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Original Article

Chronotype as a predictor of scholar performance in a full-time middle school

Cronotipo como preditor de desempenho em uma escola de ensino médio de tempo integral

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Abstract

The performance of day-to-day tasks, whether satisfactory or unsatisfactory, varies due to several environmental synchronizers, including the 24-hour light-dark cycle. For instance, human performance on physical and/or cognitive demanding activities reaches its peak during the day when the body temperature is at its circadian peak. Individual differences in the circadian peaks in temperature along with individuals' timing of sleep is referred to as chronotype. Here, we aimed to answer if (a) chronotypes affect the performance of students in a Brazilian full-time school with an early start time and if (b) there are differences in performance based on chronotype. We expected to find (a) a positive effect of the morning chronotype on the students' performance, particularly in subjects that take place in early morning; (b) while a negative effect of the evening chronotype in that same period. To address the effect of the chronotype on the students' scholar performance we build a Generalized Linear Mixed Model (GLMM). Results support the hypothesis that the students' performance is partially attributed to their chronotype. In particular, our findings shows that evening-type students are expected to have an increase of 0.038 ($p \leq 0.05$) log counts on their performance in Portuguese classes compared to other chronotypes. Here we add evidence for the effect that individual chronotypes have on the students' performance in a Brazilian full-time middle school. Distinctive features of the studied Brazilian full-time middle school related to chronotypes are discussed.

Keywords: chronobiology, circadian system, sleep, matutine, vespertine.

Resumo

O desempenho em tarefas no dia a dia, seja satisfatório ou insatisfatório, varia devido a diversos sincronizadores ambientais, incluindo o ciclo claro-escuro de 24 horas. Por exemplo, o desempenho humano em atividades físicas e/ou cognitivamente exigentes atinge seu pico durante o dia, quando a temperatura corporal está no pico circadiano. Diferenças individuais nos picos circadianos de temperatura, juntamente com o horário de sono dos indivíduos, são referidas como cronotipo. Neste trabalho o objetivo foi responder se a) os cronotipos afetam o desempenho dos estudantes em uma escola brasileira de período integral e se b) há diferenças no desempenho com base no cronotipo. Esperamos encontrar a) um efeito positivo do cronotipo matutino no desempenho dos estudantes, especialmente em disciplinas que ocorrem no período da manhã; b) enquanto um efeito negativo do cronotipo vespertino nesse mesmo período. Para endereçar o efeito do cronotipo no desempenho acadêmico dos estudantes, construímos um Modelo Linear Generalizado Misto (GLMM). Os resultados corroboraram a hipótese de que o desempenho dos estudantes é parcialmente atribuído ao seu cronotipo. Em particular, nossos resultados mostram que é esperado que os estudantes vespertinos tenham um aumento de 0,038 ($p \leq 0,05$) pontos logarítmicos em seu desempenho em aulas de Língua Portuguesa em comparação com outros cronotipos. Assim, adicionamos evidências para o efeito que o cronotipo têm no desempenho dos estudantes em uma escola de ensino médio integral no Brasil. As características particulares da escola estudada e suas relações com os cronotipos foram discutidas.

Palavras-chave: cronobiologia, sistema circadiano, sono, matutinos, vespertinos.

1. Introduction

The human circadian rhythmicity, a special type of biological rhythm, plays a crucial role in various day-to-day activities, whether exercising, during a nap or performing cognitive demanding tasks (Koukkari and Sothern, 2007). This rhythm describes biological variations, including changes in core body temperature

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and plasma melatonin, which follow a roughly 24-hour cycle (± 4 hours) (Halberg et al., 1977). By comparing an individual's body temperature to specific environmental cues, known as zeitgebers or "time-givers", such as the 24-hour day, researchers can assess the individual's phase of entrainment, a measure of their alignment with the external environment (Roenneberg, 2012; Koukkari and Sothern, 2007). In other words, researchers concerned in the study of biological rhythms can determine the specific times when an individual's body temperature reaches a circadian peak or trough during a 24-hour period, thereby identifying the optimal times for physical exercise or cognitive tasks. For instance, the individuals' performance on such physical and cognitive activities typically peaks during the day, when their body temperature reaches its highest point, and decline during the night when body temperature is at its lowest (Koukkari and Sothern, 2007; Wright Junior et al., 2002). Overall, understanding the role of the circadian rhythm in regulating various physiological processes and its influence on daily activities has important implications for human health and performance.

