Sleep Hygiene Practices and Exercise as Mediators (Effects of Stress and Self Care Practices on Academic Engagement in Undergraduate Students) of the Relationship between Stressful Life Events and Academic Engagement in Undergraduate Students

Audrey R. Nelson

University of Arizona

Author Note

[Include any grant/funding information and a complete correspondence address.]

TABLE OF CONTENTS

LIST OF TABLES ………………………………………………………………………...

LIST OF FIGURES………………………………………………………………………...

ABSTRACT…………………………………………………………………….………..... 3

CHAPTER 1: INTRODUCTION………………………………………………………..... 4

CHAPTER 2: REVIEW OF RELEVANT LITERATURE………………………………

Academic Engagement……………………………………………………………

Stress and Stressful Life Events (SLEs)………………………………

Sleep…………………………….

Sleep Hygiene…………………………………..….....

Exercise…………………...

Self-Care and Academic Engagement………..

Overview of Literature………………………………

CHAPTER 3: METHOD………………………………………………………………….

Participants and Procedures…………………………………………………………...

Measures……………………………………………………………...

Statistical Analyses……………………………………………………………………..

CHAPTER 4: RESULTS…………………………………………………………………

*Null Hypotheses 1 and 2: ……..………………………………...*

*Null Hypotheses 3 and 4: …………………………………………...*

*Null Hypotheses 5 & 6:……………………..………………………..*

*Null Hypothesis 7: ……………………………………...*

*Secondary Analysis……………………………………………………………….*

CHAPTER 5: DISCUSSION & CONCLUSIONS………………………………………

Limitations of the Study…………………………………………………………..

Future Directions for Research…………………………………………………....

APPENDIX A: IRB APPROVAL…………..

APPENDIX B: …………………………….. …...

APPENDIX C: CONSENT FORM………………..…...

REFERENCES ...............................................................................................................

(CHAPTER I: INTRODUCTION ......................................................................................

Overview of Sleep Hygiene.................................................................................

Sleep Hygiene in Young Adults

Exercise .................................................................................

Overview of Stressful Live Events…………………………………………………

Academic Engagement/Factors

Stressful Life Events and the Impact on Academic Engagement……………....

Purpose of the Present Study..............................................................................

CHAPTER II: REVIEW OF RELATED LITERATURE.................................................

Characteristics of Sleep Hygiene...........................................................................

Factors of Sleep Hygiene.............................................................

Stressful Life Events .........................................................................................

Academic Engagement in Undergraduate Students............................................

Four Factors of Academic Engagement.................................................................

Assessment of Academic Engagement.............................................................

Current Assessment Screening Measures for Academic Engagement/

Stressful Life Events/Sleep Hygiene………………………………………...

Demographic Variables Associated with ..................................................

Grade Level and Academic Engagement/Stressful Life Events/Sleep Hygiene......

Exercise and Academic Engagement/Stressful Life Events/Sleep Hygiene......

Overview of the Literature....................................................................................

CHAPTER IV: RESULTS ...............................................................................................

Logistic Regression Analyses..............................................................................)

Abstract

[The abstract should be one paragraph of between 150 and 250 words. It is not indented. Section titles, such as the word Abstract above, are not considered headings so they don’t use bold heading format. Instead, use the Section Title style. This style automatically starts your section on a new page, so you don’t have to add page breaks. Note that all of the styles for this template are available on the Home tab of the ribbon, in the Styles gallery.]

The findings of this study will aid in maximizing academic engagement in college students (cognitive and behavioral functioning in children) by identifying areas for sleep interventions.

Keywords: [Click here to add keywords.]

**Introduction**

Academic engagement is a broad concept including aspects of behavior and both intrinsic and extrinsic characteristics that lend themselves to learning and academic success. There have been a variety of ways in which the research on student engagement has focused and defined academic engagement, identifying relevant factors such as motivation, participation, instructor relationships, achievement, and study skills (Zepke & Leach, 2010; Handelsman et al., 2005; NSSE, 2000). As Zepke & Leach (2010) describe, “Student engagement… is a far reaching construct that can be variously defined. Chapman (2003) offers a possible definition – students’ cognitive investment in, active participation in and emotional commitment to their learning. The Australian Council of Educational Research proposes another: ‘students’ involvement with activities and conditions likely to generate high quality learning’ (ACER, 2008: vi).” (pg 168).

After a thorough search on the research of student engagement, Zepke & Leach (2010) evaluated 93 research studies from 10 different countries that resulted in the identification of four research perspectives on school engagement, including: “Motivation and agency: Engaged students are intrinsically motivated and want to exercise their agency,” “Transactional engagement: Students and teachers engage with each other,” “Institutional support: Institutions provide an environment conducive to learning,” and “Active citizenship: Students and institutions work together to enable challenges to social beliefs and practices.” Their research suggests potential for addressing academic engagement from both the macro (institutionally based) and micro (student focused) level.

Various research articles have approached school engagement from the macro level, looking at how institutional practices can impact the likelihood of a student to engage, and ideally succeed, in the academic environment (Froh & Hawkes, 1996; citation). Research has also evaluated academic engagement from a more intrinsic perspective, often focusing on singular aspects of an individual, identifying specific variables such as motivation, participation, and study skills (cite). Unlike previous research focusing on motivation as a defining characteristic of academic engagement at the college level, Handelsman et al. (2005) approached engagement as a more multi-faceted concept in the creation of a measure on student course engagement. They chose to look at the “micro” level of a student’s engagement rather than evaluate engagement from the “macro level,” which has been addressed by previous research looking at engagement from the perspective of the institution to determine effective programs to enhance engagement in their students (Froh & Hawkes, 1996; NSSE, 2000). Their research indicated four distinct factors of college student engagement: Factor 1 – “skills engagement”, Factor 2 – “emotional engagement”, Factor 3 – “participation/interaction engagement”, and Factor 4 – “performance engagement.”

Academic Engagement is significant in that research has shown its connection with successful academic outcomes (cite). For instance,

As suggested by Handelsman et al. (2005), we took the approach of evaluating students on the “micro” level, believing that this approach affords more opportunities for interventions and allows for the evaluation of the potential impact of personal care variables such as sleep hygiene and exercise.

Discuss engagement and relationship to achievement – justify using them interchangeably.

Marks 2000: “Although research examining the effect of engagement on achievement is comparatively sparse, existing studies consistently demonstrate a strong positive relationship between engagement and performance across diverse populations (Finn, 1989, 1993; Finn & Rock, 1997). Nonetheless, the process of disengagement can begin in the early school years if students do not fit in, participate, and succeed (Finn, 1989). Lack of engagement adversely affects student achievement and initiates a downward spiral that may lead to dysfunctional school behavior and, ultimately, culminate in some students leaving school entirely (Finn, 1989; Newmann, 1981, 1992; Steinberg, 1996; Wehlage, Rutter, Smith, Lesko, & Fernandez, 1989).”

