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Sleep in Adolescents : Sleep and the Prediction of Academic Investment and Achievement

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Abstract

This study was part of a larger and ongoing research effort involving the investigation of aggression, socioeconomic status, student productivity, social functioning, sleep patterns, school environment, and academic achievement in 892 high-school adolescents. The present study specifically examines potential psycho-physiological, environmental, and habitual predictors of adolescent academic achievement and academic investment. Students were assessed on various dimensions including instances of insomnia, restless leg syndrome, sleep hygiene; and attributes such as demographics, academic investment, and GPA. It was hypothesized that participants' levels of sleep disturbances, would in turn significantly predict grade point averages. Furthermore, it was believed that sleep quality, measured via reported sleep disturbance scores, would significantly predict a student's degree of academic investment. Lastly, rates of electronics usage just prior to bedtime would significantly predict students' reported GPA's, in addition to their self-reported levels of academic investment. Results of the study confirmed three of the four experimental hypotheses. Greater quantities of student sleep disturbances was significantly predictive of lower academic investment levels; more frequent usage of Electronics at Sleep Onset was significantly predictive of lower reported GPA's, and more frequent usage of Electronics at Sleep Onset was significantly predictive of lower academic investment levels.

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Sleep in Adolescents:

Sleep and the Prediction of Academic Investment and Achievement

by

Justin Farhat

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A considerable amount of time, effort, and resources have been devoted to understanding sleep (Cappuccio et al., 2008; Fallone, Acebo, Seifer, & Carskadon, 2005; Gregory & O'Connor, 2002; Ireland & Culpin, 2006; Meltzer et al., 2013; Meltzer et al., 2014; Meltzer & Mindell, 2006; Meltzer & Mindell, 2007; Mindell & Meltzer, 2008; Mindell, Meltzer, Carskadon, & Chervin, 2009; Moore & Meltzer, 2008; Navara & Nelson, 2007; Smaldone, Honig, & Byrne, 2007). The complexity of sleep as a physiological process poses challenges to understanding the implications of sleep quality and subsequent effects of poor sleep. Given the proportion of time that an individual spends sleeping, furthering comprehension and acquiring new information are especially important. To put this proportion of time into perspective, by the time a child reaches the age of 18 years, he or she will have spent approximately 40% of his or her life sleeping (Meltzer et al. 2013). Getting an adequate amount of sleep becomes even more critical as children progress from pre to post adolescence (Carskadon, 1990a; Dahl and Carskadon, 1995; Fredriksen, Rhodes, Reddy, Way, 2004).

Many studies including cross-sectional, longitudinal, and cohort research, have demonstrated relationships between poor sleep quality and many physical, behavioral, and psychological issues (Carskadon, 1990a; Chervin, Dillon, Archbold, & Ruzicka, 2003; Dahl & Carskadon, 1995; Fallone et al., 2005; Fredriksen et al., 2004; Jackson, Grilo, & Masheb, 2000; Meltzer et al., 2013; Meltzer et al., 2014). Conditions such as obesity, increased aggression, and attention problems have all been shown to correlate with poor sleep (Jackson et al., 2000; Rivas, 2014; Chervin et al., 2003; Fallone et al.,

2005). One topic of particular concern relates to the roles that sleep quality and quantity play in affecting academic performance. Several researchers have long held the belief that adequate sleep is essential to academic success (Amschler & McKenzie, 2005; Fallone et al., 2005; Fredriksen et al., 2004; Moore & Meltzer, 2008).

The purpose of this particular study was to better understand the role that different sleep variables (e.g. Symptoms of restless legs, insomnia, parasomnias, bedtime fears, and sleep hygiene) play in predicting grade point average and academic investment. Additionally, several demographic measures, such as socioeconomic status (SES), age, race, and gender have been introduced into the analysis to serve as control variables by better identifying any significant variability potentially caused by these outside of our primary predictors. The inclusion of these demographic measures ideally will control for the effects of any covariation and help test for the effects that sleep disturbances and electronic use at sleep onset have on our criteria.

Importance of Sleep in Children and Teens

Research has demonstrated the crucial roles that sleep plays in relation to child and adolescent development as well as the consequences of inadequate sleep (Cappuccio et al., 2008; Fallone et al., 2005; Gregory & O'Connor, 2002; Ireland & Culpin, 2006; Meltzer et al., 2013; Meltzer & Mindell 2006; Meltzer & Mindell, 2007; Mindell et al., 2009; Mindell & Meltzer, 2008; Moore & Meltzer, 2008; Navara & Nelson, 2007; Smaldone et al., 2007). Children and teens who suffer from high levels of sleep disturbances often fail to perform to the level of their full cognitive potential (Peigneux, Laureys, Delbeuck, & Maquet, 2001; Stickgold, Hobson, Fosse & Fosse, 2001). A number of studies past have provided evidence of the existence for a significant

interdependence between sleep, learning, and memory (Moore & Meltzer, 2008; Peigneux et al., 2001; Stickgold et al., 2001). An experiment conducted by Peigneux et al. (2001) demonstrated that sleep deprivation frequently impairs mental tasks such as those associated with word fluency, decision-making, short-term memory, and the ability to recall learned information. More specifically, several studies have demonstrated the importance of humans getting sufficient amounts of REM (Rapid Eye Movement) sleep, the stage of sleep that most commonly occurs toward the end of a person's nightly sleep-cycle. Research has shown REM sleep to be an essential component of the human sleep pattern, particularly during early childhood development (Mastin, 2013).

Furthermore, as children approach adolescence, they generally tend to undertake later bedtimes and are faced with earlier school start times (Fredriksen et al., 2004; Meltzer et al., 2014). Although adolescents tend to obtain fewer hours of rest than their younger counterparts, research has shown that teens may in fact require relatively more sleep than before. By the time teens have reached mid-adolescence, those within this age group have been found to experience greater fatigue during the day, while older adolescents become tired in the daytime even in cases when they received as much sleep as younger adolescents (Carskadon, 1990a; Dahl and Carskadon, 1995; Fredriksen et al., 2004).

Measuring Sleep Quality

There are many complexities and complications to consider while attempting to measure quality of sleep. Methods of objective assessment for sleepiness or fatigue, generally conducted by clinicians, can be both time-consuming and costly, and in fact are

not offered by many sleep disorder clinics (Miletin & Hanly, 2003). The Multiple Sleep Latency Test is one such objective assessment, however the impediments mentioned have given rise to a number of more practical and efficient measurement alternatives (Meltzer et al. 2013; Meltzer & Mindell, 2006; Miletin & Hanly, 2003; Mindell & Meltzer, 2008; Moore & Meltzer, 2008; Peigneux et al. 2001). This need for substitute methods has resulted in researchers developing and utilizing new scales and tools for the purpose of assessing sleep quality. Two examples of such tools include the Epworth Sleepiness Scale (ESS), and the Pittsburgh Sleep Quality Index (PSQI) (Chervin, Aldrich, Pickett, & Guilleminault, 1997; Ireland & Culpin, 2006; Miletin & Hanly, 2003).

The ESS is a questionnaire that was developed with the purpose of differentiating individuals with excessive daytime sleepiness from alert individuals by measuring sleep propensity or waking/sleep-drive interactions (Miletin & Hanly, 2003). This assessment asks respondents to report their likelihood of dozing-off in eight different typical daily situations as measured on a four-point Likert scale (Miletin & Hanly, 2003). Some examples of these typical daily situations include sitting and reading, watching TV, and sitting as a passenger in a car for an hour without a break (Chervin et al., 1997). However, multiple researchers have expressed their opinions regarding a key deficiency in the ESS, in the belief that the eight items or situations that were chosen to comprise the questionnaire were poorly described by its developers within their publications, neglecting to provide adequate justification for their inclusion (Miletin & Hanly, 2003). Furthermore, the ESS has an additional limitation in that certain situations may not be applicable to all age or demographic groups.