Furthermore, individual differences in the timing of sleep relative to local time, in conjunction with the circadian peak in body temperature, are collectively referred to as chronotype (Stampi, 1992; Roenneberg, 2012; Foster and Kreitzman, 2004; Kerkhof and van Dongen, 1996). The Morningness-Eveningness Questionnaire (MEQ) provides a subjective measure of an individual's chronotype, as defined by Horne and Östberg (Horne, Östberg 1976). The MEQ scores individuals based on five chronotypes, including definitely morning (MA), moderately morning (MM), indifferent (IN), moderately evening (MV), and definitely evening (VE). Typically, MA individuals display an earlier oral temperature peak compared to VE individuals, in addition to higher daytime temperature and lower post-peak temperature (Horne and Östberg, 1976; Kerkhof and van Dongen, 1996; Adan et al., 2012). Indifferent individuals have temperatures that fall between those of the other chronotypes (Horne and Östberg, 1976; Adan et al., 2012).

In addition, the Horne-Östberg morningness-eveningness questionnaire (MEQ) is a validated measure of an individual's chronotype, based on their sleep-wake cycle (Horne, Östberg, 1976; Valdez et al., 2012; Roenneberg, 2012; Koukkari and Sothern, 2007). The use of the MEQ in controlled populations has enabled researchers to investigate how environmental synchronizers, such as school schedules, impact an individual's internal phase and subsequent performance (Horne and Östberg, 1976; Valdez et al., 2012; Roenneberg, 2012; Koukkari and Sothern, 2007). Through its application, the MEQ has yielded valuable insights into the influence of chronotype on performance in various settings, including organizational environments (Barber et al., 2013), physical activities (Rossi et al. 2015), and educational institutions (Lund et al., 2010; Díaz-Morales and Escribano, 2013; Rique et al., 2014; Arrona-Palacios et al., 2015; Randler and Frech, 2006; Beşoluk et al., 2011). The understanding of chronotypes is essential in determining the optimal time for individuals to perform physical and cognitive activities, which can ultimately enhance their performance and well-being.

In educational settings, there is a clear relationship between students' cognitive performance, both subjectively and academically, and their chronotype (Lund et al., 2010; Díaz-Morales and Escribano, 2013; Rique et al., 2014; Arrona-Palacios et al., 2015; Randler and Frech, 2006; Beşoluk et al., 2011). Research has shown that middle and high school students with a moderately evening (MV) or definitely evening (VE) chronotype may struggle with early school start times (e.g., between 7h and 8h am in Brazilian schools), resulting in shorter sleep durations during weekdays (Carissimi et al., 2016; Sousa et al., 2007, 2009). These students may attempt to compensate for this sleep deficit by sleeping up to 2 hours more on weekends (Sousa et al., 2007). Besides that, the effect of early school start times can be especially detrimental for evening-type students, leading to significant disadvantages compared to their morning-type peers, even in important exams such as those used for university entrance decision (Randler and Frech, 2006). Moreover, research has also shown that early school start times can negatively impact the scholar performance of middle school students with an evening chronotype, further highlighting the importance of considering individual differences in sleep-wake patterns in educational settings (Arrona-Palacios et al., 2015; Rique et al., 2014; Fallone et al., 2002; Shochat et al., 2014).

Therefore, we conducted a study to analyze the impact of chronotype on the subjective and school-declared performance of Brazilian full-time school students. Our goal was to answer if (a) the chronotypes affect the students' school-declared performance, and (b) if there are performance differences between chronotypes. Based on previous research (Lund et al., 2010; Díaz-Morales and Escribano, 2013; Rique et al., 2014; Arrona-Palacios et al., 2015; Fallone et al., 2002; Randler and Frech, 2006; Shochat et al., 2014; Beşoluk et al., 2011) that has examined the effect of chronotype on scholar performance, we hypothesized that (a) morning chronotypes would have a positive effect on scholar performance, particularly in morning classes, and (b) evening chronotypes would have a negative effect during the same period. This study is, to our knowledge, the first to investigate the influence of chronotype on adolescent students' performance in a full-time school.