Marks 2000 – “More complex and cognitively challenging class work, according to this theory, has the potential to engage students more deeply. …Because the need for competence is generally inherent, most students begin their school careers motivated to learn. For many students, however, their experience of school dulls that motivation or even suppresses it entirely. For these students to become academically engaged would require a reversal of the alienating experiences, a sense of membership in school to replace impersonality and isolation and authentic academic work to replace low-level school work (Newmann, 1989a; Newmann et al., 1992). Authentic academic work involves students intellectually in a process of disciplined inquiry to solve meaningful problems, problems with relevance in the world beyond the classroom and of interest to them personally.”

Stress impact on Academic Engagement

Zepke & Leach 2010: “One aspect of this challenge is a drive to improve student success, understood as increasing or widening participation, achieving high levels of course completion and attaining a passport to employment with a positive attitude to lifelong learning (Yorke, 2006).”

Marks 2000: “Focusing on student engagement in relation to classroom instruction, this study conceptualizes engagement as a psychological process, specifically, the attention, interest, investment, and effort students expend in the work of learning. Defined in this way, engagement implies both affective and behavioral participation in the learning experience. The conception is consistent with other researchers' definitions of engagement: students' "involvement with school" (Finn, 1989, 1993); their "psychological investment in and effort directed toward learning, understanding, or mastering the knowledge, skills, or crafts that academic work is intended to promote" (Newmann, Wehlage, &Lamborn, 1992, p. 12); and students' "interest" and "emotional involvement" with school, including their "motivation to learn" (Steinberg, 1996). Engagement is an important facet of students' school experience because of its logical relationship to achievement and to optimal human development.” and “How children and adolescents choose to allocate their attention depends on the interaction of several factors: their natural inclinations, the satisfaction they have derived from paying attention in other settings, and the value they attach to the activity based on its relevance to a future they anticipate (Csikszentmihaiyi, 1990).” And “The disengagement portrayed by these researchers is still a pervasive problem, particularly in U.S. secondary schools (Newmann, 1992; Sax et al., 1997; Steinberg, 1996). Chronic disengagement reportedly afflicts 40% to 60% of secondary school students (Sedlak et al., 1986; Steinberg, 1996), an estimate that excludes repeated absentees and dropouts.^ No comparable estimate of disengagement exists for students in elementary schools. However, critics have indicted these schools for providing meaningless instructional activities that disillusion students about the usefulness of school and for failing to equip them with the skills they need to succeed in later grades (Finn, 1993; Goodlad, 1984; Sedlak et al., 1986).” And “When high levels of classroom engagement occurred, observers ascribed it to the uppertrack status of the class, students' self-selection into a program of special interest to them, or, occasionally, teachers' instructional styles, including the expectations they held for students (Oakes, 1985; Powell et al., 1985).” And “Although much of the research on student engagement has focused primarily on the influence of student background factors, it is important to 156 Student Engagement in Instructional Aclivity expand that inquiry to learn whether schools and families can enhance engagement through particular efforts. One way to approach this is to examine the major theoretical perspectives that explain student engagement through comprehensive frameworks, specifically those proposed by Bronfenbrenner (1979), Finn (1989, 1993), and Newmann (1981, 1992).” And “More complex and cognitively challenging class work, according to this theoiy, has the potential to engage students more deeply. Overall, however, schooling fails as a developmental context. Bronfenbrenner specifically laments that students do not do "real" work (i.e., work another actually depends on) and do not participate in a "curriculum for caring" (i.e., giving care in the community).”

Students tend to show more engagement when they have self-selected courses that are of specific interest to them (Marks, 2000; Handelsman et al. 2005 - ? check if they reference this under emotional factor). Additionally, doing well in a class is not only a classifying attribute of engagement, but often a positive outcome of increased academic engagement.

Disengagement at the college level can lead to failing grades, higher dropout rates,

Impact of sleep on academic engagement/achievement – self-care practices. Sleep is essential for the consolidation of memory, learning, decision making, alertness, mood, and cognitive performance (Banks & Dinges, 2007; Pilcher & Walters, 1997)… Deficits in sleep have been shown to negatively impact academic performance (Gomes et al. 2011; Gilbert & Weaver, 2010). Specifically, sleep quality and duration are correlated with lower academic achievement and course grades in college students (Pilcher, Ginter, & Sadowsky, 1997\* check for this). It is also important to note that college students do not have good insight into the impact of sleep loss on their cognitive functioning, believing their abilities and functioning to be much higher than those students with adequate sleep levels (Pilcher & Walters, 1997).

Sleep hygiene has been shown to impact the quality of actual sleep **(check current research)**. Positive sleep hygiene practices are associated with improved sleep and consequently with improved performance in activities impacted by sleep. For instance, executive functioning including working memory tasks, reading and math performance, physical conditioning, and emotional regulation.

**Talk about sleep and its impacts on life’s functions, then move into how sleep hygiene is related to sleep, and then discuss sleep hygiene and related research.**

Exercise paragraph

Sleep and exercise have been shown to mitigate some of the influences of stress on one’s wellbeing. Specifically, sleep demonstrates a restorative property, reducing stress levels and increasing attention, focus, memory, ; thereby potentially increasing one’s level of academic engagement. When looking at the definition of Academic Engagement delineated above it can be seen that aspects of self-care may be essential in the healthy implementation of academic engagement. More specifically, areas of academic engagement directly influenced by self-care practices are proposed to have a greater moderating affect of sleep and exercise on the relationship between stress and academic engagement. For instance, the factor of Skills Engagement includes variables such as completing work, paying attention in class, studying, taking notes, and being organized. These areas comprise many aspects of executive functioning which have been shown to be directly impacted by sleep quality and exercise (). Consequently, sleep hygiene practices focused on optimizing sleep quantity and quality should, in turn, influence the improvement of executive functioning in the classroom. Although self-care practices including good sleep hygiene and physical activity have also been shown to promote mood (), the emotional factor of academic engagement revolves more around the concepts of applying course content to your life and finding ways to make it personally interesting. As such, the impact on mood may play a more indirect or over-arching role on engagement, since improvements in mood may, in fact, increase the desire to learn and apply concepts outside of the classroom, but, in addition, may also improve other areas of engagement, including increasing participation in the classroom, improving confidence in one’s performance, and showing good study skills. The current study proposes the following research questions and hypothesis:

**Specific Aim 1: To document the (relationship/effects) of stressful life events on academic engagement in undergraduate students.**

*We hypothesize that increased levels of life stressors will be associated with lower (negatively correlate with/result in lower) levels of academic engagement. We believe that academic engagement will be lower in undergraduate students who experience a greater number of stressful life events.*

**Specific Aim 2: To document the (relationship/effects) of sleep hygiene on academic engagement in undergraduate students.**

*We hypothesize that as sleep hygiene is impaired so will academic engagement in undergraduate students. We postulate that academic engagement will be lower in undergraduate students who experience reduced levels of healthy sleep hygiene practices.*

**Specific Aim 3: To determine if sleep hygiene mediates/moderates the relationship between stressful life events and academic engagement.**

*We hypothesize that students with higher levels of stressful life events will experience lower academic engagement (with increased deficits in) if they show poor sleep hygiene practices. We postulate that in students exhibiting the poorest sleep hygiene habits, we will see (a more pronounced/the strongest) relationship between reduced academic engagement (associated with) and high levels of stress. Sleep hygiene practices…*

