

Effect of social jetlag and chronotype on academic achievement in nursing students during the COVID-19 pandemic

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ABSTRACT

Purpose: To evaluate the effect of chronotype and social jetlag on academic achievement in nursing students during the COVID-19 pandemic.

Materials and methods: This descriptive and cross-sectional study was conducted with nursing students (n=416), who were members of the Student Nurses Association, continued to attend their classes, were not during the exam period, and agreed to participate in the research. Data were collected online using the Introductory Characteristics Form, the Social Jetlag Form, and the Morningness-Eveningness Questionnaire. The Kruskal- Wallis H, chi-square and Spearman's correlation tests were used in the statistical analysis of data.

Results: The mean age of the students participating in the study was 21.2±1.4 years. Of the students, 87.3% were female, 33.4% were in the fourth grade,

and 94% were living with their families. Eighteen percent of the students were determined to be the evening type, 67.5% intermediate type, and 14.4% morning type. The mean social jetlag value was 1.47±0.94. When the chronotype groups and social jetlag values were examined, they had no significant effect on the students' academic performance (p>0.05).

Conclusions: This study showed that chronotype and social jetlag value did not have a significant effect on academic achievement. We support the idea that flexible work schedules can create an environment for the improvement of chronotype and social jetlag.

Keywords: Social jetlag, chronotype, nursing students, academic achievement

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INTRODUCTION

The novel coronavirus disease (COVID-19), which was first seen in the Wuhan city in China in December 2019 and declared a pandemic by the World Health Organization (WHO) on March 11, 2020, remains at the top of the global agenda [1]. The rapid transmission of the disease from person to person has revealed that abstaining from physical contact is essential. This has led to the emergence of new concepts, such as social distancing and social isolation in the literature. During this process, lifestyles, daily habits, working styles, and education and socialization habits have changed due to quarantine measures [2]. University students constitute one of the affected populations facing many difficulties in this process. Some of these challenges and problems are related to the shift to online education and adaptation to distance education, limited access to the internet and equipment (tablets, computers, etc.) used for these purposes, problems in the home working environment, fear of contracting the virus, concerns about the health of family members [3], delay in graduation, reduction in job acceptance, internship interruptions, increased or reduced time spent on studying [4], closure of libraries, and concerns about future education and career [5]. Other difficulties faced by students during the ongoing pandemic include increased use of digital media before going to bed, sleeping and waking up late, staying in bed longer [6], changes in daily work/rest schedules [3,7], time management problems, and lack of autonomy and self-control [3]. In this process, university students have had to change their routines [6,7].

In humans, physiological and behavioral processes occur in cycles of approximately 24 hours, which are autonomously generated by the internal circadian rhythm [8,9]. Daily timing preferences of individuals may differ according to their circadian rhythm phases, which has brought about the concept 'chronotype'. Chronotypes are basically examined in three groups as morning, intermediate, and evening [10]. Course-related achievements, sleep duration, social jetlag, and chronotype measurements of individuals with different daily rhythm types are important for their academic success [11].

Distance education students may have a tendency to delay their sleep-wake cycles since they do not physically attend school during the COVID-19 pandemic, and there are no compulsory programs on their free days. The inconsistency in sleep-wake cycles between free days and work/school days is referred to as social jetlag [12]. It is suggested that there is a negative relationship between sleep quality and social jetlag [13]. According to sleep pattern type/chronotypes, evening-type individuals generally have a higher social jetlag value than

intermediate- and morning-type individuals [12]. Chronotype affects the quality of the sleep-wake cycle and sleep deprivation, thus affecting the learning process of university students [14]. It has been suggested that the effect of chronotype is stronger than sleep time on student achievement [15,16]. Students who do not have difficulty in waking up in the morning and are active in the early hours of the day are reported to perform better in school and exams than evening-type students [15].

Montaruli et al. found that morning-type students had higher grade point averages in theoretical and practical exams than the other chronotypes (intermediate and evening) [17]. Similarly, Ferguson et al. reported that morning-type students had higher grade point averages than evening-type students [18]. In a study by Chang et al. conducted with nursing students, social jetlag was negatively correlated with academic achievement, while chronotype was positively associated with academic achievement [16].