2. Materials and Methods

2.1. Data availability statement

The datasets generated and analyzed during the current study are available in the Zenodo repository (see Cezário et al., 2022).

2.2. Written informed consent form

The coordinator of the Brazilian full-time middle school signed a Written Informed Consent Form prior to data collection on behalf of the students. Participation was voluntary. Data collection have been performed in accordance with the ethical principles of the Declaration of Helsinki (WMA, 2013). The data collection procedure was conducted in 2019 by RRC as part of his undergraduate thesis.

2.3. Research subjects

Fifty-five (n = 55) students (35 male and 20 female) aged 14 to 15 years participated in data collection. The students were from three different classrooms (A = 14, B = 20, and C = 21) of the 8th grade (i.e., middle school) of a full-time school from 7:30 a.m. to 4:30 p.m.). Only students with a minimum attendance of 75% were eligible to participate in data collection. The students' performance was assessed based on their school-declared grade in three cognitive demanding subjects (Portuguese, Science, and Math) (see, Valdez et al., 2012; Zerbini et al., 2017) during the year 2019, which served as a proxy for their cognitive performance. These subjects were selected based on their relevance and frequency in the school curriculum as well as on the fact that they rely on different mental abilities, fluid (Science and Math subjects) and crystallized intelligence (Portuguese language subject) (Zerbini et al., 2017).

2.4. Assessing the students' chronotype

To assess the students' chronotype, we used the Morningness-Eveningness Questionnaire (MEQ) adapted for the Brazilian population (Benedito-Silva et al., 1990), which assigns a chronotype based on the individual's circadian peaks in temperature (Horne and Östberg, 1976). The Brazilian MEQ contains 19 questions, each with a unique score ranging from 1 to 5. The total score is used to determine the individual's chronotype, with scores of 70-86 indicating a definitely morning (MA) type, 59-69 indicating a moderately morning (MM) type, 42-58 indicating an indifferent (IN) type, 31-41 indicating a moderately evening (MV) type, and 16-30 indicating a definitely evening (VE) type (Benedito-Silva et al., 1990).

2.5. Assessing the students' subjective performance

To further understand the correspondence between school-declared performance and subjective perception, we conducted a qualitative assessment of the students' self-reported performance. Using a Likert scale ranging from 1 (very bad performance) to 5 (very good performance), we asked the students to rate their own performance, providing insights into their impressions and perspectives regarding their scholar achievement.

2.6. Statistical analysis

To address the effect of the chronotype on the students' scholar performance we built a Generalized Linear Mixed Model (GLMM) by using 'lme4' package for R environment (Bates et al., 2015). We used the students' school-declared performance as dependent variables, while the students' chronotype, the school subjects and students' classes were considered our independent variables. The distribution frequency of the students' scholar performance was considered Gamma with a canonical inverse function for the mean values, and a Laplace integral approximation. The model optimizer used for the GLMM was "bobyqa" from 'minqa' package (Bates et al., 2014). The students were considered our variable of random effect.

Then, because our data was not normally distributed, we performed a non-parametric Kruskal-Wallis' test to access the differences between students' subjective and school-declared performance attributed to their chronotypes. Kruskal-Wallis' test allow the comparison between three or more groups (i.e., independent variables) against a continuous variable (i.e., dependent or response variable) (Kruskal and Wallis, 1952). Epsilon Squared (ε^2) effect size is reported. Epsilon Squared assumes the value from 0 (indicating no relationship) to 1 (indicating a perfect relationship) between the variables (Cohen, 1992). All statistical analysis were performed in R environment (R Core Team, 2022). The Kruskal-Wallis test was performed using the 'jmv' package for R environment (The Jamovi Project, 2022).

3. Results

3.1. Morningness-eveningness assessment and students' school grade

The results of the MEQ showed that out of 55 students: none exhibited the definitely morning (MA) chronotype, 3 were moderately morning (MM), 39 were indifferent (IN), 7 were moderately evening (MV), and 6 were definitely evening (VE). The school schedule is reported (Table S1).