*Additionally, it is hypothesized that sleep hygiene practices will show the greatest mediating effect on the academic engagement factor of skills engagement due to the research indicating strong associations between sleep quality and executive functioning.*

***“Sleeping restfully may therefore be allowing individuals the rejuvenation needed to manage their stress adaptively”***

*Likewise, we postulate that in between-subjects analysis, increased stressful life events and lower sleep hygiene practices will be associated with reduced academic engagement. (No within-subjects analysis because only one point measure.) We believe that there will be an interaction effect of sleep hygiene, stressful live events, and academic engagement in undergraduate students. We believe that there will be an interaction effect of sleep hygiene practices as a moderator of the relationship between stressful live events and academic engagement in undergraduate students.*

**Specific Aim 4: To determine if exercise mediates/moderates the relationship between stressful life events and academic engagement.**

*We hypothesize that students with higher levels of stressful life events will experience lower academic engagement (specifically in the area of participation) if they show poor sleep hygiene practices. We postulate that in students exhibiting the poorest sleep hygiene habits, we will see (a more pronounced/the strongest) relationship between reduced academic engagement (associated with) and high levels of stress.*

**Specific Aim 5: To provide a predictive model of the effects of self-care practices, including both sleep hygiene and exercise, on the relationship between stressful life events and academic engagement.**

**Specific Aim 4: To evaluate the impact of gender, ethnicity, exercise, and age on academic engagement.**

*We hypothesize that*

(Legget et al., 2003) “Multilevel models were run to examine between- and within-person variability in sleep disturbance and life event stress as predictors of depressive symptoms, and an interaction to test sleep disturbance as a moderator is included in a second step.”

**Stress/Stressful Life Events**

Research has shown that stress as measured through Stressful Life Events (SLE) shows a significant impact on the likelihood of externalizing behaviors, internalizing behaviors, psychopathology, lowered life satisfaction, delinquent behaviors, negative affect and (Ash & Huebner, 2001; McCollough et al. 2002; McKnight et al. 2003; Suldo & Huebner, 2004; Kim et al. 2003; ) Using a 6 year longitudinal study design looking at adolescents, Kim et al. (2003) found that SLEs predict not only internalizing behaviors such as anxiety and depression, but also externalizing, delinquent behaviors, as well.

Stress is a multifaceted concept including aspects of both acute and chronic adversity. In looking at how life satisfaction varies based on accumulated SLEs, Ash & Huebner (2001) isolated negative life events from chronic stressors in order to determine their differential impact. They found that the inclusion of both significantly improved predictability. In a similar vein, McCullough et al. (2002) found that negative daily events contributed more variance to participant affect than the contribution of major life events. Crandall et al. (1992) found in their development of The Undergraduate Stress Questionnaire (USQ) that daily hassles resulted in a similar level of perceived stress as major life events. Consequently, they argued that weighted scales were not necessary in the measure of overall stress, since their research indicated that both types of stressors contributed in a similar manner to the overall stress score. They posited that it is more essential to utilize questionnaires that include items that are salient to the subjects whose stress levels are being evaluated. For instance, a measure used with undergraduate students should contain items pertaining to college life and the school environment to accurately depict the potential overall stress of these individuals. The importance of this was underscored by the fact that in their research the subjects were more likely to endorse items related to their university experience than the other stressors on the measure.

When looking at the myriad impacts of SLEs, various mediating/moderating factors have been addressed such as life satisfaction (McKnight et al. 2003 and Suldo & Huebner, 2004), locus-of-control (Ash et al.),

**Stress & Academic Engagement**

McKnight et al. 2003: “McCullough et al. (2000) found that in adolescents, “environmental life events explained variance in well-being over and above that of a powerful intrapersonal variable, global self-concept” (p. 287). Furthermore, Ash and Huebner (2001) found that both positive and negative chronic, everyday stressors and acute events contributed significantly to life satisfaction. Such findings suggest the importance of adolescents’ acute and chronic stressors at school and at home.”

“The first model predicted that life satisfaction has a moderating effect on the relationship between stressful life events and maladaptive behavior (externalizing and internalizing). As suggested in Lazarus’ theory, life satisfaction may act as a buffer between the number of SLEs an adolescent has experienced and his or her internalizing and externalizing behavior. Such an outcome is expected based on the notion that when an individual has an overall positive (vs. negative) outlook on her life, which is at least moderately stable, he or she is less likely to adapt to SLEs in maladaptive ways such as through internalizing or externalizing behaviors. In other words, we predicted that the relationship between SLEs, and behavior problems would be smaller for students with high life satisfaction than for those students with low life satisfaction. The second model predicted that life satisfaction would act as a mediator between stressful life events and externalizing and internalizing behavior. Thus, we predicted that increased stressful life events would be related to a decreased level of life satisfaction, which in turn would relate to an increased likelihood of maladaptive coping behavior (i.e., externalizing and internalizing behaviors) in adolescents. This prediction is consistent with Evans’ (1994) model in which perceived life satisfaction links various input variables (e.g., temperament, environmental experiences) and output variables (coping behavior).”

Such an outcome is expected based on the notion

that when an individual has an overall positive (vs. negative) outlook on her life, which is at least

moderately stable, he or she is less likely to adapt to SLEs in maladaptive ways such as through

internalizing or externalizing behaviors. In other words, we predicted that the relationship between

SLEs, and behavior problems would be smaller for students with high life satisfaction than for

those students with low life satisfaction.

Suldo & Huebner (2004) found that life satisfaction mediated the relationship between stressful life events and psychopathology. “To illustrate, even though the occurrence of multiple stressful life events (e.g., death in the family, divorce, moving to a new city) is known to increase the likelihood of the development of childhood behavior problems (Anderson, Greene, Hetherington, & Clingempeel, 1999; Compas, 1987), it is nevertheless possible that positive life satisfaction may serve as a buffer against the development of behavior problems.”

**Sleep**

Sleep is essential to a variety of life’s activities. Sleep deprivation has been found to impair multiple tasks in the realms of motor performance, cognitive performance, and even mood (Pilcher & Huffcutt, 1996; Pilcher & Walters, 1997). Some of the areas of cognitive functioning that have been shown to be impacted by sleep disturbances include: working memory, attention, perseveration, cognitive flexibility/inflexibility, creative thinking, decision making, and long-term memory (Alhola & Polo-Kantola, 2007; Harrison & Horne, 1998; Horne, 1988; Redline et al., 2007). In Pilcher and Huffcut’s (1996) meta-analysis of 56 studies examining the impact of sleep loss on performance in adults, they found that cognitive abilities were more impaired than motor abilities. Interestingly, they found that a partial sleep deprivation versus long- or short-term deprivation had the most profound detrimental influence on cognitive performance tasks. This is significant in that the majority of students do not experience full sleep deprivation as measured by above or below 45 total hours of total deprivation. They are more likely to experience the partial deprivation of less than five hours of sleep in a 24 hour period. In this light, the findings of Pilcher and Huffcut’s meta-analysis have particular relevance to the functioning of undergraduate students.

