification of the types of life-long learning competencies of university students and verification of relationships with related variables. *Korea University Institute of Educational Research*, *33*(4), 61–87. http://doi.org/10.24299/kier.2020.33.4.61

Organization for Economic Co-Operation and Development. (2021). OECD skills outlook 2021: Learning for life. https://read.oecd-ilibrary.org/education/oecd-skills-outlook-2021_0ae365b4-en#page1

Owens, J. A., Belon, K., & Moss, P. (2010). Impact of delaying school start time on adolescent sleep, mood, and behavior. *Archives of Pediatrics & Adolescent Medicine*, *164*(7), 608. https://doi.org/10.1001/archpediatrics.2010.96

Park, B. K., & Park, S. M. (2012). Development and validation of an academic stress scale. *Korean Journal of Educational Psychology*, *26*(2), 563–585.

Polugrudov, A. S., Panev, A. S., Smirnov, V. V., Paderin, N. M., Borisenkov, M. F., & Popov, S. V. (2016). Wrist temperature and cortisol awakening response in humans with social jetlag in the north. *Chronobiology International*, *33*(7), 802–809. https://doi.org/10.3109/07420528.2016.1168829

Quincho, F. S., Rodríguez Galán, D. B., Farfán Pimentel, J. F., Yolanda Josefina, H. F., Arenas, R. D., Crispín, R. L., & Navarro, E. R. (2021). Academic stress in university students: Systematic review. *Ilkogretim Online*, *20*(5), 3224–3230. https://doi.org/10.17051/ilkonline.2021.05.351

Roenneberg, T., Pilz, L. K., Zerbini, G., & Winnebeck, E. C. (2019). Chronotype and social jetlag: A (self-) critical review. *Biology*, *8*(3), 54. https://doi.org/10.3390/biology8030054

Roenneberg, T., Wirz-Justice, A., & Merrow, M. (2003). Life between clocks: Daily temporal patterns of human chronotypes. *Journal of Biological Rhythms*, *18*(1), 80–90. https://doi.org/10.1177/0748730402239679

Santisteban, J. A., Brown, T. G., & Gruber, R. (2018). Association between the Munich chronotype questionnaire and wrist actigraphy. *Sleep Disorders*, *2018*, 5646848. https://doi.org/10.1155/2018/5646848

Saxvig, I. W., Pallesen, S., Sivertsen, B., Hysing, M., Evanger, L. N., & Bjorvatn, B. (2022). Sleep during COVID-19-related school lockdown, a longitudinal study among high school students. *Journal of Sleep Research*, *31*(2), e13499–NaN. https://doi.org/10.1111/jsr.13499

Suh, S., Kim, S. H., Ryu, H., Choi, S. J., & Joo, E. Y. (2018). Validation of the Korean Munich chronotype questionnaire. *Sleep and Breathing*, *22*(3), 773–779. https://doi.org/10.1007/s11325-017-1609-z

Sung, E. M., Choi, C. W., Kim, H. K., Oh, S. Y., & Jin, S. H. (2015). The development and validation of Korean youth competency Index (KYCI) and definition. *Asian Journal of Education*, *16*(2), 117–144. https://doi.org/10.15753/aje.2015.16.2.005

Sung, E. M., Kim, K. H., & Jin, S. H. (2016). The development and validation of measurement tools for Korean youth lifelong learning competency. *Studies on Korean Youth*, *27*(3), 219–256. http://doi.org/10.14816/sky.2016.27.3.219

Uslu, E., Özsaban, A., & Çağan, Ö (2021). Social jetlag in adolescents: From a nursing perspective. *Journal of Child and Adolescent Psychiatric Nursing*, *34*(4), 276–282. https://doi.org/10.1111/jcap.12332

Vollmer, C., Jankowski, K. S., Díaz-Morales, J. F., Itzek-Greulich, H., Wüst-Ackermann, P., & Randler, C. (2017). Morningness-eveningness correlates with sleep time, quality, and hygiene in secondary school students: A multilevel analysis. *Sleep Medicine*, *30*, 151–159. https://doi.org/10.1016/j.sleep.2016.09.022

Wilks, S. E. (2008). Resilience amid academic stress: The moderating impact of social support among social work students. *Advances in Social Work*, *9*(2), 106–125. https://doi.org/10.18060/51

Wittmann, M., Dinich, J., Merrow, M., & Roenneberg, T. (2006). Social jetlag: Misalignment of biological and social time. *Chronobiology International*, *23*(1–2), 497–509. https://doi.org/10.1080/07420520500545979

Zerbini, G., van der Vinne, V., Otto, L. K. M., Kantermann, T., Krijnen, W. P., Roenneberg, T., & Merrow, M. (2017). Lower school performance in late chronotypes: Underlying factors and mechanisms. *Scientific Reports*, *7*(1), 4385. https://doi.org/10.1038/s41598-017-04076-y

Zhou, S., Zhang, L. G., Wang, L. L., Guo, Z. C., Wang, J. Q., Chen, J. C., Liu, M., Chen, X., & Chen, J. X. (2020). Prevalence and socio-demographic correlates of psychological health problems in Chinese adolescents during the outbreak of COVID-19. *European Child & Adolescent Psychiatry*, *29*(6), 749–758. https://doi.org/10.1007/s00787-020-01541-4

Author Biographies

Soo Yeon Lee, RN, MSN is a graduate student at ChungAng University in Seoul, South Korea.

Sun Joo Jang, RN, PhD is an associate professor at ChungAng University in Seoul, South Korea.