3.2. The effect of chronotype on students' performance

Math is the only subject that shows a correlation between subjective and school-declared performance ($p = 0.034$) (Figure 1). There is little agreement between students' perception and teachers' evaluation of performance in Portuguese ($p = 0.919$) and Science ($p = 0.929$) (Figure 1). The Generalized Linear Mixed Model (GLMM) considering the students' performance as dependent variable and the interaction between chronotype and school subjects as independent variable had the lowest Akaike Information Criterion (AIC) value (i.e., criteria for model selection) (Table 1). The model indicates that moderately evening (MV) chronotype is positively associated with performance in Portuguese classes (estimate = 0.038, $p < 0.05$) (Table 2; Figure 2), suggesting that performance is affected by the individuals' chronotype. Despite the majority of Portuguese classes occurring before the students' lunchtime (i.e., 11h55 to 12h55) during late morning (Table S1), they were not considered early. Additionally, the Kruskal-Wallis' test indicated significant differences in the students' school-declared performance across different school subjects that may be attributed to their chronotypes (Table 3). Notably, among the school subjects, the study of the Portuguese language was more impacted by the chronotype (Table 3).

4. Discussion

By using a morningness-eveningness questionnaire (MEQ) adapted for the Brazilian population, we were able to characterize the subjective sleep-wake cycle preferences (chronotype) of middle school students attending an early start time full-time school (from 7:30 a.m. to 4:30 p.m.). Our results showed that the students' chronotype affects their school-declared performance, indicating a positive

Table 1. Generalized Linear Mixed Models (GLMM) showing Akaike Information Criterion (AIC), Bayesian Information Criterion (BIC), log-Likelihood (logLik), Deviance, chi-square difference test ($\chi 2$), and probability value (*P*). The GLMM was built to unravel the relationship between students' chronotype and performance. The students were treated as a random effect. Significant results are highlighted in bold ($\alpha = 0.05$).

Model	AIC	BIC	logLik	Deviance	$\chi 2$	*P*
†School-declared performance ~ chronotype *subjects*class + (1|students)	464.64	573.35	-197.32	394.64	30.254	0.087
†School-declared performance ~ chronotype*subjects + (1|students)	452.89	496.38	-212.45	424.89	17.049	**<0.05**
†School-declared performance ~ chronotype*class + (1|students)	467.94	508.32	-220.97	441.94	0.000	1.000
†School-declared performance ~ subjects*class + (1|students)	454.75	488.91	-216.37	432.75	13.542	**<0.05**
School-declared performance ~ chronotype + subjects + (1|students)	457.60	482.45	-220.80	441.60	0.052	0.820
School-declared performance ~ chronotype + class + (1|students)	462.29	487.14	-223.14	446.29	0.000	---
School-declared performance ~ subjects + class + (1|students)	455.65	477.39	-220.82	441.65	6.829	**<0.05**
School-declared performance ~ chronotype + (1|students)	460.48	479.11	-224.24	448.48	0.047	0.829
School-declared performance ~ subjects + (1|students)	453.58	469.11	-221.79	443.58	6.877	**0.032**
School-declared performance ~ class + (1|students)	458.53	474.06	-224.26	448.53	0.000	---
‡School-declared ~ 1 + (1|students)	456.46	465.78	-225.23	450.46	---	---

†Models considering the interaction between the independent variables; such interactions are denoted with an asterisk (*); ‡Null model.

Table 2. Fixed effects for the Generalized Linear Mixed Model (GLMM) showing Estimate, Standard Error (SE), and t-value for each predictor. The GLMM examines the effect of students' chronotype and school subjects (independent variables) on scholar performance (dependent variable), while considering the students as a random effect.

	(Intercept)	Estimate	SE	t-value	*P*
		0.161	**0.007**	**23.743**	**<0.05**
Chronotypes	MM	0.007	0.025	0.276	0.782
	MV	0.002	0.016	0.123	0.902
	VE	-0.007	0.019	-0.385	0.700
Subjects	Pt	0.004	0.003	1.083	0.279
	Sc	-0.003	0.003	-0.778	0.437
Interactions	MM:Pt	0.008	0.014	0.617	0.537
	MV:Pt	0.038	0.011	3.581	**<0.05**
	VE:Pt	-0.013	0.009	-1.355	0.175
	MM:Sci	0.008	0.013	0.645	0.519
	MV:Sci	0.009	0.010	0.914	0.360
	VE:Sci	-0.004	0.009	-0.455	0.649

Significant results are highlighted in bold ($\alpha = 0.05$). The estimate value indicates a positive response of the student's performance when predictors are held constant, except for moderately morning (MM) chronotypes in Portuguese classes. MM = moderately morning; MV = moderately evening; VE = definitely evening; Pt = Portuguese; Sci = Science.