Multiple studies have evaluated the impact of sleep on the behavioral and cognitive functioning of children and adolescents (Dahl, 1996; Lavigne et al. 1999; Randazzo, Muehlbach, Schweitzer, & Walsh, 1998; Sadeh, Gruber, & Raviv, 2003; Touchette et al., 2007). Reinforcing the findings of the meta-analysis discussed above, Sadeh et al. (2003) found that even subtle changes in sleep can effect neurobehavioral functioning in children (mean age = 10.6). In this study, sleep habits were either altered by an average of 41 minutes decreased sleep over three nights (restricted sleep group) or by an average 35 minutes increased sleep over the same time period (extended sleep group). Individuals with an increased sleep time showed a better performance on neuropsychological tasks that include skills such as processing speed, attention, memory, and scanning. Look at some of the research on the impact of sleep in adults, and in other areas than working memory, for instance: mood, attention, grades, self-esteem, etc. Also, pull information related to circadian shifts in adolescents and the impact that has for college students. (look at my comprehensive exams for this.)

Likewise, in another study addressing the relationship between sleep duration and behavioral/cognitive functioning in young children, Touchette et al. (2007) found that a one hour reduction in nightly sleep was correlated with a decreased performance on a picture vocabulary test (a measure of receptive vocabulary and verbal intelligence) and the Block Design subtest of the Wechsler Intelligence Scale for Children – Third Edition (WISC-III) (a measure of visual/spatial skills and nonverbal intelligence). Their results show that decreased duration of sleep may influence language acquisition by impairing the integration of new words into memory. Similar findings by Randazzo et al. (1998) demonstrated in adolescents that restriction in just one night of sleep showed a decrease in executive function which they described as being involved in the “retrieval of knowledge from long-term memory” along with involvement in other functions (p. 866). In childreneven small sleep deficits have been found to impair working memory tasks (Sadeh, Gruber, & Raviv, 2003). Sadeh et al. (2003) documented increased memory performance in children with only a half hour sleep extension. Seventy-seven children in the fourth or sixth grade were evaluated using an actigraph watch (which measures motor activity and sleep-wake patterns in a child’s natural setting) and a sleep-wake diary (which documented self-reported assessments of daytime fatigue, perceived duration to fall asleep, etc.). The watch was worn by participants for five nights, two of which were meant to establish a baseline and three nights to evaluate the treatment conditions. In order to assess their neurobehavioral functioning, the children were given a series of six tests including three that involved working memory: symbol-digit substitution (where the child must identify a rearranged group of digits and symbols from a short presentation of a nine figure sequence), visual digit span (where the child must recall a visually displayed sequence of numbers), and serial digit learning (where the child must recall verbally presented sequences of numbers). Neurobehavioral functioning was first assessed on the second morning to establish baseline and then again on the sixth morning (at the same time of day) after the treatment of either one hour sleep restriction or extension had been in effect for three nights. The study found that with just a 35 minute sleep extension children showed a significant improvement in memory related activities such as digit span forward as compared to children with no change in sleep duration or sleep restriction.

Sleep impairments have a profound influence on the functioning of students in various ways but possibly the most significant effect is in the academic setting. One aspect that is essential for success in the classroom, and is significantly impacted by insufficient sleep, is academic engagement. When transitioning to the college level, students acquire a new level of independence that often involves changes in responsibility and new requirements for more self-motivation and self-control. Students need to be responsible for their own learning, engagement, and outcomes. As a result, academic engagement becomes more essential to the success of college students.

Academic engagement is vital for academic learning and success, *as it is the concurrent storage and manipulation of information that is used in more complex tasks* (). A number of key skills that are impacted by stress and self-care practices are comprise the foundation for scholastic achievement are found as part of the definition of AE. dependent on the ability to retrieve and process information at the same time. The findings of these studies suggest general working memory impairment in students that are underachieving academically. Describe AE more and segue into sleeps impact on it.

Numerous studies have discussed the negative impact of impaired sleep on aspects related to achievement. Turner, Drummond, Salamat, and Brown (2007) reported that specifically the span of working memory is associated with total sleep deprivation. In another study, working memory scanning speed showed no learning improvement when the participant was sleep deprived, whereas performance improved over time when the subject got adequate sleep (Casement, Broussard, Mullington, & Press, 2006). Casement et al. found a 58% increase in learning for adults who had 8 hours of sleep a night as compared to those that only had 4 hours. Perhaps the most significant aspect of the findings in this study is that the lower sleep group did not show deficits when compared to their baseline. It was only over the course of days and in the context of progressive learning that there appeared to be a differential impact.

Sleep patterns and their relationship with academic performance have commonly been evaluated for children and adolescents. For example, several studies have found correlations between sleep behaviors and achievement (Curcio et al., 2006; Dewald et al., 2010; Sadeh et al., 2003; Wolfson & Carskadon, 1998 – make sure I have these and review them, check Gomes paper for citations). Based on a meta-analysis by Dewald et al. (2010) analyzing the impacts of sleep variables such as sleepiness, sleep quality, and sleep duration on cognitive functioning and academic performance in children and adolescents, it is clear that these innfluences are not necessarily the same across age groups and separate investigations are necessary to illuminate the specific impacts involved with older students. Accordingly, several researchers have focused on examining this relationship specifically in undergraduate students or across multiple age groups (Gilbert & Weaver, 2010; Gomes et al., 2011; Oginska & Pokorski, 2006; Pagel et al., 2010; Trockel et al. 2002).

Trockel or Gomes research

In their research, Gilbert & Weaver (2010) postulated that sleep quality may be more salient than psychopathologies, such as depression, as a predictor of poor academic performance. They noted that few university psychologists are assessing sleep when working with college students, and “sleep quality is seldom a direct target of therapeutic interventions.” (pg. 298) Controlling for depression, Gilbert & Weaver evaluated the effects of sleep quality and sleep deprivation on the academic performance of university undergraduates. Participants (mean age = 19.46), screened to rule out depression, were provided multiple measures to determine a global sleep quality (GSQ) score. Additionally, information related to gender, age, and GPA was collected. A significant negative correlation between GSQ and GPA was found, indicating that poorer sleep quality was associated with decreased performance. Sleep length was also found to be a predictor of GPA. Their findings suggest that impaired sleep significantly impacts performance independent (irrespective?) of the influence of depression, sleep habits of undergraduate students are poor, and sleep education programs at the college level that focus on sleep hygiene may be beneficial as a therapeutic practice to address the needs of this at-risk population.