Recently, one of the more commonly used questionnaires, specifically in the assessment of children and adolescents has been the Children's Report of Sleep Patterns (CRSP: Meltzer et al., 2013). The questionnaire is another example of a self-report measure of sleep. Initially developed for utilization with school-aged children, its reliability and validity have since been examined and confirmed in studies involving adolescent participant samples (Meltzer et al., 2013; Meltzer et al., 2014). Meltzer et al. (2014) obtained results for the adequate internal consistency and test-retest reliability of the various sleep scales that comprise the CRSP when used with adolescent samples, of which are presented in Table A1. With the only exception being the Bedtime Fears/Worry scale ($\alpha = 0.61$), all of the other Sleep Disturbance scales and sub-scales met, or exceeded the minimum consistency requirement for group comparisons set for the study ($\alpha \geq 0.70$). Meltzer et al. (2014) states that the three questionnaire items within the Bedtime Fears/Worries Sleep Disturbance sub-scale are not necessarily expected to have a strong relationship with one another. For example, "An adolescent with fears may not also be thinking about the next day or worry" (Meltzer et al., 2014). Ultimately, with regard to test-retest reliability, medium to large correlations between test administrations were found for most of the CRSP subscales when testing for inter-rater reliability (r = 0.34-0.82) (Meltzer et al., 2014). In terms of construct validity, significant multivariate effects were found for both the Sleep Hygiene Indices, one of which is the Electronics Use at Sleep Onset Index, and for the Sleep Disturbance Scales, including age ($F(18, 1058) = 1.88$, $p = 0.015$) and sleep quality ($F(9, 530) = 21.01$, $p < 0.001$) (Meltzer et al., 2014).

The CRSP is a three-module assessment of Sleep Patterns, Sleep Hygiene, and Sleep Disturbances. Replication studies have demonstrated the CRSP's reliability and validity as a self-report measure, through the use of these three sleep modules both in combination or independently (Meltzer et al., 2013). The reliability and validity of the CRSP are feats in their own right considering the degree of complexity involved in effectively measuring sleep quality. For example, Sleep Patterns tend to change with age and although many parents may believe they have an overall awareness of their child's bed and wake times, study results have suggested that as much as 60% of students are awake at least several nights per week when their parents thought that they were asleep (Amschler & McKenzie, 2005).

Measuring Sleep Hygiene can be just as complex and also in part as a result of parents being unaware of their children's sleep habits. The CRSP includes four distinct Sleep Hygiene indices: Caffeine Index, Activities Before Bed Index, Sleep Location Index, and Electronics Use at Sleep Onset. These indices include questions regarding caffeinated beverage intake throughout the day, involvement in athletic activities, sleeping in bed or on a couch, and listening to music just prior to sleep.

Sleep Disturbances differs from the other modules in that some disturbances such as sleep disordered breathing or partial arousal parasomnias are more likely to be reported and recognized by parents since children are usually unaware of related behaviors such as snoring or sleepwalking (Meltzer et al., 2013; Meltzer et al., 2014). The CRSP accounts for this by phrasing such sleep disturbance questions appropriately. The sleep disturbances module also includes items to assess bedtime fears and worries of

children and teens, as well as symptoms of Restless Leg Syndrome that negatively affect sleep (Meltzer et al., 2013; Meltzer et al., 2014).

Sleep and academic achievement. Recent technological and methodological advancements in the fields of biology and psychology have begun to provide a convincing body of evidence suggesting the importance and role of sleep in learning and academic achievement (Fallone et al., 2005; Fredriksen et al., 2004; Meltzer et al., 2013; Moore & Meltzer, 2008; Stickgold, James, & Hobson, 2000). For example, research has shown that adolescent's show improvement on a variety of learning tasks, such as visual discrimination exercises, only after getting a sufficient amount of sleep (Stickgold et al., 2000). Unfortunately however, longitudinal research of sleep-needs through puberty have demonstrated that adolescents require more than 9 hours of sleep at night to optimally function during the day; a quantity that only about 15% of teens attain (Moore & Meltzer, 2008). In a study conducted by Fallone et al. (2005), researchers attempted to determine the effects of experimental sleep restriction on teacher ratings of academic performance and behavior in children. The children were assigned to one of three groups, each of which involved a specific sleep schedule that differed in quality in comparison to the two alternatives. At the end of each study condition, teachers filled out questionnaires and assessed such factors as academic problems, disruptive behaviors, aggression, sleepiness, and attention (Fallone et al., 2005). The overall findings of Fallone et al. (2005) support the notion that sufficient time in bed is critical to high-level academic functioning in children and that restriction of sleep leads to a variety of adverse

consequences including total attention problems, increased aggression, disruptive behaviors, academic problems, and increased severity of attention problems.

A review authored by Moore and Meltzer (2008) provides additional evidence highlighting the crucial role of sleep in academic performance. Moore and Meltzer (2008) explain that 28% of US high school students report falling asleep at school at least once a week. Perhaps more importantly, 80% of high school students who reported obtaining an optimal amount of sleep (>8.5 hours) also reported earning grades within the A-B range in comparison to teens that obtained insufficient sleep reporting lower grades (Moore & Meltzer, 2008). In addition, parents of preadolescent children with inadequate sleep are more likely to report that their child has problems at school, depressive symptoms, and or personal safety concerns (Smaldone et al., 2007). Despite the prevalence of such relationships demonstrated in research, approximately 40% of parents are not aware of their child's difficulties with sleep onset latency, night wakings, or poor sleep quality, when such conditions exist (Meltzer et al., 2013).

Although evidence exists as a result of these different studies, some scholars believe that the available data produced thus far is too limited to draw any definitive relationships regarding sleep, memory, and learning. Peigneux et al. (2001) specifically call into question the idea that the consolidations of non-declarative and declarative memories are dependent upon REM sleep processes. The issues raised by Peigneux et al. (2001) are confirmed by other researchers such as Maquet (2001), who emphasizes the idea that the underlying role of sleep in memory and learning has yet to be accurately characterized.

Electronics use at sleep onset. The unprecedented rate of innovation, invention, and advancements in technology seen during the past 20 years has resulted in price decreases observable with many electronic devices on the market today. This decrease in price has inevitably led to widespread availability and ownership of items such as smart phones, tablets, and LED televisions. In fact, nearly two-thirds of Americans own a smart phone today, and with manufacturers constantly improving cell phone capability, individuals have become more reliant on such devices throughout their daily functioning than before (Smith & Page, 2015). Smart phone users now have virtually instant access to information that in the past, has been available to a much more limited population. In addition to more accessible information, smart phone users now have a constant source of digital entertainment available including music and video. However despite the apparent benefits, this accessibility and dependence has created some cause for concern. Research has shown that individuals with relatively low income and educational attainment levels, as well as younger adults, are especially likely to be more dependent on smart phones (Smith & Page, 2015).