Table 3. Kruskal-Wallis' tests showing chi-square difference test ($\chi 2$), Degree of Freedom (DF) and epsilon-squared (ε^2) effect size considering the differences between students' subjective and school-declared performance for Science, Portuguese, and Math, with students' chronotype as the grouping variable. The tests showed a medium effect of chronotype on school-declared performance for Portuguese ($\varepsilon^2 = 0.14$), and no significant effects for Science and Math.

	School subjects	$\chi 2$	DF	p	ε^2
School-declared performance	Science	2.281	3	0.516	0.042
	Portuguese	7.962	3	**0.047**	0.147
	Math	0.450	3	0.930	0.008

Significant results are highlighted in bold ($\alpha = 0.05$).

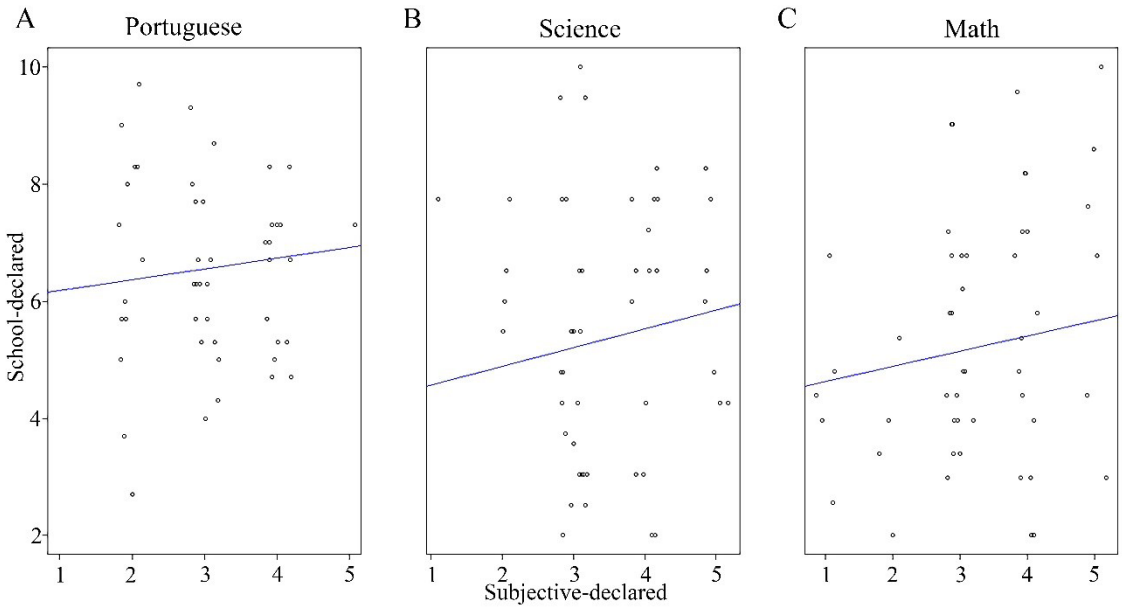

Figure 1. Scatterplot of subjective-declared against school-declared performance for Portuguese (A), Science (B) and Math (C) subjects. The measures were found to be significantly correlated for Math ($p = 0.034$). There was little agreement between students' perception and teachers' evaluation of performance in Portuguese ($p = 0.919$) and Science ($p = 0.929$). To reduce data point superposition, subjective-declared performance was jittered.