A noted limitation of the research of Gilbert & Weaver is the potential for mediating factors influencing the relationship between sleep quality and academic performance. As an example, they suggest that poor sleep may lead to negative? behaviors (i.e. truancy) that may be the true source of lower performance. In their research, Gomes et al. (2011) also evaluated the impact of sleep on undergraduate students; however, they looked to tease out potential mediating factors by including the variables of attendance, study time, substance usage, exercise, neuroticism, age, and sex, among others, in the study to help determine the specific impact of aspects of impaired sleep on college students and whether sleep shows a significant impact when including other potential predictors of performance (total of 30 potential predictors, four of which were sleep related). Using stepwise multiple regression, they found 5 significant predictors of school marks in order of significance: previous academic achievement, class attendance, frequency of enough sleep, night outings, and sleep quality. When comparing alongside a swath of potential predictors, two of those found to be significant were *(directly related to)* sleep variables. *(the association between exercise and GPA was found to be nonsignificant. Also, the other two potential sleep predictors (sleep phase and regularity of sleep schedule) were not found significant which may prove to be problematic as far sleep hygiene is concerned, but possibly not)*.

The findings of Gomes et al. (2011) are in line with a review of the effects of sleep reduction by Banks & Dinges (2007) that discussed how sleep reductions of only a few hours per night accumulated over several nights, can lead to neurobehavioral deficits similar to those found with full sleep deprivation. Specifically, they explained how research has shown that a reduction in sleep over the course of multiple nights can result in impairments in mood, alertness, cognitive functioning, and health factors including detrimental effects on endocrine (increased weight gain and BMI), immune, and cardiovascular responses/systems.

Oginska & Pokorski (2006) also provide support for the negative impact of sleep deprivation, in the form of insufficient sleep, on cognitive and affective functioning. By addressing three age groups (adolescents age 14-16, university students age 20-27, and young employees age 30-45) they were able to determine that adolescents showed the biggest discrepancy between the amount of sleep they desired and the amount of sleep they were getting a night. When looking at the impact of sleep deficits across all groups, deficits resulted in universal decline in aspects such as daytime fatigue, apathy, feeling drowsy upon waking, concentration issues, fatigue upon awakening, overall weakness, and reduced inclination to put forth effort. Relating these deficits to the multi-faceted construct of academic engagement, it can be seen that impaired sleep has a myriad of implications in the success and engagement of undergraduate students. Feeling fatigued, lacking concentration, and reduced effort were found to be the areas most correlated with sleep loss in university students. Issue/Deficits? of this kind can impact many of life’s functions, including academic engagement and subsequent scholastic success. More specifically, deficits in these areas may have the greatest impact on the “skills engagement” factor of academic engagement, which is defined by concepts such as “putting forth effort,” “listening carefully in classes,” and “coming to class every day.” *Apathy was correlated with sleep loss in the adolescent group but was not on of the strongest correlates for the (university) student group. “Emotional engagement” is the factor most tied to the concept of apathy with items such as “finding ways to make the course interesting to me.” These results suggest that emotional engagement may not reflect the same impact of sleep loss as other areas of academic engagement.(check the apathy aspect – can’t tell if it was correlated from the paper. Check and change sentence if needed)* Consequently, skills engagement characteristics of attendance and active engagement in the form of taking notes, completing homework, and being organized are likely the areas of engagement most influenced by issues with sleep quality and quantity.

Decreased levels of rapid eye movement (REM) sleep, a stage of sleep characterized by increased dreaming, can also show detrimental effects on the consolidation of learning (find this and check - De Koninck J, Lorrain D, Christ G, Proulx G, Coulombe D. Intensive language learning and increases in rapid eye movement sleep: Evidence of a performance factor. Int J Psychophysiol. 1989;8:43-47.). Since this stage of sleep is often found later in a night’s sleep, reductions in overall sleep or in the early morning when it is occurs most, can have a detrimental effect on learning and retention of knowledge (Find this and check- Smith C, Lapp L. Increases in number of REMS and REM density in humans following an intensive learning period. Sleep. 1991).

In looking further into the aspects of sleep most impacted by disordered sleep behaviors, Pilcher et al. (1997) found that not only is sleep quantity a factor in influencing many of life’s functions, but that sleep quality is important with health, mood, life satisfaction, and even more influential on levels of sleepiness.

Gomes et al. : “Specifically, in samples of university students observed in their natural environment, poorer academic results have been consistently associated with shorter sleep duration (Borisenkov et al., 2010; Jean-Louis et al., 1996; Kelly et al., 2001; Medeiros et al., 2001; Trockel et al., 2000), with later sleep-wake schedules (Elliason et al., 2010; Johns et al., 1976; Medeiros et al., 2001, 1996; Smith et al., 1989; Trockel et al., 2000), and/or with related variables, such as delayed sleep phase (Lack, 1986) and eveningness orientation (Bes¸oluk et al., 2011; Borisenkov et al., 2010; Medeiros et al., 2001; Randler & French, 2006; Smith et al., 1989). Eveningness preference has also been found to be associated with other variables apparently related to academic achievement, such as procrastination (Digdon & Howell, 2008; Hess et al., 2001).” “Summarizing the vast literature on sleep and chronobiology, we may assume that four fundamental sleep patterns are expected to be associated with academic achievement: sleep quantity, sleep quality, sleep regularity, and sleep phase schedules. Specifically, sleep restriction, poor sleep quality, and irregular and late sleep schedules are expected to be associated with poorer school performance.” Look up and discuss these articles: “Trockel et al. (2000) analyzed the associations of first-year undergraduate academic performance with health-related variables relative to exercise, nutrition, sleep habits, mood states, perceived stress, time management, social support, religious or spiritual habits, extra number of hours worked per week, sex, and age. Multiple regression analyses selected five significant predictors, two of which were sleep variables (weekday and weekend wake-up times), that accounted for the highest proportion of explained variance in GPA. In a study focused on links between alcohol use, sleep, and academic performance in college students, Singleton and Wolfson (2009) found Scholastic Aptitude Test scores were the strongest predictor of GPA, with the other significant predictors being sex, alcohol consumption, sleep duration, and daytime sleepiness.”

**Sleep Habits in Adolescents and Young Adults**

Sleep difficulties are a growing problem, particularly with undergraduate students whose sleep schedules, sleep environments, increased autonomy (social life), and circadian shifts result in circumstances of reduced sleep times and sleep quality (Brown & Buboltz, 2002; Brown et al. 2001; Pilcher et al. 1997 ). In an effort at identifying the sleep habits of university students, Bulboltz et al. (2001) found that although students averaged just over 8 hours of sleep per night regardless of it being a weekend or weekday, students showed close to a two hour shift to later sleep onset and wake times on the weekend, indicators of sleep disturbances or problems with sleep were reported by 73% of the students. Additionally, issues regarding sleep quality versus sleep quantity were identified, with students reporting morning fatigue and difficulties with sleep onset latency (the time it takes to fall asleep). Notably, students perceived themselves as getting less sleep during the week than they actually received, perhaps impacting the level of perceived daytime sleepiness. (women reported more symptoms than men) Look at Brown articles and report more about sleep levels with undergraduate students.

As compared to clinical populations who seek out support for sleep difficulties such as insomnia or other sleep disorders, (i.e. insomnia), college students may be less aware that their current functioning may be impaired because of sleep difficulties. For instance, sleep deprived students have been shown to rate themselves higher in cognitive performance when sleep as compared to non-sleep deprived students, even though their performance was significantly more impaired (Pilcher & Walters, 1997). Consequently, it is important to help educate and support healthy sleeping habits for these students in the form of educational sleeping programs focused on effective sleep hygiene (Brown & Bulboltz, 2002).