Although there are studies conducted with university students in the pre-pandemic period in the field of medicine, we found no national or international study focusing on the effect of social jetlag and chronotype on academic success during the ongoing COVID19 pandemic. Since nursing students work in variable shifts after graduation, in addition to describing the effect of social jetlag and chronotype on academic achievement, this study is considered to be meaningful in terms of increasing awareness and guiding possible interventions. The aim of this study was to evaluate the relationship between social jetlag and chronotype and academic achievement in nursing students during the COVID-19 pandemic.

MATERIALS AND METHODS

This descriptive study was conducted between March and May 2021 with 416 students, who were members of the Student Nurses Association (SNA) continued to attend their classes, were not in the exam period, and agreed to participate in the research. The formula $n = \frac{Nt^2}{pq/d^2 (N-1) + t^2}$ was used to calculate the sample size. $(n=(11.000).(1.96)^2 \times (0.5).(0.5)/(0.5)^2. (11.000) + (1.96)^2.(0.5).(0.5))$. The data collection forms used in the research were prepared online and disseminated via Google Forms. The link to the form was shared via SNA on social media platforms created by students who were members of this association, and students were asked to complete the forms. While preparing the questions with Google Forms, to prevent data loss, the 'required field' option was selected for each question to ensure that no question was left unanswered. Determining criteria were accepted as data collection not being performed for one week before and during the midterm and final exams of the students.

Data Collection Tools

To collect data for the research, three instruments were used: Student Information Form, Social Jetlag Form, and Morningness-Eveningness Questionnaire (MEQ).

Student Information Form

This instrument was developed by researchers under the guidance of the literature and consisted of six demographic questions related to age, gender, class, weighted grade point average (GPA), family type, family economic status, and type of accommodation.

Social Jetlag Form

The students' were directed open-ended questions to inquire about their waking up/sleeping times on work/school days and waking up/sleeping hours on free days. Using the students' responses, their social jetlag values were calculated with the formula, mid-sleep on free days - mid-sleep on workdays [12].

Morningness-Eveningness Questionnaire

This scale was developed by which was developed by Horne and Östberg (1976) [19] and the validity and reliability studies of the Turkish version were undertaken by Pündük et al. with university students.

The Cronbach alpha coefficient of the Turkish version of the scale was determined as 0.812.

The items of the scale question the physical and psychological performance of individuals within 24 hours and the preferred time periods to achieve these performances.

The scale contains atotal of 19 items based on the four-, five- and six-point Likert type. Participants receive different scores according to the option they mark in each item. Items 3-9 and 13-16 are scored 1 to 4; items 1, 2, 10, 17 and 18 are scored 1 to 5; items 11 and 18 are scored 1 to 6, and items 12 is scored 0 to 5. The total score varies between 16 and 86, and low scores indicate the evening type while high scores indicate the morning type. In the current study, the respondents were classified as definitely morning type (score: 70-86), close to morning type (score: 59-69), intermediate type (score: 42-58), close to evening type (score: 31-41), and definitely evening type (score: 16-30) [20]. The Cronbach alpha Value of the scale for our study was calculated as 0.745.

Academic Performance

The academic performance of the students was evaluated by obtaining their academic grade averages based on the four-point grading system for the relevant year.

Data Analysis

Data were analyzed using SPSS v. 25.0. As descriptive statistics, frequency, percentage, mean and standard deviation values were used. The suitability of the data to normal distribution was evaluated with the Kolmogorov-Smirnov test. In the statistical analysis of the measurement tools, it was determined that data were not normally distributed, and therefore the the spearman rank-order correlation coefficient was conducted. The results were assessed on 95% confidence interval and a p-value $p < 0.05$ indicated statistical significance.

Ethical Considerations

To conduct the study, written permission was obtained from the participants and approval from the Scientific Research and Publication Ethics Committee of Ege University (protocol number: 844,25.02.2021). Permission to use MEQ was received from the corresponding author. Written permission was obtained from the Student Nurses Association with the approval of the ethics committee. Participation in the study was voluntary, and all the students participating in the study provided written consent online.

RESULTS

The mean age of the students was 21.24 ± 1.41 (18-27) years. Of the students, 87.3% were female and 16.6% were in the first grade, 27.2% in the second grade, 22.8% in the third grade, and 33.4% in the fourth grade. It was determined that for 64.9% of the students, the family income was equal to expenses, and 94% lived with their families (Table 1).