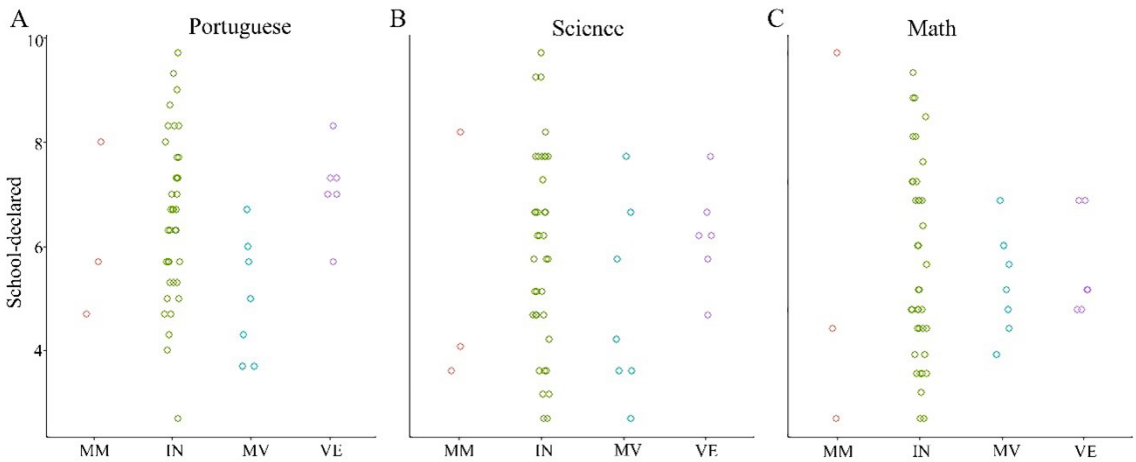

Figure 2. Scatterplot showing the impact of chronotype (MM, IN, MV, and VE) on school-declared performance for Portuguese (A), Science (B) and Math (C) subjects. The plot shows that moderately evening chronotypes demonstrate lower school-declared performance in Portuguese classes. MM = moderately morning; IN = indifferent; MV = moderately evening; VE = definitely evening chronotypes.

effect on Portuguese classes. Notably, although we expected moderately evening students to perform poorly, this was not the case, possibly due to the fact that most Portuguese classes were held during the late morning (between 9:25 a.m. and 12:55 p.m.) after the mid-morning break, which provided enough time for these students to become alert. Other studies showed similar patterns regarding language school subject, though their results were from schools of either morning, afternoon, or evening start times (Goldin et al., 2020; Zerbini et al., 2017). Indeed, evening-type students exhibit slightly higher grades in language subjects in evening school timing compared to out-of-phase, morning students. Even in schools of early start time the effect of chronotype on language grade is very low or almost absent (Goldin et al., 2020; Zerbini et al., 2017). These results highlight the importance of considering students' chronotype when scheduling classes.

Chronotype is a crucial aspect of students' lives from a (chrono)biological but also from a decision- and policy-making standpoint (Lund et al., 2010; Díaz-Morales and Escribano, 2013; Rique et al., 2014; Arrona-Palacios et al., 2015; Fallone et al., 2002; Randler and Frech, 2006). For instance, students who are out of phase tend to experience lower subjective and school-

declared performance due to their poorer sleep quality, in contrast to their entrained counterpart (Lund et al., 2010; Díaz-Morales and Escribano, 2013; Rique et al., 2014; Arrona-Palacios et al., 2015; Fallone et al., 2002; Randler and Frech, 2006). In middle and high schools, poor sleep quality has been associated with a decline in quality of life, which manifests in various psychosocial disorders such as increased drug use and risk-taking behaviors, depressed mood, motor and cognitive deficits, and a decrease in academic performance (Wolfson and Carskadon, 1998; Shochat et al., 2014; Wolfson and Carskadon, 2003; Fallone et al., 2002; Randler and Frech, 2006; Lund et al., 2010; Díaz-Morales, Escribano 2013; Rique et al. 2014; Arrona-Palacios et al. 2015). These findings suggest that sleep quality is an essential component of overall health and that addressing sleep-related issues in students may improve their scholar performance and overall well-being.

Results show that moderately morning chronotypes tended to have a positive effect in students' performance. Morning individuals exhibit a circadian temperature peak earlier than evening individuals as well as higher daytime temperature and lower post peak temperature (Horne and Östberg, 1976; Kerkhof and van Dongen, 1996; Adan et al., 2012). Moreover, the performance of moderately morning students increases during the day, whilst decreases during the night (Koukkari and Sothern, 2007; Wright Junior et al., 2002). Hence, morning-type students may not have the same difficulties as evening-type students when it comes to wake up early because of the school start time. Indeed, morning-type students usually have higher school-declared performance compared to evening students in schools which have early start time. For instance, morning-type students from an early start time Spanish middle school (aged between 10 and 14) declare higher subjective performance than evening students (Díaz-Morales and Escribano, 2013) (see also Fallone et al., 2002; Wolfson and Carskadon 2003, 1998; Shochat et al., 2014). Nonetheless, the positive effect of the evening chronotype on the students' performance may be an artifact caused by the subjective character of the MEQ as the students' subjective performance did not correlate with their school-declared performance (i.e., the performance obtained in the school tests and schoolwork); or yet, as our study suggest, the full-time school may be the cause of this effect of the chronotype on the students' performance.