Brown & Bulboltz 2002: “Many students are unaware that their academic difficulties may be related to their sleep habits. In fact, many rate their cognitive abilities higher when they are sleep deprived, while objective evidence indicates they perform worse than those who obtain 8 hours of sleep (Pitcher & Walters, 1997).” (find this article and quote it). “Research in clinical populations indicates that psychoeducational programs are among the most effective means to reduce sleep difficulties (Morin, Culbert, & Schwartz, 1997; Murtagh & Greenwood, 1995) and are clearly more effective than sleep medications (Bootzin & Perlis, 1992; Morin et al., 1994; Morin & Wooten,1996).” Additionally, students with misperceptions of positive sleep behaviors are more likely to have more impaired sleep habits (\*Hicks, Lucero-Gorman, & Bautista, 1999 – get this article and check this anecdote). Addressing sleep disorders in these students can help with not only school failure, but with school retention rates. Since it is difficult to restructure the schedule of university classes to cater to the needs of sleep deprived and often prohibitive, a more student-directed intervention may be more effective and less prohibitive schedule-wise. One suggested method to address the sleep disorders of university students is a psychoeducational program proposed by Brown & Buboltz (2002) based on educating students on positive sleep hygiene practices. They suggest that this program may be implemented as part of residence housing or freshman orientation programs. Brown & Buboltz (2002a) provide a good example of a potential sleep education program in their paper “Applying…” (this can lead into the topic of sleep hygiene).

Prevalence of poor sleep quality in adolescents/undergraduate students: talk about brown & buboltz research and Gilbert & Weaver’s quote: “Strikingly, 70% of our sample had clinically poor sleep quality, defined as GSQ scores two standard deviations above the mean of the control group of the original Buysse and colleagues (1989) PSQI validation study.”

Gilbert & Weaver (2010): “Not surprisingly then, both sleep deprivation and poor sleep quality are particularly prominent in young adult and college student populations (Brown et al., 2001; Jensen, 2003; Lack, 1986; Markel, 2003). One recent study found that university students report at least twice as many sleep difficulties as the general population (Brown et al., 2001).” “One study of college students found that sleep loss results in a preference for cognitive tasks Downloaded by [University of Arizona] at 13:55 27 September 2017 Sleep Quality and Academic Performance 297 demanding minimal effort so that adequate performance can be maintained (Engle-Friedman et al., 2003), suggesting that sleep loss may also constrain the academic, extracurricular, and perhaps even the vocational choices of at least some sleep-deprived students.” “Brown & Buboltz (2002b, p. 33) stated “at least two thirds of college students report occasional sleep disturbances, and about one third of those report regular, severe sleep difficulties. The problem is even more evident in a recent study that found that only 11% of the students surveyed met the criteria for good sleep quality (Buboltz, Brown, & Soper, 2001). The rest of the sample had moderate-to-severe sleep complaints.”

Adolescents show a phase shift in their sleeping habits, including later bedtimes and earlier wake times. This phase delay has been documented in several studies (look up my comprehensive exam question addressing this) (Carskadon, etc) and impacts the length and quality of sleep that adolescents receive. Pair this with the responsibilities that come with independence during college and many students struggle to have healthy sleep practices that promote academic achievement and engagement. For instance, undergraduate students show a pattern of reduced sleep quantity and quality (Gaultney, 2010; Orzech et al. 2011; ). In a study by Orzech et al. (2011)**,** they foundthat pulling all-nighters was associated with lower GPAs, and interviews with students indicated experiences of impaired memory, concentration, and focus as a result of sleep loss. Using a simple sleep education intervention the researchers saw improvements in the sleep length, latency, and other sleep practices of the participating college students. Other research has indicated a link between reduced sleep and reduced academic performance, as well (Gaultney, 2010). Gaultney **(**2010)

Summarize all the research on how much sleep undergraduate students are getting overall. (Brown & Bulboltz articles)

**Sleep Hygiene**

Our behaviors and choices are integral to the quality and quantity of sleep we receive. Certain conditions and practices have been found to be more conducive to getting a good night’s rest (Bootzin. … find this and others). For instance, light, noise, caffeine, alcohol, sleep schedules, delayed circadian phase, discomfort, rumination, naps, exercise near bedtime, being upset at bedtime have all been associated with impaired sleep (Brown & Bulbitz, 2002 – look at this more; Bootzin?; Brown et al. 2001). There are various measures we can take in order to optimize our sleep, and, consequently, improve aspects that benefit from adequate optimized sleep. (discuss the common disturbances of sleep more with research)

Delayed Sleep Phase Syndrome (DSPS) is characterized by later sleep onset and wake times, and has been associated with negative academic performance (find a reference). Brown et al. (2001) looked specifically at how college students are experiencing DSPS. There findings showed that 11.5% of participants had symptoms consistent with DSPS. The difference between weekday and weekend bedtimes and wake times showed significance, indicating that in both cases students showed a phase delay. Additionally, students reported sleep disrupting behaviors such as napping during the day, issues with sleep latency, in addition to general sleep difficulties. As discussed in previous

Research on sleep hygiene has shown that it exacerbates but is not the root cause of sleep disorders such as insomnia. Sleep hygiene includes behaviors related to improved sleep conditions, and, subsequently, sleep quantity and quality. According to Stepanski and Wyatt (2003) the behaviors (commonly? –check if this is the study for the survey I am using and specify if so) addressed in sleep hygiene include consistent/variable sleep bedtimes/waking; light and noise, naps/homeostatic pressure, impact of stimulants/depressives including alcohol, caffeine, and prescription medications; exercising close to bed time; spending time in bed while not sleeping, for example, watching television, reading, etc.; performing mental activities, planning, etc. in bed or just before bedtime; and poor sleep conditions/bedding. Make sure I put this section in quotes if needed. Look further into this research and then discuss the study by Mastin et al. (2006) that developed the SHI measure I will be using. Discuss in detail the International Classification of Sleep Disorders from the American Sleep Disorders Association (1990), whose criteria were used to develop the SHI. Highlight the different criteria, how they differ/are similar to that used in Stepanski & Wyatt, and determine if I want to look at the two factor model of SH from Cho et al (2013). Provide some evidential research for the various components of SHI and how they specifically impact sleep. Address the issue of exercising near bedtime as an item of SHI, and the potential confounding aspects of that item.

Brown & Buboltz give a great summary of sleep hygiene factors – reference that here.

In a study looking at the impacts of sleep hygiene on infants and children, Mendell et al. (2009) found that poor sleep hygiene practices were associated with reduced sleep quantity and quality. For instance, late bedtimes were associated with extended sleep latency times. Additionally, obtaining less sleep (shorter night’s rest) was associated with late bedtimes, caffeine consumption, lack of a consistent bedtime routine, and having a television in the bedroom.