When the MEQ scores of the participants were examined, 0.5% ($n = 2$) were definitely the morning type, 13.9% ($n = 58$) were close to the morning-type, 67.5% ($n = 281$) were the intermediate type, 15.4% ($n = 64$) were close to the evening type, and 2.6% ($n = 11$) were definitely the evening type. Due to the low number of definitely morning-type and definitely evening-type individuals, close to and definitely morning-type individuals were grouped under the morning type and close to and definitely evening-type individuals were grouped under the evening type. Accordingly, 14.4% ($n = 60$) of the students were determined to prefer morningness, 67.5% intermediateness ($n = 281$), and 18% ($n = 75$) eveningness (Figure 1).

The social jetlag values of the participants were found to be in the range of 0.0-4.45, with a mean value of 1.47 ± 0.94 . It was seen that the MEQ scores of the participants varied between 23.00 and 72.00, and the mean value was 49.27 ± 8.51 . The weighted GPAs of the participants were in the range of 1.86 to 4.00, with a mean value of 3.27 ± 0.41 (Table 2). The general academic GPA based on the four-point system was 3.39 ± 0.36 for

the morning-type group, 3.26 ± 0.42 for the intermediate-type group, and 3.23 ± 0.41 for the evening-type group ($p > 0.05$).

When the reported sleep quality of the students was examined according to their chronotype types, it was observed that that of the evening-type group was poor ($p < 0.05$) (Figure 2).

A negative correlation was found between social jetlag and chronotype ($r = -0.309$, $p = -0.289$), but there was no correlation between academic performance and social jetlag ($r = 0.027$, $p = 0.579$) or chronotype ($r = 0.048$, $p = 0.333$) (Table 3).

Table 1. Distribution of students according to sociodemographic characteristics

	n	%
Gender		
Female	363	87.3
Male	53	12.7
Grade		
1	69	16.6
2	113	27.2
3	95	22.8
4	139	33.4
Family Type		
Nuclear family	349	83.9
Extended family	67	16.1
Family Income Level		
Income less than expenses	86	20.7
Income equals expenses	270	64.9
Income greater than expenses	60	14.4
Type of accommodation		
Lives with family	391	94.0
Lives with friends	18	4.3
Lives alone	7	1.7
Total	100	100.0
	Mean±SD	
Age	21.24±1.41	

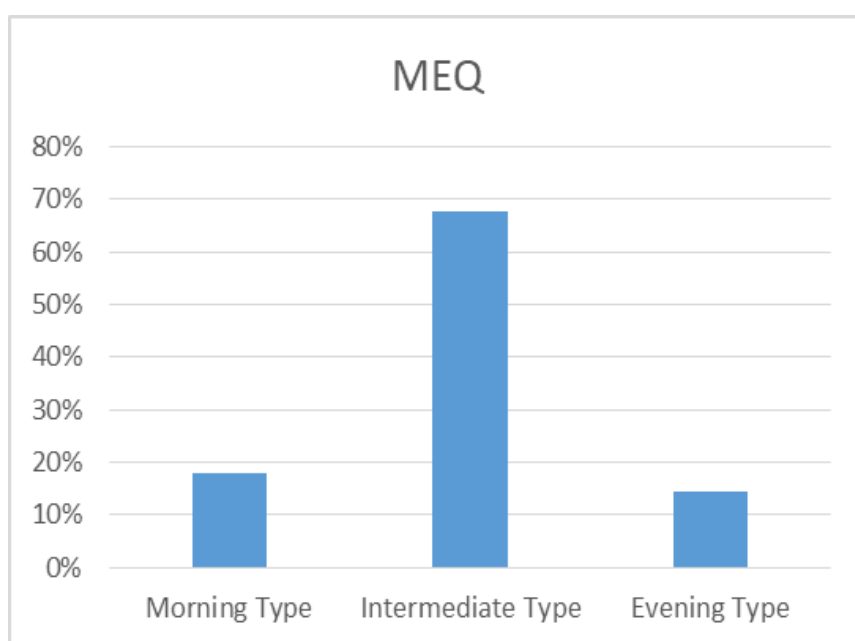


Figure 1. Distribution of students according to chronotypes

Table 2. Students' mean circadian parameters and academic performans

Variable	Mean (SD)	Median [interquartile range]
Social jetlag (h:min)	1.47 (0.94)	1.30 [0.00-4.45]
MEQ scores	49.27 (8.51)	49.00 [23.00-72.00]
Weighted GPA	3.27 (0.41)	3.27 [1.86-4.00]