This trend has been shown to result in a variety of adverse experiences for those who have poor sleep habits. In a 2013 study, children who classified themselves as poor sleepers reported more frequent use of electronics at sleep onset in addition to greater amounts of sleep disturbances (Meltzer et al., 2013). Additionally, the use of electronics prior to sleep can have a profound effect in disrupting an individual's circadian rhythm. In relatively simplistic terms, the circadian rhythm is the human biological clock that regulates appropriate behaviors relative to the time of day. One such behavior is the induction of sleep after sundown. However several studies have shown that the light

emitted by electronics, especially those with LED screens, can suppress the secretion of melatonin; the primary chemical produced by the brain to initiate sleep (Harvard, 2015; Navara & Nelson, 2007). The idea that greater electronics usage at sleep onset contributes to a disruption in sleep patterns and limits certain cognitive functions while awake is feasible. These limitations can potentially result in constrained learning ability. With research providing evidence for more widespread smart phone and electronic device usage among youth, this trend increases the potential of more electronic use at sleep onset, and in turn negatively affecting sleep quality and academic achievement or investment.

Academic investment. Some students tend to consistently assess the educational consequences of their behaviors in relation to their future academic goals (Peetsma & van der Veen, 2010). It is this type of assessment and appraisal of future goals, such as earning high grades, that often motivates students to put forth the necessary effort and learning behavior to achieve them (Nuttin & Lens, 1985). These efforts and behaviors can be seen as an example of academic investment or investment in learning. More specifically, researchers see this type of educational investment as a component of self-regulated learning (Zimmerman, 2000). Unfortunately, research has often shown that students tend to experience a decline in motivation, investment in learning, and academic achievement in secondary level education (Peetsma & van der Veen, 2010). However, there have been very few longitudinal studies concerning students' investment in learning and academic achievement, and the current list of possible predictors of academic investment remains quite extensive (Peetsma & van der Veen, 2010). A number of researchers have emphasized the importance of academic investment as a predictor of

academic achievement (Robbins, Allen, Casillas, Peterson, & Le, 2006). For example the results of one study suggested that academic investment of effort adds significantly to the ability to predict students' freshman year grade point average and persistence into their sophomore year (Robbins et al., 2006).

In a 2002 study, researchers Alice Gregory and Thomas O'Connor conducted a longitudinal study in Colorado, U.S. to examine the specificity, order of appearance, and developmental changes in relationships between sleep problems, emotional problems, and behavioral problems in children and adolescents (Gregory & O'Connor, 2002). Such problems include, but are not limited to, attention problems, eating disorders, anxiety disorders, depression, and borderline personality disorder (Gregory & O'Connor, 2002). Four hundred and ninety children were observed from the ages of 4 to 15 years. During that time-span, the researchers continuously collected parental ratings of any sleep and or any of the aforementioned problems displayed by the children. They found that overall, sleep problems decreased with age, however, the existence of such problems early on in childhood predicted behavioral and emotional problems in early adolescence. More specifically, their results demonstrated a significant correlation between sleep problems and anxiety/depression, a correlation that increased significantly as children aged into mid-adolescence (Gregory & O'Connor, 2002). The development of anxiety or depressive disorders in adolescent students can have a serious impact on a student's academic investment. For example, time spent in a state of anxiousness or depression when a student is concerned about earning a poor grade, is time that could be better utilized by strengthening the particular area of academic deficiency and improving academic confidence. Academic stressors that can often lead to anxiety or depression

include a student's self-perception of the knowledge base required to excel in class and the perception of inadequate time to develop that knowledge base, usually through studying (Carveth, Geese, & Moss, 1996). In fact, students report experiencing the highest levels of academic stress as a result of studying for exams, concerning themselves with grade competition amongst their peers, and mastering academic concepts within a given timeframe (Carveth et al., 1996). Other studies have demonstrated similar findings with regard to a relationship between mental health and academic achievement and investment. In one of the first studies of its kind, Eisenberg, Golberstein, and Hunt (2009) examined how mental health predicts academic success in students. They found that depression is a significant predictor of a lower GPA and higher probability of dropping out of school, especially for students who suffer from an anxiety disorder.

Study Overview and Description

Despite research to identify primary predictors of academic performance and academic investment, the results of studies have failed to yield a comprehensive set of factors that involve sleep related variables. The present study highlights four research areas in particular, all of which are related to sleep quality. First, children and adolescents who suffer from a greater degree of sleep disturbances often display poorer academic achievement. Next, those students who report poor sleep quality also tend to demonstrate lower levels of academic investment. Finally, students who more commonly engage in usage of electronics just prior to bedtime generally experience lower levels of academic achievement and academic investment.

The questionnaire (SCUBA: Donoghue & Raia-Hawrylak, 2016) utilized to test the predictability of these construct relationships draws primarily upon the Children's

Report of Sleep Patterns (CRSP: Meltzer et al. 2013; Meltzer et al. 2014) for scale items and scoring (Table A2). The current study utilized a total of five primary predictor variables and four secondary control variables to determine scores for two separate criteria through the development and analysis of a series of regression equations.

Four of the five primary predictors used in the regressions were drawn from the Sleep Disturbances scale of the Children's Report of Sleep Patterns (CRSP: Meltzer et al., 2013; Meltzer et al., 2014). These four predictors included Bedtime Fears and Worries, Restless Leg Scale, Insomnia, and Parasomnias. The fifth predictor and scale, Electronics Use at Sleep Onset was also developed by Meltzer et al. (2013) for the CRSP, however unlike the four Sleep Disturbance scales, is classified as a measure of Sleep Hygiene.

The two criteria in this study are Academic Achievement (represented in GPA) and Academic Investment. Finally, the four control variables utilized include age, socioeconomic status, gender, and race. The goal of the present study was to examine the respective scores for each of the five predictor–scales in addition to the four control variables and their relation to academic investment and academic performance. ~~than their peers. By investigating the roles of these attributes and their relationships, the present study provided a cross sectional context to understanding and identifying some of the factors that commonly contribute to lower grade point averages and academic investment.~~

Commented [J1]: Possible discussion content.

Research hypotheses in question. The research conducted throughout the present study attempted to investigate four hypotheses in particular. For H1 we expected a significant predictive association between any of the four types of sleep disturbances

(IV/Predictors) and students' reported grade point averages (DV). Next, (H2) we expected a significant predictive association between any of the four types of sleep disturbances (IV/Predictors) and levels of academic investment (DV). In addition, (H3) we expected a significant predictive association between electronics use at sleep onset (IV/Predictor) and reported GPA's (DV). Lastly, (H4) we expect a significant predictive association between frequencies of electronics use at sleep onset (IV/Predictor) and levels of academic investment (DV).

Methods

Participant Sample

The present study utilized purposive sampling and took place in a high school within a primarily middle-class suburb in New Jersey. Students were primarily of ages 15-18 years (M = 16.03, SD = 1.25) and Caucasian, with minority races accounting for approximately 16% of the sample. Approximately 40% (N=377) of participants were male and 54% (N=501) were female, with the remaining percentage of subjects indicating that they prefer not to answer the item regarding gender during the survey.