Sleep hygiene interventions offer an affordable, non-clinical way to address health needs for adults (Irish et al. 2015). Irish: “Recent public health campaigns have advanced general knowledge about the importance of good sleep, though they are often focused on adequate sleep duration rather than good sleep quality, and the effectiveness of these campaigns is generally unclear. Less is known regarding scientifically valid strategies by which the average person might effectively improve their sleep. Relatively few studies have investigated the efficacy of sleep hygiene interventions in nonclinical samples [16e20]. Overall, this work has provided some preliminary support for the use of sleep hygiene education in nonclinical populations, but the findings are inconsistent. Taken together with findings in clinical samples, these data raise an interesting question.”

Young adults show significantly lower awareness and use of beneficial sleep hygiene practices than adults of other ages (Cho et al., 2013; Voinescu & Szentagotai-Tatar, 2015).

The Sleep Hygiene Index has been found to be significantly correlated to sleep quality, subjective daytime sleepiness, \_\_\_\_\_\_\_\_\_ (Brown et al., 2002; Cho et al., 2013; Mastin et al. 2006). Based on an evaluation of the Sleep Hygiene Index, Cho et al. (2013) proposed that the Sleep Hygiene Index would be more appropriately broken down into two factors, including “sleep disturbing behavior” and “irregular sleep-wake schedule.” (decide if I want to look further into the two factor model)

Write a whole paragraph on this article: (Brown et al. 2002 ) “Their findings suggest that knowledge of sleep hygiene is related to sleep practices, which, in turn, is related to overall sleep quality. The data from their regression modeling indicated that variable sleep schedules, going to bed thirsty, environmental noise, and worrying while falling asleep contribute to poor sleep quality.”

**Stress & Sleep**

Minkel et al. (2012) looked at impacts of sleep deprivation on the ability to manage stress. Discuss this research in detail.

**Exercise**

Gender and exercise in college students: Buckworth & Niggs 2004.

Similar to sleep, exercise has been shown to positively impact a myriad of life’s functions including mood, mental health, telomere length, cognitive functioning, attention, cardiovascular health, stress levels, and self-esteem (Dunn et al. 2001; Galper et al. 2006; Manger & Motta, 2005; Puterman et al. 2010; Spence et al. 2005; VanKim & Nelson, 2013; )

**Exercise and Academics/Achievement**

A study completed by Swedish researchers Kall et al. (2013) utilized a school-based physical activity intervention “School in Motion” program for a group of 5th graders in a cross-sectional design to determine whether it impacted the students’ odds of reaching the national goals in areas such as Swedish, English, and mathematics. Their findings indicate that “The results of this study showed that a school-based physical activity intervention program designed to make students more physically active during the school day significantly improved the children’s academic achievement.” And “However, our findings are in line with those of other previous studies,4,5,10,18-26 and thus, contribute to the body of evidence for a link between exercise and learning. Because time devoted to physical activity could instead be time devoted to academic work, physical education is sometimes seen as a competitor of academic studies. One could question whether school-based physical activity is provided at the expense of time dedicated to academic learning. However, previous studies have demonstrated that increases in time spent in physical education are not likely to detract from students’ academic effort.5,30,31 At the time of our study, the intervention school did not have a regulated time plan, and the play and motion activities did replace some academic time. Only a little extra time for some classes was added to the ordinary schedule.” The authors noted benefits to physical activity on academic achievement as potentially improved concentration and enhanced behaviors conducive to learning, increasing self-efficacy, reducing stress, and enhancing mental health.

From Kall “The author of a previous study38 suggested that increased physical activity during the school day may induce arousal and reduce boredom, which may result in increased concentration and an increased attention span. A more motivating school environment may have encouraged the students in the present study to engage more fully in schoolwork and may have thus been a mediating factor contributing to the results observed. However, all these effects may also have been the result of the intervention having a direct or indirect impact on the children’s academic achievement. Biological effects, such as increased cerebral blood flow and angiogenesis (a primer for neuronal plasticity), may also have contributed to enhancements of the prerequisites for learning. In combination or separately, these mechanisms may be the underlying factors mediating the link between exercise and academic achievement. The literature provides evidence that fitness and exercise may boost brain function and cognition.23,39,40”

Physical exercise and fitness has been shown to have a myriad of beneficial impacts on cognition, executive control, learning, academic achievement, mood, self-esteem, and general health (Fedeway & Ahn, 2011; Hillman, Erickson, & Kramer, 2008; Kristjansson et al., 2010; Pontifex et al. 2009). In a meta-analysis looking at the effects of physical activity/fitness on children’s achievement, Fedewa & Ahn (2011) analyzed 59 studies from 1947 to 2009 and found a significantly positive effect on both achievement and cognitive outcomes. Their overall results were similar to previous meta-analyses that indicated a similar effect of exercise on cognitive outcomes (Sibley & Etnier, 2003; Etnier et al, 2006). Although most areas of evaluated physical activity yielded significantly positive results, the meta-analysis showed that aerobic exercises resulted in the largest impact on cognitive outcomes and academic achievement. One area of physical activity that did not show significant results was that of flexibility. A study completed by Pontifex et al. 2009 also found positive effects of aerobic activity. In their study aerobic exercise showed a larger reduction in response times for working memory than in those conditions with resistance exercises or seated rest. Additionally, the analysis by Fedewa & Ahn suggested an increase in achievement as activity levels increase. It is also interesting to note that the area of achievement most affected in these children was mathematics, followed by positive effects on reading achievement and IQ. Finally, the authors note that the effects were as significant or more so on children with learning or physically disabilities. Fedewa: “Physical education is therefore assumed to be a threat to academic subjects, as time spent in physical activity could be time devoted to learning reading, science, and mathematics.”

Fedewa pg 522 “smaller studies have associated time spent in physical activity and/or the level of children’s physical fitness with higher cognitive performance. Similar findings are reported throughout the literature in this area, suggesting that an increase in physical activity and fitness level is positively associated with higher cognitive functioning and achievement scores in elementary and middle school-age children (Burton & VanHeest, 2007; Sibley & Etnier, 2003).”

Fedewa: “, a number of recent studies have addressed the question of whether physical fitness enhances cognitive or achievement outcomes for children (e.g., Castelli, Hillman, Buck, & Erwin, 2007; Coe, Pivarnik, Womack, Reeves, & Malina, 2006; Eveland-Sayers, Farley, Fuller, Morgan, & Caputo, 2009). Thus, the inclusion of these recent studies is critical to inform the relationship between physical activity/ fitness and children’s cognitive functioning. Given budget constraints and increasing.” “the purpose of this study was to quantitatively synthesize the research on physical activity and children’s cognitive outcomes and to discuss implications for educators and other stakeholders in children’s academic achievement.”

**Exercise and Study Skills and Classroom Participation**

**Exercise and self-esteem**

One of the factors of Academic Engagement is “perfomance engagement” and a component of that is “Being confident that I can learn and do well in the class”. Self-esteem is intrinsically linked to self-confidence (find supporting evidence), as the definitions of both include…. The effects of exercise on global self-esteem were evaluated in a study be Spence et al. 2005. They did a quantitative review of the research and found a small but significant increase in self-esteem associated with exercise and a larger effect size when there were significant changes in physical fitness.