Note: Social jetlag value represents the absolute difference between mid-sleep on free days and mid-sleep on workdays. MEQ scores indicate chronotypes. MEQ, Morningness-Eveningness Questionnaire; GPA, grade point average

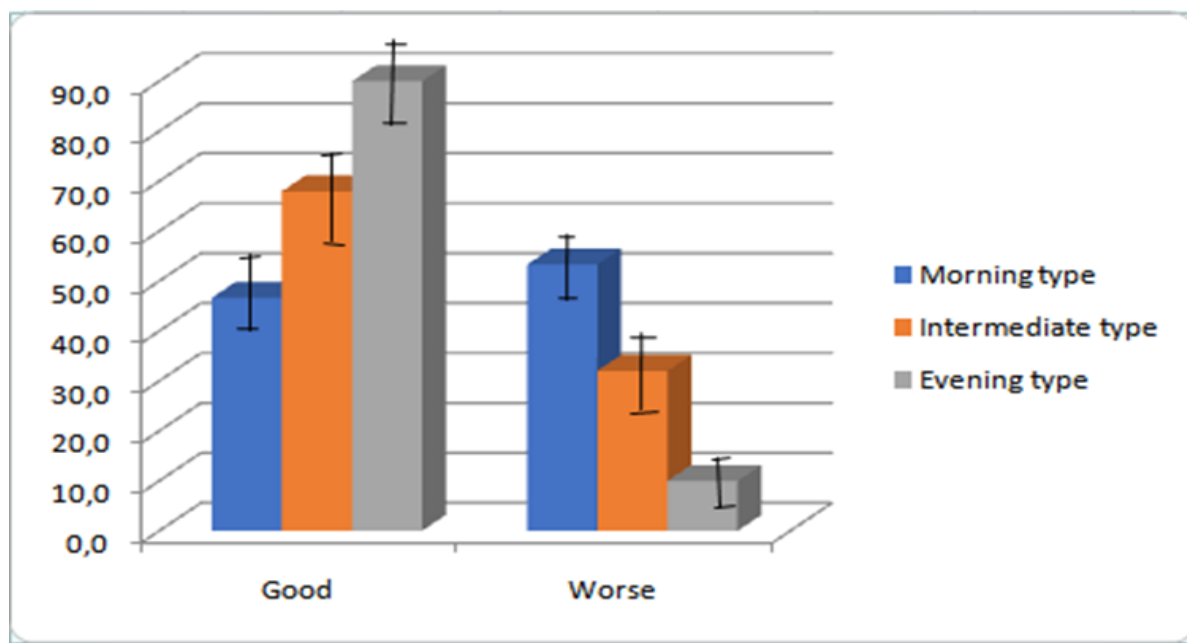


Figure 2. Sleep quality according to chronotypes

Table 3. Relationship between social jetlag, chronotype and academic performance

	Social Jetlag	Chronotype	Academic Performance
Social Jetlag	1.000	-0.309	0.027
p	-	0.00*	0.579
Chronotype		1.000	0.046
p			0.353
Academic Performance		0.048	1.000
p		0.333	-

DISCUSSION

The circadian rhythm is a system that regulates and optimizes physiological events and behaviors in living things [8]. The circadian rhythm provides the management of physiological and behavioral processes, such as physical activity, sleeping, and eating [7]. The evening chronotype and longer duration of social jetlag have been associated

with low academic achievement [15,16,21], memory and cognitive problems [11,18], and poor sleep quality [12]. The current study was conducted to evaluate the relationship of social jetlag and chronotype with academic achievement.

Social jetlag, as assessed by the difference between the median values of sleep hours on weekdays and weekends, measures the discrepancy between biological rhythms and social

timing [8,12]. Unlike jetlag that occurs due to travel and is temporary, social jetlag is permanent [8]. In our study, the mean social jetlag value was 1.47 hours. In contrast to previous research results, this suggests that there is a positive change in social jetlag with staying at home. In a study conducted with university students during the COVID-19 pandemic, Wright et al. found that their social jetlag values decreased [22]. In another study conducted with individuals from Switzerland, Germany, and Australia during a six-week quarantine period in the pandemic, it was determined that there was a 13-minute decrease in the social jetlag values of the individuals [23]. This decrease in the social jetlag value is considered to be because students tend to postpone their sleep-wake cycles as on free days since they do not go to school during the COVID-19 period.