Recruitment letters and consent forms were sent home for all students to be signed by their respective parents. In accordance with New Jersey P.L.2001, c.364 (C.18A:36-34), which concerns surveys involving questions pertaining to anti-social behavior, parents were required to provide written informed consent in order for their children to be eligible for participation. As an incentive, all students who returned their form were offered a chance to win one of four $25 gift cards through a randomly selective process. Entry into the raffle required only that the forms be returned, regardless of a signature granting participation. Students, who were over the age of 18

and thus considered adults, were provided with an alternative consent form on the day of the survey. After a two-week period, 74% of the students had returned their consent forms, with 77% ~~of them with~~granting ~~granting~~ parental consent. The sample was reduced by students who missed school on the day of the survey, those who elected not to participate by selecting an opt-out option preceding the survey, and a small number of students that did not answer the required question regarding gender. The final sample consisted of 933 students, or approximately 46% of the student body, 83% of which that had obtained parental consent. The remaining 17% gave personal consent as adults. (Donoghue & Raia-Hawrylak, 2016a)

Materials and Procedures

The questionnaire utilized in this study (SCUBA: 2016), was developed by Donoghue and Raia-Hawrylak, and inspired by the designs of several previously established surveys, including the Children's Report of Sleep Patterns (CRSP: Meltzer et al., 2013), the Thriving Quotient Survey (TQS: Schreiner, McIntosh, Nelson, & Pothoven, 2009), the Survey of Income and Program Participation (SIPP: US Census Bureau, 2010) and the School Climate Bullying Survey (SCBS: Cornell, 2012). The assessment was comprised of 200 questions pertaining to aggression, school climate, academics, demographics, and many aspects of sleep; most of which were measured on a Likert-type scale. Each of the participating students completed the survey online in a school computer lab under the supervision of the research team. Subjects were allotted approximately 35 minutes to record their responses. Instructions on the first page of the questionnaire explained that all of the students' responses would remain anonymous and that they were under no obligation to participate. It was also explained that they could

opt not to continue at any point throughout the process. Responses were recorded using the Qualtrics online survey application and analysis was conducted by way of IBM's SPSS statistics software.

CRSP measures and scoring. TAll the questions included in the survey, those derived from the two primary scales (e.g. Sleep Disturbances and Sleep Hygiene/Electronics Use) and four related sub-scales of the CRSP (Meltzer, 2013; Meltzer, 2014), were of particular focus as predictor variables in this study. Cronbach α coefficients were used to measure internal consistency and reliability for the each of the four Sleep Disturbance subscales: Bedtime Fears and Worries, Restless Legs Scale, Parasomnias, and Insomnia. Because there were multiple indicators for each Electronics Use at Sleep Onset item score that may not be related (e.g. a child that watches TV just prior to bed isn't likely to be listening to music at the same time), internal consistency was not evaluated for this scale, as recommended by previous researchers (Meltzer et al., 2013; Meltzer et al., 2014). Descriptive measures including means, standard deviations, and reliabilities for all variables tested are available in Table B1.

Sleep disturbances sub-scales. The first of these primary scales, the Sleep Disturbances scale (SD) and more specifically the four sub-scales of which it is composed are used as primary predictor variables. The Sleep Disturbances Scales are comprised of 14 questionnaire items across the four sub-scales. The four Sleep Disturbance sub-scales include the 2-item Bedtime Fears and Worries scale (SDF), 5-item Restless Legs Scale (RLS), 2-item Parasomnias scale (SDP), and 5-item Insomnia scale (SDI).

Bedtime fears and worries (SDF). Example items from Bedtime Fears and Worries sub-scale are as follows: "When you are trying to sleep at night, are you upset or worried?"; "How often are you scared at sleep onset?" All of the items from the SDF offered participants response choices in a Likert-type format, including the five options of: Never, Not Very Often, Sometimes, Usually, and Always. These answer choices had assigned point values of 1-5 to each respectively. Similarly to the EU scoring procedure, each student's individual score was calculated by totaling the number of points earned from the answer choices from the two items within the SDF. For the analysis of the entire subject sample, descriptive data for the measure was calculated by finding the mean response score of each scale item, followed by the addition of those two means to produce an overall SDF scale score for the sample. Reliability and internal consistency for total participant sample SDF item scores approached the acceptable level ($\alpha = 0.65$).

Restless legs scale (RLS). Examples of items from Restless Legs sub-scale are phrased as follows: "How often do you have funny feelings in your legs at bedtime or during the night?"; "How often do you have to move your legs at bedtime or during the night?" Three of the five items from the RLS offered participants response choices in a Likert-type format, comprised of the five options of Never, Not Very Often, Sometimes, Usually, and Always, while the remaining questions presented participants with three reverse-coded answer choices: All The Time, Sometimes, or Never. These answer choices had assigned point values of 1-5 and 3-1 to each choice respectively. Each student's individual score was calculated by totaling the number of points earned from the answer choices from the five items within the RLS. For the analysis of the entire participant sample, descriptive data for the measure was calculated by finding the mean

response score of each scale item, then adding those five means to produce an overall RLS scale score for the sample. Reliability and internal consistency for total subject sample RLS item scores were at an acceptable level for the study ($\alpha = 0.75$).

Parasomnias (SDP). The two items from the Parasomnias sub-scale are phrased as follows: "Has anyone ever told you that you talk in your sleep?"; "Has anyone ever told you that you walk around or cry out in your sleep?" Both items from the SDP offered participants response choices in a reverse-coded, Likert-type format, which included: All The Time, Sometimes, or Never. These options had assigned point values of 3-1 to each choice respectively. Each student's individual score was calculated by totaling the number of points earned from the answer choices from the two items within the SDP. For the analysis of the entire participant sample, descriptive data for the measure was calculated by finding the mean response score of each scale item, then adding those two means to produce an overall SDP scale score for the sample. Reliability and internal consistency for total subject sample SDP item scores approached an acceptable level for the study ($\alpha = 0.65$). This coefficient was almost identical to that of Meltzer's et al. (2013) test for reliability and consistency ($\alpha = 0.64$).

Insomnia (SDI). Examples of the items presented from the SDI sub-scale are as follows: "How often do you have trouble falling asleep at bedtime?"; "How often do you wake up during the night?" Three of the five items from the SDI offered participants response choices in a Likert-type format, comprised of the five options: Never, Not Very Often, Sometimes, Usually, and Always, while the remaining questions presented participants with two sets of five reverse-coded answer choices (e.g.): Almost every night, Several times per week, 1-4 times per week, Every now and then, and I almost

never wake up during the night. These answer choices had assigned point values of 1-5 and 5-1 to each choice respectively. Each student's individual score was calculated by totaling the number of points earned from the answer choices for each of the five items within the SDI. For the analysis of the entire subject sample, descriptive data for the measure was calculated by finding the mean response score of each scale item, followed by the addition of those five means to produce an overall SDI scale score for the sample. Reliability and internal consistency for total subject sample SDI item scores were at an acceptable level for the study ($\alpha = 0.79$).

Electronic use at sleep onset (EU). The other primary scale and predictor variable of this study, Electronics Use Prior to Sleep Onset (EU), is one measure of Sleep Hygiene described in the CRSP. Sleep hygiene generally refers to habits and routine behaviors that an individual engages in while awake that tend to affect sleep. The Electronics Use Prior to Sleep Onset scale is comprised of three separate questionnaire items each with five Likert-type response choices. These five response choices included: Never, Not Very Often, Sometimes, Usually, and Always. Each of the response choices was coded 1-5 points respectively and each student's individual score was calculated by totaling the number of points earned for the three scale items. For the analysis of the entire subject sample, descriptive data for the measure were calculated by finding the mean response score of each scale item, then adding those three means to produce an overall EU scale score for the sample. It is important to note that in the instance of EU, higher scores indicate poorer sleep hygiene. The three questionnaire items are phrased in the format of the following item examples: "When you are trying to sleep at night, is a

television on in your room?" Another item from the EU scale reads as follows: "When you are trying to sleep at night, are you listening to music?"

Criteria.

GPA/Achievement. The two measured constructs and scales that served as the potentially predictable criteria in the study included Academic Achievement as well as Academic Investment. Questions related to Academic Achievement included different items asking students to report their current grade point average and others about current course placement. This study placed particular focus on grade point average as a criterion due to the objective nature of measurement. The questionnaire presented students with the item in the following form: "Which letter grade (A+ - F or Below) is most representative of your current grade point average?" The 13 letter grades included within the grading scale of "A+" through "F or Below", were reverse coded, and assigned point values of 13-1 respectively for analysis. A second example of an item drawn from the Academic Achievement scale and questionnaire pertained to any honors courses that the participant was or was not enrolled in. This question read as follows: "How many Honors or Advanced Placement (AP) course/courses are you taking this academic year?" Students were asked to choose a numerical value ranging from "0" to "5 or more". Each of these values was coded to represent 0-5 points respectively.