Meanwhile, the definitely-evening chronotype tended to have a negative effect on the students' performance. Perhaps a larger sample size would enable us to better understand the chronotype effects on definitely-evening individuals, who are known to be even more affected by early start times in schools. In Brazilian schools, which typically start between 7 and 8 am, evening-type students may struggle to wake up early and experience significant performance disparities compared to morning-type students. This finding is consistent with results from German high schools, where evening-type students have been found to perform worse on school exams than morning-type students (Randler and Frech, 2006). In their final year in high school, the final exams of these students are used for university entrance decisions, so a poor school performance may negatively affect their future life choices (Randler and Frech, 2006). Once in university, because of the early university start time out of phase students (i.e., evening-type students) also suffer from sleep deprivation and in consequence achieve lower academic performance (Beşoluk et al., 2011; Rique et al., 2014; Medeiros et al., 2001). As sleep deprivation have chronic effects on the students' life quality and had become a serious public health issue, schools and universities should adopt measures to circumvent this problem. The partnership between sleep scientists and educators should allow a better understanding of how sleep patterns impact scholar performance (Wolfson and Carskadon, 1998; Shochat et al., 2014; Wolfson and Carskadon, 2003; Mazzilli Louzada and Pereira, 2019). Policymakers and researchers should develop targeted interventions to increase students' sleep hygiene, prevent the negative effects of an out-of-phase chronotype on performance, and promote better scholar outcomes (Wolfson and Carskadon, 1998; Shochat et al., 2014; Wolfson and Carskadon, 2003).

Additionally, several unique factors of the Brazilian full-time middle school that was studied may have contributed to the observed effects of chronotypes on school-declared performance, especially the positive response of moderately evening students in language subjects. First, the school schedule has its start time at 7h30 in the morning, which is 30 minutes later than many other Brazilian schools. This small delay led to a shift in students' bedtimes and have a substantial positive impact on their mood (Owens et al., 2017). Second, along with the traditional school subjects (see Brasil, 1996) the full time-school studied here offers subjects such as (i) "life project", where students discuss their aspirations; (ii) "elective courses", which allow students to diversify their learning; and (iii) "guidance", which provides students with an opportunity to resolve any doubts they may have about their coursework. Third, the larger number of breaks between the classes in the full-time school, such as 9:10 to 9:25 am and 11:55 am to 12:55 pm, compared to non-full-time schools, could provide students with an opportunity to interact with each other, eat their snacks, and recharge their energy. Future studies should explore these factors further to determine their specific contributions to the observed effects of chronotype on scholar performance.

In sum, the present study add evidence demonstrating the impact of individual chronotypes on the scholar performance of middle school students attending to full-time schools. Our results support the hypothesis that evening-type students tended to have worse performance than morning-type students in early start time schools. Additionally, the results suggest that chronotype is a significant predictor of scholar performance and that scholar performance are partially because of chronotype. We conclude that future studies should address the relative effects that sleep deprivation have on the students' school and academic performance along with their socioeconomic and cultural context. A larger sample of male and female subjects of different age (Duarte et al., 2014; Koukkari and Sothern, 2007) and from different locations (Leocadio-Miguel et al., 2017; Koukkari and Sothern, 2007) may provide greater support to our results. As previously

(Shochat et al., 2014) suggested, interventions designed to promote healthy sleep practices in school and university students are needed.

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Supplementary Material

Supplementary material accompanies this paper.

Table S1. Students' school grade from three (9A, 9B and 9C) different classes of the 8th grade (i.e., middle school) of a full-time school in the São Carlos, SP, Brazil. Bold designates the school subjects of which the student's performance were obtained. Pt = portuguese; Pratic = practical class; Hist = History; Geo = Geography; Eng = English lesson; Pj = Student Protagonism; Phy Ed = Physical Education; Pv = Life Project; Oe = Guidance; Elet = Elective course.

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