There are many factors that affect the academic achievement of students. In addition to sleep problems, circadian rhythm disturbances affect academic achievement negatively. In the current study, the chronotype classification revealed that the highest number of individuals were the intermediate type. Previously, the intermediate type was reported in 56.38% of nursing students by Santos et al. [24] and 67.1% of those doing health-related majors by Milic et al. [25]. Our findings support the literature.

Chronotype affects the quality of the sleep-wake cycle and sleep deprivation, and thus the learning process of university students is affected [11,14]. In our study, it was observed that the evening-type individuals had lower sleep quality. Since the individuals in the evening chronotype are more exposed to light at night than in the morning, their melatonin release is impaired, which may result in changes in sleep quality and duration [9,15,26]. In the literature, it was found that the sleep quality of individuals with the evening chronotype was worse than that of the morning-type individuals [10,12].

In our study, no significant relationship was found between the students' chronotype characteristics and academic performance. In a meta-analysis study by Preckel et al. , it was reported that the morning type was positively correlated while the evening type was negatively correlated with academic achievement [27]. Similarly, Genzel et al. found a relationship between academic performance and chronotype in medical students [28].

It is considered that the COVID-19 pandemic has created a recovery environment for late chronotypes since they can determine their own schedules and are more flexible. In the current study, we found no significant correlation between the students' overall academic GPA and social jetlag hours. Similarly, Haraszti et al., who evaluated the data obtained from 753 university students, reported that the social jetlag value decreased in the exam periods when they did not go to school, during which they freely adjusted their sleeping and waking

patterns and noted that there was no relationship between social jetlag and academic achievement [21].

CONCLUSIONS

We found that the social jetlag and chronotype variables did not have a significant effect on academic achievement during the ongoing COVID-19 pandemic. Although the chronotype effect was not significant, it was seen that academic performance decreased from the morning to evening type. It is considered that the pandemic leading to the creation of a more comfortable and autonomous schedule has provide an environment for improvement for chronotypes and social jetlag, which has had a positive impact on academic achievement. It is recommended to carry out further, evidence-based and randomized controlled studies on this subject and to consider daily rhythm types while organizing education and training processes to allow individuals to learn more effectively and meaningfully.

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Conflicts of interest

The authors declare that they have no conflict of interest.

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REFERENCES

1. WHO [Internet]. Archived: WHO Timeline-COVID-19. 2020 [cited 2021 May 18]. Available from: <https://www.who.int/news/item/27-04-2020-who-timeline---covid-19>.
2. Bostan S, Erdem R, Öztürk YE, Kılıç T, Yılmaz A. The Effect of COVID-19 Pandemic on the Turkish Society. *Electron J Gen Med*. 2020;17(6):em237.
3. Rahiem MDH. Remaining motivated despite the limitations: University students' learning propensity during the COVID-19 pandemic. *Child Youth Serv Rev*. 2021 Jan;120:105802.