To maximize valid sample size for the study, the Academic Achievement measure was limited to the questionnaire item concerning GPA. It is also worth noting that the original participant sample was comprised of three different schools, not all of which offered AP courses. Furthermore, even in the event that a school did offer these types of courses, students are generally not required to enroll in them. As such, hypothetically, a

student could opt not to take part in any AP courses but have a 4.0 GPA, and earn a lower score on the overall Academic Achievement measure as a result of their choice. Students could also report lower GPA's simply due to the fact that AP/Honors courses tend to be more challenging. Some high schools attempt to counter the negative effect that AP courses tend to have on students' GPA's by automatically "boosting" students' AP course grades simply for taking part in the course (e.g. B→B+). This beneficial grade "boost" can vary from school to school, and therefore results in an un-standardized AP grading measure and the possibility of earning a GPA above 4.0 (Geiser & Santelices, 2007). Additional support for the use of the self-reported GPA item as the sole academic achievement measure has been presented in recent research. A 2015 study conducted by Sanchez and Buddin revealed that high school GPA computed from self-reported course grades was highly correlated with transcript GPA (r = 0.83), and that factoring in variables such as race, gender, and SES did little to affect reporting accuracy. What's especially promising about the validity of the self-reported GPA measure in the present study is that the average letter grade reported by the entire sample was a B+, the same grade that is representative of the high school's average numerical GPA published online within the high school's 2016-2017 official school profile.

Academic investment (AI). The second criterion, Academic Investment was composed of seven distinct questionnaire items developed with the purpose of assessing an individual student's attitudes, behaviors, and tendencies as they relate to academic management. Examples of Academic Investment items include: "I am always on time for school", and "I spend a lot of time studying." Students were asked to respond on a four-point Likert-type scale comprised of answer choices: 1. Strongly Disagree, 2.

Disagree, 3. Agree, and 4. Strongly Agree. For the entire participant sample, an overall mean score was then calculated for students' responses on each of those seven items, then summed resulting in a total value between 7 and 28 points (7 items x 1 point – 7 items x 4 points). Reliability and internal consistency for total sample Academic Investment item scores were at an acceptable level for the study ($\alpha = 0.78$).

Control Variables. The following four variables were analyzed in two additional multiple regression equations. These four demographic measures served as controls, and although not the focus of this study, may relate to academic performance or investment. SES was the only multi-item scale/variable of the four, and therefore the only scale wherein internal consistency was tested using Cronbach's α.

Age. Age was assessed in an open-ended type question phrased simply as: "What is your current age?" Participants were free to enter any value however the majority of entries ranged between 15 and 18 years old. Extreme outliers or virtually impossible numeric entries were omitted for analysis based on the assumption of user-input error (e.g. Ages > 99).

Gender. Gender was measured with one questionnaire item simply phrased: "What is your gender?" The item offered three response choices: Male, Female, or Prefer not to answer. Students who preferred not to answer were excluded from the descriptive gender measure for analysis.

Race. The race questionnaire item allowed for multiple responses. It was arranged in a list/checkbox type format asking the following: "What is your race? (CHECK ALL THAT APPLY)". Options included Black, Hispanic or Latino, White, Multi-racial, Asian, Native American, and Other. Responses were dummy coded 1-7 for

analysis. Data review revealed that the final participant sample consisted of approximately 89% Caucasian students. For purposes of the multiple regression analyses, the Race variable was recoded to represent students who were either White, or non-White.

Socioeconomic Status (SES). The SES scale consisted of five questionnaire items including: "Was there any time in the last year when you had to leave your home because your parent(s) could not pay the rent or mortgage?" and "In the past year was there a time when you or someone else in your home needed to see a doctor or go to the hospital, but did not go?" Answer choices for the five questions consisted of: Yes, No, or I don't know. Student responses of "I don't know" were excluded from the descriptive calculation of SES. The alternative answer choices were "dummy" coded for 1=Yes and 0=No. Reliability and internal consistency analysis for total subject sample SES scale item scores were acceptable for the study ($\alpha = 0.75$).

Analysis

Two multiple regression equations were first calculated introducing the four demographic control variables: age, gender, race, and SES (Block #1). As with the other predictors, the control predictors were used in these equations to predict the criteria of GPA and Academic Investment. A total of 5 variables were chosen as primary predictors for regression analysis, four of which were the sleep disturbance subscales SDF, RLS, SDI, and SDP. The fifth primary predictor, EU (Block #2), was implemented in the calculation of two simple regression equations immediately following the demographic control variables. Similarly to the other regression equations, these two equations predicted GPA and Academic Investment. The four sleep disturbance subscales were

introduced in the final block (Block #3) of the regression analysis following the four control and EU variables. The subscales were grouped together in this final block for calculating two multiple regression equations, one equation to predict GPA and the other predicting Academic Investment. Following the calculation of the six different regression equations, ΔR^2, the change in the proportion of the total variance in the criterion scores that was predictable from the regression equations, was calculated between each set of regressions. Furthermore, regression coefficients and weight of each variable/scale were calculated to determine significance ($p < .05$).

Results

Descriptive statistics including means, standard deviations, reliabilities, and correlations of predictor, control variables, and criteria are found in Table B1. The mean age for the sample was approximately 16 years old, which is what would be expected for a sample of high school participants. A majority of participants were both Caucasian and female (84%; 57%). Furthermore, most students tended to report high levels of socioeconomic status, with the participant sample reporting a mean SES score of .31 on a scale that ranged from 1-5 points, where higher scores suggest more socioeconomic difficulty. Finally, 729 students provided valid responses to all items of interest, out of a possible 933.

Table B1--

Descriptive Statistics

	N	Mean	Std. Deviation	Minimum	Maximum
(Controls)					
RACE	933	---	---	---	---
GENDER	878	---	---	---	---
AGE	891	16.03	1.25	14.00	21.00
SES [a]	882	.31	.81	0.00	5.00
(Predictors)					
EU [b]	877	4.89	2.41	3.00	15.00
SDF [b]	877	3.30	1.73	2.00	10.00
RLS [b]	871	8.39	3.25	5.00	21.00
SDP [b]	866	2.87	1.06	2.00	6.00
SDI [b]	880	11.60	4.50	5.00	24.00
(Criteria)					
GPA	898	10.42	1.73	1.00	13.00
A.INVESTMENT [c]	931	21.63	3.66	7.00	28.00

Note:
a. SES = Socioeconomic Status

b. EU = Electronics Use at Sleep (Measure of Sleep Hygiene);

SDF = Bedtime Fears/Worries, RLS = Restless Legs Scale,
SDP = Parasomnias, SDI = Insomnia (4 Sleep Distrb. Scales)

c. GPA = Grade Point Average, A.INV=Academic Investment

Scoring scales and coding for each multiple-choice variable were as follows:
Race and Gender were each single-item scales coded as 1=White, 0=Non-White and 1=Female, 0=Male respectively. SES was a 5-item scale with response options each coded as 1=Lower SES and 0=Higher SES. EU was a 3-item scale with response options coded from 1-5 points in Likert-type format. SDF was a 2-item scale with response options coded from 1-5 points in Likert-type format. RLS was a 5-item scale with 3 response options coded from 1-5 points and 2 options coded from 1-3 points in Likert-type format. SDP was a 2-item scale with response options coded from 1-3 points in Likert-type format. SDI was a 5-item scale with 4 response options coded from 1-5 points and 1 response option coded from 1-4 points in Likert-type format.
GPA was a single survey item offering 13 response choices ranging from letter grades "A+" to "F or Below". Academic Investment was a 7-item scale with response options coded from 1-4 points in Likert-type format.

Commented [IT2]: You cannot compute mean genderor mean race these need to be dropped out

Commented [IT3]: This can be reformatted to make it fit better and provide better inforamtion

Table B1 (Continued)-

Correlations (Pearson r) and Reliabilites (α)

	AGE	GENDER	RACE	SES	EU	SDF	RLS	SDP	SDI	GPA	A.INVEST.
(Controls)											
AGE	—										
GENDER	.006	—									
RACE	-.030	.064	—								
SES	.067	.049	-.075*	(α =0.75)							
(Predictors)											
EU	-.006	-.041	-.051	.100**	—						
SDF	-.021	.219**	-.062	.257**	.282**	(α =0.65)					
RLS	-.036	.113**	-.028	.234**	.225**	.434**	(α =0.75)				
SDP	.020	.047	.022	.185**	.098**	.216**	.308**	(α =0.65)			
SDI	.032	.174**	.016	.232**	.158**	.489**	.485**	.173**	(α =0.79)		
(Criteria)											
GPA	-.121**	.160**	.048	-.295**	-.193**	-.118**	-.130**	-.116**	-.103**	—	
A.INVESTMENT	-.248**	.139**	.074*	-.194**	-.157**	-.084*	-.189**	-.083*	-.132**	.536**	(α =0.78)

Note:

**$p < 0.01$ (2-tailed).

*$p < 0.05$ (2-tailed).

a. SES = Socioeconomic Status; EU = Electronics Use at Sleep; SDF = Bedtime Fears; RLS = Restless Legs Scale; SDP = Parasomnias; SDI = Insomnia; GPA = Grade Point Average; A.INVEST=Academic Investment

b. Reliabilities are included along the diagonal divide.

Significant ($p < .01$) and positive correlations were found between Electronics Use at Sleep Onset (EU) and all four of the sleep disturbance subscales; Bedtime Fears/Worries (SDF), Restless Legs Scale (RLS), Parasomnias (SDP), and Insomnia (SDI). Results also

revealed significant ($p < .01$) and negative correlations between all primary predictors (EU and SD-Subscales) and both criteria (GPA and Academic Investment). However, reliability was less than the desired level set for the study ($\alpha \geq .70$) for two of the sleep disturbance sub-scales (SDF and SDP).

Table B2-

Hierachical Regression Coefficients[a]

		Criterion- GPA			*Criterion- A.I.*		
Model		Standardized Coefficients Beta (GPA)	R^2	ΔR^2	Standardized Coefficients Beta (A.I.)	R^2	ΔR^2
1	(Controls)		0.097	0.097**		0.107	0.107**
	Race	.018			-.013		
	Age	-.071 *			-.226 **		
	Gender	.181 **			.148 **		
	SES	-.242 **			-.174 **		
2	(Electron. Use)		0.124	0.027**		0.125	.018**
	Race	.009			-.020		
	Age	-.072 *			-.227 **		
	Gender	.173 **			.141 **		
	SES	-.230 **			-.164 **		
	EU	-.166 **			-.135 **		
3	(Sleep Dist.)		0.133	0.009		0.153	.028**
	Race	.009			-.018		
	Age	-.075 *			-.233 **		
	Gender	.192 **			.159 **		
	SES	-.204 **			-.128 **		
	EU	-.144 **			-.110 **		
	SDF	-.045			.031		
	RLS	-.033			-.163 **		
	SDP	-.040			-.009		
	SDI	-.025			-.039		

a. Criterion (GPA) and Academic Investment

b. *$p < 0.05$
**$p < 0.01$

c. SES = Socioeconomic Status; EU = Electronics Use at Sleep;
SDF = Bedtime Fears; RLS = Restless Legs Scale; SDP = Parasomnias;
SDI = Insomnia; GPA = Grade Point Average; A.INV=Academic Investment

Rate of electronics use just prior to sleep onset significantly predicted both GPA and academic investment in all regression analyses, and thus, Hypotheses 3 and 4 were supported by the data, EU: $\beta 1_{GPA} = -0.13$, t (728) = -3.48, $p < .01$; r (728) = -0.16, $p < .01$ (Table B2); $\beta 1_{AINV} = -0.08$, t (728) = -2.32, $p < .05$; r (728) = -0.11, $p < .01$ (Table B2). For both criteria, the predicted influence of electronics use prior to sleep onset were negative in value. As such, the written interpretation states that more frequent use of electronics just prior to sleep onset is predictive of lower GPA's and lower levels of academic investment.

None of the four sleep disturbance sub-scales (SDF, SDI, RLS, and SDP) were shown to significantly predict grade point average when controlling for demographics ($p< .05$). These results therefore, fail to confirm Hypothesis 1. However, three of the four sleep disturbance sub-scales were significantly and negatively correlated with GPA, SDF: r (728) = -0.08, $p \leq .05$; RLS: r (728) = -0.08, $p \leq .05$; SDI: r (728) = -0.11, $p \leq .05$ (Table B1 Continued).

Results indicated that one of the four sleep disturbance scales, the Restless Legs scale, was a significant predictor of academic investment, RLS: $\beta 2_{AINV} = -0.14$, t (728) = -3.56, $p \leq .05$; r (728) = -0.16, $p \leq .05$ (Table B2). This indication provides support for Hypothesis 2; an increase in any of the four types of sleep disturbances (IV/Predictors) will predict decreased levels of academic investment (DV).

Discussion

As previously described, the conceptual hypotheses of the present study consisted of the following: (H1) First, we expected a significant predictive association between any of the four types of sleep disturbances (IV/Predictors) and students' reported grade point

averages (DV). Next, (H2) we expect a significant predictive association between any of the four types of sleep disturbances (IV/Predictors) and levels of academic investment (DV). Additionally, (H3) we expect a significant predictive association between use of electronics at sleep onset (IV/Predictor) and reported GPA's (DV). Finally, (H4) we expect a significant predictive association between frequencies of electronics use at sleep onset (IV/Predictor) and levels of academic investment (DV).

A total of five different constructs were measured in an effort to demonstrate the potential ability of multiple regression to significantly predict reported levels of academic investment or GPA scores using either of two final equations. These five predictor-variables included Electronics Use at Sleep Onset, Parasomnia-type sleep disturbances (SDP), Insomnia-type sleep disturbances (SDI), Restless Leg-type sleep disturbances (RLS), and Bedtime Fears-type sleep disturbances (SDF). In addition to the five predictors, four demographic variables were scored and controlled for within the regression analyses. These four demographic measures included Socio-Economic Status, Age, Gender, and Race.