4. Dragun R, Veček NN, Marendić M, Pribisalić A, Đivić G, Cena H, Polašek O, Kolčić I. Have Lifestyle Habits and Psychological Well-Being Changed among Adolescents and Medical Students Due to COVID-19 Lockdown in Croatia? *Nutrients*. 2020 Dec 30;13(1):97.
5. Aristovnik A, Keržič D, Ravšelj D, Tomaževič N, Umek L. Impacts of the COVID-19 Pandemic on Life of Higher Education Students: A Global Perspective. *Sustainability*. 2020;12(20):8438.
6. Marelli S, Castelnuovo A, Somma A, Castronovo V, Mombelli S, Bottoni D, Leitner C, Fossati A, Ferini-Strambi L. Impact of COVID-19 lockdown on sleep quality in university students and administration staff. *J Neurol*. 2021 Jan;268(1):8-15.
7. Sinha M, Pande B, Sinha R. Impact of COVID-19 lockdown on sleep-wake schedule and associated lifestyle related behavior: A national survey. *J Public Health Res*. 2020 Jul 28;9(3):1826.
8. Finger AM, Kramer A. Mammalian circadian systems: Organization and modern life challenges. *Acta Physiol*. 2021 Mar;231(3):e13548.
9. Roenneberg T, Foster RG. Twilight times: light and the circadian system. *Photochem Photobiol*. 1997 Nov;66(5):549-61.
10. Silva VM, Magalhaes JEdM, Duarte LL. Quality of sleep and anxiety are related to circadian preference in university students. *PLoS One* 2020 Sep;15(9):e0238514.
11. Díaz-Morales JF, Escribano C. Social jetlag, academic achievement and cognitive performance: Understanding gender/sex differences. *Chronobiol Int*. 2015 Jun;32(6):822-31.
12. Wittmann M, Dinich J, Mellow M, Roenneberg T. Social jetlag: misalignment of biological and social time. *Chronobiol Int*. 2006;23(1-2):497-509.
13. Fárková E, Šmotek M, Bendová Z, Manková D, Kopřivová J. Chronotype and social jet-lag in relation to body weight, appetite, sleep quality and fatigue. *Biol Rhythm Res*. 2019 Dec;52:1-12.
14. Onyper SV, Thacher PV, Gilbert JW, Gradess SG. Class start times, sleep, and academic performance in college: a path analysis. *Chronobiol Int*. 2012 Apr;29(3):318-35.
15. Beşoluk Ş, Önder İ, Deveci İ. Morningness-eveningness preferences and academic achievement of university students. *Chronobiol Int*. 2011 Mar;28(2):118-25.
16. Chang SJ, Jang SJ. Social jetlag and quality of life among nursing students: A cross-sectional study. *J Adv Nurs*. 2019 Jul;75(7):1418-26.
17. Montaruli A, Castelli L, Galasso L, Mulè A, Bruno E, Esposito F, Caumo A, Roveda E. Effect of chronotype on academic achievement in a sample of Italian University students. *Chronobiol Int*. 2019 Nov;36(11):1482-1495.
18. Ferguson C, Kaneta L, Li A, Nelson F, Satralkar M, Lang A. Chronotype as a Predictor of Academic Success of University Freshmen. *Int J Psychol Neurosci*. 2018;4(2):37-48.
19. Horne JA, Ostberg O. A self-assessment questionnaire to determine morningness-eveningness in human circadian rhythms. *Int J Chronobiol*. 1976;4(2):97-110.
20. Pündük Z, Gür H, Ercan I. Sabahçıl-Akşamcıl Anketi Türkçe Uyarlamasında Güvenilirlik Çalışması. *Türk Psikiyatri Derg*. 2005;16(1):40-5.
21. Haraszti RÁ, Ella K, Gyöngyösi N, Roenneberg T, Káldi K. Social jetlag negatively correlates with academic performance in undergraduates. *Chronobiol Int*. 2014 Jun;31(5):603-12.
22. Wright KP Jr, Linton SK, Withrow D, Casiraghi L, Lanza SM, Iglesia H, Vetter C, Depner CM. Sleep in university students prior to and during COVID-19 Stay-at-Home orders. *Curr Biol*. 2020 Jul 20;30(14):R797-R98.
23. Blume C, Schmidt MH, Cajochen C. Effects of the COVID-19 lockdown on human sleep and rest-activity rhythms. *Curr Biol*. 2020 Jul 20;30(14):R795-R797.
24. Santos TCdMMd, Martino MMFD, Sonati JG, Faria ALD, Nascimento EFdA. Sleep quality and chronotype of nursing students. *Acta Paul Enferm*. 2016;29(6):658-63.
25. Milić J, Milić Vranješ I, Krajina I, Heffer M, Škrlec I. Circadian Typology and Personality Dimensions of Croatian Students of Health-Related University Majors. *Int J Environ Res Public Health* 2020 Jul 3;17(13):4794.
26. Martin JS, Hébert M, Ledoux E, Gaudreault M, Laberge L. Relationship of chronotype to sleep, light exposure, and work-related fatigue in student workers. *Chronobiol Int*. 2012 Apr; 29(3):295-304.
27. Preckel F, Lipnevich AA, Schneider S, Roberts RD. Chronotype, cognitive abilities, and academic achievement: A meta-analytic investigation. *Learn Individ Differ*. 2011 Oct;21(5):483-92.
28. Genzel L, Ahrberg K, Roselli C, Niedermaier S, Steiger A, Dresler M, Roenneberg T. Sleep timing is more important than sleep length or quality for medical school performance. *Chronobiol Int*. 2013 Jul;30(6):766-71.