The analysis conducted in the present study provides valuable cross-sectional insight in identifying students whom may be at risk for low academic achievement, as well as those who may suffer educationally from inadequate academic investment. Although the results of the study provided some support for the prediction of GPA scores through the measurement of electronics use at sleep onset, it lacked the expected evidence to support the use of sleep disturbance scale scores as significant predictors of grade point average. Being that the CRSP (2013) is an assessment tool primary purposed to measure the quality of sleep that an individual experiences, it is entirely possible that

sleep quantity is the much more important variable to focus on when trying to predict GPA. In fact, in one of the first studies to test for reliability and validity after developing the CRSP, Meltzer et al. (2013) conducted a secondary analysis to review "actigraphy" of participants. This actigraphy analysis focused on sleep duration of children and pre-adolescents, and revealed that those who slept less than eight hours a night reported more symptoms of insomnia and more frequent snoring than children who obtained more than eight hours (Meltzer et al., 2013). Furthermore, later research conducted with the purpose advancing the development of the CRSP, particularly to extend its application to adolescents, resulted in Meltzer and colleagues adding new items and measures to directly assess sleep duration (Meltzer et al., 2014). Had the SCUBA assessment been developed using the revised version of the CRSP (CRSP: 2014), it is likely that findings would have been more closely related to Moore and Meltzer's (2008) study, which had demonstrated that adolescent students who obtain less than 8.5 hours of sleep/night generally report earning grades below the B range. Unfortunately, one of the limitations of the current study exists in that the SCUBA assessment, the questionnaire administered to this participant sample, fails to measure sleep quantity in any way. Even the simple addition of an item asking what time participants went to sleep the night before, or how many hours of sleep on night do participants get on average, would have allowed for a more complete analysis in comparing sleep quality versus quantity and GPA.

Another possible limitation of the study ~~that would be irresponsible to neglect mentioning is~~ is that although the ~~fact that although the~~ CRSP is a respected, repeatedly used, and peer reviewed sleep assessment scale; there are various alternative measures that share many of the same qualities. It is possible that the CRSP was simply the

incorrect survey for utilization with the current participant sample. The participant sample in this study was not particularly diverse. An overwhelming majority of students were Caucasian and of a high SES. Additionally, although the CRSP has recently been used with adolescents and has shown acceptable reliability (Meltzer et al., 2014), the present research is very possibly the second study to ever examine the administration of the CRSP to teens up to this point. As substitute measures, the Epworth Sleepiness Scale (ESS) and the Pittsburgh Sleep Quality Index (PSQI) are two alternative questionnaires that are commonly utilized in making assessments similar to the CRSP (Buysse et al., 2008). Another possible limitation of the SCUBA assessment may have been self-report biases. For example, with some items offering odd quantities of response options, the assessment may have been prone to participants taking a "mid-point response style". It is also possible that student responses were prone to recency bias, with participants answering questions based on their most recent experiences, instead of mentally assessing their life experiences as a whole.

Alternatively, the electronics use at sleep onset scale exceeded expectations in that it was shown to be a significant predictor of GPA and academic investment in all four of the regression equations tested that included EU as a predictor. Furthermore, in the one instance that a sleep disturbance subscale was shown to be a significant predictor, as in the case of RLS and academic investment, that particular regression model accounted for 15% of the variance in academic investment. Interestingly enough, these results are corroborated in various ways by previous research involving the CRSP. In a study of the CRSP scales' reliability and validity, Meltzer et al. (2013) utilized parent-completed sleep measures such as Owens, Spirito and McGuinn's (2000) Children's

Sleep Habits Questionnaire (CSHQ) and Harsh's et al. (2002) Children's Sleep Hygiene Scale (CSHS) to carry out comparison analyses with the CRSP. Study results revealed a moderate agreement between parent-reported and child-reported sleep assessments in the measurement of electronics use at sleep onset and RLS (ICC>0.50), but not such agreement for Bedtime Fears/Worries or Parasomnias (ICC<0.50), thus suggesting EU and RLS to be relatively more reliable than other measures. Furthermore, the study found significant associations ($p < .001$) between the CRSP Electronics Use measure and the CSHS Cognitive Scale ($r = -.37$). Both the CRSP-EU and CSHS-Cognitive are measures of sleep hygiene, however higher CRSP scores are indicative of poorer sleep hygiene while higher CSHS scores are indicative of better sleep hygiene. As a secondary analysis, hierarchical regression was conducted for both criteria using each of the three EU survey items as individual predictors. In support of expectations developed following the initial analysis, the largest beta weights were found for the EU items concerning television and music before bed. It is believed that the light waves emitted by modern television sets and MP3 devices negatively affect students' circadian rhythms and lead to lower GPA's and academic investment.

Overall, the study did accomplish its primary goal of identifying significant predictors to determine GPA and level of academic investment (Table B2). For the criterion of GPA, the equation included the significant predictor of Electronic Use at Sleep Onset. For our other criterion, Academic Investment, significant predictors included Electronics Use at Sleep Onset and symptoms from the RLS sleep disturbances sub-scale. To review, the Restless Legs Scale (RLS) included five questionnaire items within the SCUBA assessment that primarily inquired about feelings and movements in

participants' legs during sleep. Such items included: "How often do you feel like your legs bother you at bedtime or during the night?" and "How often do you feel like you have to move your legs at bedtime or during the night?" For items of this type, participants responded on a five point scale (1-5) choosing either Never, Not Very Often, Sometimes, Usually, or Always. The RLS also included two reverse coded items that essentially relied on other's observations of participant behaviors. For example, one of these assessment items included: "Has anyone ever told you that you move a lot in your sleep?" These two items allowed for responses of: All the time, Sometimes, or Never, worth 3-1 points respectively. All five RLS items can be seen in Table A2. Reasons as to why the RLS in particular was found to be significant as opposed to any of the other three sleep disturbance sub-scales are somewhat unclear.

It is possible that the RLS may have been less prone to response bias than other sleep disturbance scales. The fact that some of the items within the RLS were reverse coded, may have prevented acquiescence bias. Acquiescence bias, which is also referred to as "yea-saying", is a category of response bias in which respondents to a survey have a tendency to agree with all the questions or repeatedly choose the same response in a measurement scale (Watson, 1992). Changing the number and order of some items, as was done with the RLS questions in the SCUBA assessment, has shown to be an effective strategy to reducing bias in some cases (Knowles & Nathan, 1997; Podsakoff, MacKenzie, Lee, & Podsakoff, 2003; Watson, 1992). Another potential strength of the RLS was the number of questions used to assess the measure. Unlike some of the other two-item sleep disturbance scales (i.e. SDF and SDI), the RLS was comprised of five individual survey questions. The five RLS questions also seemed to be more specific in

assessing a particular type of symptom or behavior as well. For example, four out of the five items made specific reference to participants' legs within their wording. This is a stark contrast to other scales such as the SDI, which included individual items related to trouble falling asleep, waking up during the night, thinking about the next day, and time passed before returning to sleep. The relatively thorough and specific question pool of the RLS may have lead to improved validity of the measure.

The significant results of this study could potentially lead to school officials and parents developing preventative and progressive school programs to increase academic investment in and improve grade point averages in students. The primary goal of these strategic efforts would be to improve the potential for academic achievement in students at risk for poor educational performance or students suffering from adverse experiences inhibiting their academic ability. Ultimately, these improvements will allow a greater number of students to proceed on to postsecondary education or improve their chances of employment within the increasingly competitive job market.

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Appendix A

Table A1. Meltzer et al. (2014) obtained results for the adequate internal consistency and test-retest reliability of the various sleep scales that comprise the CRSP

when used with adolescent samples.

Descriptive statistics (*M*, SD), internal consistency (α), correlations, and paired *t*-tests for CRSP Sleep Hygiene Indices and Sleep Disturbance Scales for the full sample and test–retest subgroup.

Item	Mean (SD)	α	*Test-Retest subgroup (n = 57)*				
			Time 1 Mean (SD)	Time 2 Mean (SD)	*r*	*t*	*p*[d]
Sleep Hygiene Index							
Caffeine Index	7.15 (2.44)	–	6.98 (2.81)	7.00 (2.63)	0.79***	−0.09	.93
Soda	2.90 (1.16)		2.73 (1.15)	2.73 (1.25)	0.73***		
Tea	2.39 (1.24)		2.17 (1.17)	2.10 (1.12)	0.64***		
Coffee	1.87 (1.12)		2.12 (1.35)	2.21 (1.26)	0.84***		
Activities Before Bed Index	17.69 (3.00)	–	17.00 (2.82)	17.24 (3.22)	0.70***	−0.75	.46
Have activities (dance, sports, etc.)	2.50 (1.27)		2.59 (1.44)	2.68 (1.29)	0.59***		
Email/Instant Message	3.25 (1.35)		2.88 (1.21)	3.00 (1.21)	0.66***		
Watch TV/Movies	3.78 (0.98)		3.77 (1.04)	3.47 (1.05)	0.47**		
Play Video/Computer Games	2.77 (1.23)		2.19 (2.11)	2.21 (1.12)	0.77***		
Take Bath/Shower[a]	2.35 (1.25)		2.52 (1.42)	2.89 (1.37)	0.33*		
Read[a]	3.02 (1.13)		2.88 (1.10)	2.84 (1.17)	0.36*		
Sleep Location	8.89 (4.04)	–	8.18 (3.78)	8.33 (3.49)	0.82***	−0.49	.63
Fall asleep in sibling's bed	1.32 (0.78)		1.26 (0.82)	1.19 (0.50)	0.81***		
Fall asleep in parent's bed	1.42 (0.92)		1.27 (0.73)	1.25 (0.72)	0.49***		
Fall asleep in another location in house (e.g., couch)	1.97 (1.07)		1.53 (0.88)	1.60 (0.96)	0.54***		
Wake in sibling's bed	1.23 (0.67)		1.09 (0.29)	1.14 (0.41)	0.68***		
Wake in parent's bed	1.33 (0.83)		1.30 (0.85)	1.20 (0.67)	0.63***		
Wake in another location in the house	1.66 (1.01)		1.30 (0.74)	1.37 (0.76)	0.81***		
Electronics Use Before Bed	6.25 (2.80)	–	4.93 (2.31)	5.04 (1.91)	0.68***	−0.47	.64
TV in room	2.02 (1.43)		1.47 (1.14)	1.58 (1.18)	0.87***		
Listening to music	2.58 (1.35)		1.98 (1.10)	1.98 (1.12)	0.71***		
Light in room	1.68 (1.16)		1.30 (0.99)	1.33 (0.84)	0.34*		
Indicator Items		–					
Wet the bed	1.15 (0.59)		1.14 (0.51)	1.09 (0.47)	0.72***		
Nightmares	2.13 (0.92)		2.09 (0.71)	2.05 (0.83)	0.66***		
Wake very thirsty	2.40 (1.22)		2.36 (0.87)	2.32 (0.96)	0.39**		
Wake with headache	1.91 (0.96)		1.73 (0.76)	1.68 (0.83)	0.49***		
Snore[b]	1.95 (0.75)		1.56 (0.59)	1.51 (0.67)	0.41**		
Sleep Disturbance Scales							
Bedtime Fears/Worries Scale	5.98 (2.26)	0.61	5.57 (1.80)	5.27 (1.45)	0.68***	1.46	.15
Scared at sleep onset	1.53 (0.90)		1.42 (0.73)	1.42 (0.66)	0.71***		
Upset/worried at sleep onset	1.98 (0.98)		1.86 (0.97)	1.93 (0.88)	0.69***		
Can't fall asleep because thinking of day	2.56 (1.13)		2.95 (1.21)	2.83 (1.00)	0.66***		
Restless Legs Symptoms (Self Report) Scale	4.59 (2.69)	0.76	5.32 (2.25)	5.45 (2.11)	0.41**	−0.38	.71
Legs bother during night	1.63 (0.96)		1.51 (0.77)	1.77 (0.84)	0.37*		
Funny feelings in legs	1.71 (1.0)		1.66 (0.99)	1.64 (0.72)	0.38*		
Have to move legs during night	2.30 (1.23)		2.18 (1.14)	2.07 (1.02)	0.31*		
Restless Legs Symptoms (Observed) Scale	4.17 (1.33)	0.73	3.44 (1.18)	3.47 (1.44)	0.51***	−0.12	0.91
Told kick legs during sleep[b]	2.04 (0.78)		1.63 (0.69)	1.70 (0.80)	0.52***		
Told move a lot in sleep[b]	2.13 (0.71)		1.81 (0.73)	1.77 (0.75)	0.48***		
Insomnia Scale	9.61 (3.38)	0.73	9.64 (2.34)	8.98 (2.35)	0.34*	1.62	0.11
Trouble falling asleep	2.57 (1.15)		2.64 (0.84)	2.55 (1.00)	0.24		
Wake up during night[c]	2.49 (1.14)		2.28 (0.96)	1.86 (1.00)	0.33*		
Return to sleep after waking	2.42 (1.22)		2.09 (1.01)	1.77 (1.08)	0.43**		
Night waking frequency	2.11 (1.06)		1.98 (0.85)	1.86 (1.00)	0.24		
Parasomnias Scale	3.84 (1.50)	0.76	2.77 (0.95)	3.40 (1.38)	0.45**	−3.24	0.00**
Talk in sleep[b]	1.98 (0.75)		1.63 (0.76)	1.81 (0.73)	0.60***		
Walk in sleep[b]	1.86 (0.91)		1.14 (0.41)	1.58 (0.85)	0.37*		

Full sample $N = 570$, Test–Retest $N = 56$. Higher scores are associated with poorer sleep hygiene and more sleep disturbances. Unless otherwise noted, response choices were as follows: Never = 1, Not Very Often = 2, Sometimes = 3, Usually = 4, and Always = 5.

* $p \leq 0.05$, ** $p \leq 0.01$, *** $p \leq 0.001$.

[a] Never = 5, Not Very Often = 4, Sometimes = 3, Usually = 2, and Always = 1.

[b] Never = 1, Sometimes = 2, and All the Time = 3.

[c] Almost every night (5–7 times/week) = 4, Several times a week (1–4 times/week) = 3, Every now and then (2–3 times/week) = 2, I almost never wake up during the night = 1.

[d] Indicates significance of *t*-test.

Table A2. CRSP scoring instructions for Sleep Disturbances and Electronics Use at Sleep Onset Scales.

Scoring for Questions 23-29 and 32-57
1 = Never
2 = Not very often
3 = Sometimes
4 = Usually
5 = Always

Reverse Scoring for Questions 30 and 31
5 = Never
4 = Not very often
3 = Sometimes
2 = Usually
1 = Always

Scoring for Questions 58-62
3 = All the time
2 = Sometimes
1 = Never

Electronics Use at Sleep Onset (3 items)
35. Television on in room
36. Listen to music
37. Light on in room

SLEEP DISTURBANCES SCALES

Bedtime Fears/Worries Scale (2 items)
38. Scared at sleep onset
39. Upset/worried at sleep onset

Restless Legs Scale (5 items)
44. Funny feeling in legs
45. Legs bother at bedtime
46. Have to move legs at bedtime
59. Kick legs when sleeping
60. Move a lot during sleep

Parasomnias Scale (2 items)
61. Talk in your sleep
62. Walk around/cry out during sleep

Insomnia Scale (6 items)
16. How long to usually fall asleep (1=No time, 2=Few minutes, 3=Little while, 4=Long time)
18. How often usually wake (4=Almost every night, 3=Several times/wk, 2=Now and then, 1=Never wake up)
19. How long to usually return to sleep (1=Usually don't wake, 2= No time, 3=Few minutes, 4=Little while, 5=Long time)
40. Thinking about that day/next day
47. Trouble falling asleep at bedtime
48. Wake up during the night