Kristjansson et al. 2008, showed not only a positive correlation between physical activity and academic achievement, but a similar link between physical activity and increased self-esteem in a study evaluating adolescents in Iceland. However, they found that self-esteem was a weak mediator of the relationship between physical activity and increased academic performance, stating, “the influence that health behaviors have on academic achievement appears mostly to take place outside the impact of self-esteem.” (can look at this study to review use of mediators). Kristjansson: “In a study of preadolescent children’s health behavior, self-esteem, and academic achievement, Tremblay, Inman, and Willms (2000) found that the relationship between physical activity and academic achievement was weak but that participation in physical activity was positively related to higher levels of self-esteem. Similar findings regarding the association between health behavior and high levels of self-esteem have been reported by other investigators (e.g., Huntsinger &Luecken, 2004).” “Despite these limitations, the fact that self-esteem did not, for the most part, mediate the impact of the health-behavior variables on academic achievement supports the notion that adolescent engagement in healthy behavior remains important if societies wish to simultaneously improve both the health status and academic-achievement goals of young people. The fact that health behavior also strongly influences self-esteem only reinforces the significance of this fact. Furthermore, the influence that health behaviors have on academic achievement appears mostly to take place outside the impact of self-esteem.”

**Amount of Exercise**

**Fedewa: “**In terms of how much physical activity to provide students, a related finding of the current analysis revealed that physical activity provided three times per week exerted the strongest effect on children’s cognitive outcomes and achievement. Although few researchers have examined the relationship between the amount of physical activity and children’s cognitive outcomes and achievement, there is evidence that more physical activity produces higher achievement scores (Coe et al., 2006; Shephard, 1997). One proposed reason for this is that increased activity may enhance arousal and minimize fatigue and boredom (Shephard, 1996). An alternative explanation by Shephard (1996) proposes that increased physical activity leads to higher levels of self-esteem, optimizing students’ academic achievement. Other, more neurological, theories tout that changes in brain structure, function, and neurotransmitter concentrations occur in individuals who are more physically active (Hillman et al., 2004; Hillman et al., 2006; see Trudeau & Shephard, 2010). All of these hypotheses could serve as possible explanations for the current findings, but more research is needed to investigate the complex relationship between physical activity dosage and cognitive outcomes in children.”

**Exercise and Stress**

Exercise has been shown to improve emotional well-being in a variety of ways. For instance as a study by Manger & Motta (2005) indicated, a 12-session aerobic exercise intervention improved the symptoms of Post-traumatic Stress Disorder (PTSD), anxiety, and depression. Puterman et al. (2010) found a significant moderating effect of exercise on the impact of perceived stress levels on telomere length (TL), stating that, “Vigorous physical activity appears to protect those experiencing high stress by buffering its relationship with TL (telomere length).” Another study (VanKim & Nelson, 2013) showed that in a sample of over 14,000 undergraduate students those that met the most vigorous levels of physical activity were less likely to indicate perceived stress and poor mental health. No differences based on sex or ethnicity were identified. They discussed how poor mental health and perceived stress are highly correlated so consequently showed similar magnitude and directionality for the association with vigorous physical activity. Additionally, their study suggests that socializing partially moderates the relationship between mental health/perceived stress and physical activity. Vankim and Nelson discussed the following “Approximately a third of young adults (ages 18–24 years) in the United States attend college, representing a critical mass of the young adult population.11 In addition to decreased PA, the transition to college can be academically and socially stressful for students.12 In a study assessing cardiovascular health among college students, nearly 60% of participants reported high or very high stress.13 Increases in reported stress could be attributed to the set of academic and social stressors within the college setting, such as examinations, interpersonal relationships, and the transition to living independently.12 Relatedly, college can also be a period of increased risk for poor mental health and depression.14,15 A nationally representative study of college students found that 4.8% reported symptoms of poor mental health and depression,14 and a study of adolescents and young adults (ages 15–24 years) from the National Comorbidity Survey found that 5.8% met Diagnostic and Statistical Manual of Mental Disorders (Third Edition Revised) criteria for major depression and 2.1% met criteria for minor depression in the past 30 days.15 Recent national data from the Behavioral Risk Factor Surveillance System indicates that compared to other adult age groups, young adults (ages 18–24) have the highest prevalence of depressive symptoms that do not meet the criteria for major depression.16 The ability to cope with the stressors associated with the college environment is important for maintaining both mental and physical health.” And for discussion: “Interventions aiming to improve mental well-being of college students should also consider promoting physical activity. At least some of the positive benefits of physical activity may arise from social interactions.” It has also been noted that physical activity shows a decline as students advance in age with less likelihood of participating in vigorous exercise at the college level than in earlier years (Vankim & Nelson, 2013; Nelson et al., 2007; Troiano et al. 2007). Consequently, research such as this can help identify the areas of personal care that will have the greatest impact on undergraduate’s academic engagement and subsequent, positive college outcomes. Understanding the pathways for student achievement and engagement can help focus intervention efforts to highlight areas that will be the most beneficial and effective. Nelson et al.: “Vigorous physical activity (VPA) declines from adolescence into adulthood and social disparities in VPA exist. Physical activity is understudied in the college setting. Fewerstudents engaged in VPA in college compared with high school (males 74% to 52%; females 68% to 44%). Athletics was associated with VPA, but 51% participated in high school and 15% in college. Among females, African Americans, Asians, and students of lower socioeconomic position (SEP) were less likely to engage in VPA in college, adjusting for high school VPA. Among males, Asians and older students were less likely to engage in VPA.”

**Exercise – Methods**

In research by Galper et al. they classified physical activity into four groups including inactive (< 1), insufficiently active (1-10), sufficiently active (11-19), and highly active (>=20) based on miles per week of walking, jogging, and running. (Although overall significance was found for both?), They found no significant differences between the sufficiently active and highly active groups when it came to the impact on depressive symptoms and emotional well-being. Galper et al.: “The analyses presented here show that depression and emotional well-being reached a plateau at 11–19 miles per week of walking, jogging, and running on the PAI (see Figs. 2 and 4). It is noteworthy that this weekly dose of physical activity is equivalent to 1100 –1900 kcal·wk1 , or approximately 2–3 miles or 30 min of aerobic activity on most days of the week, which is “sufficiently active” to attain most health benefits according to current public health recommendations for physical activity in adults (22,32). However, some research suggests that the intensity, frequency, or duration of physical activity may be independently associated with health outcomes (7,16). We were not able to examine these parameters because they are not part of the PAI. If we had been able to investigate other measures or categories of physical activity, we may have found different dose–response relationships. For instance, our results may have been more consistent with evidence of a nonlinear dose–response relationship (7)”

**Exercise – Discussion:**

Buckworth & Niggs found that different sedentary behaviors were negatively correlated with exercise or physical activity, (showing that discretionary time of college students is often utilized based on gender), with females more likely to watch television and males more likely to spend time on the computer versus exercising. However, “Time spent studying was positively correlated with days per week of strength training for females, and with typical duration of exercise for both males and females.”

Buckworth & Niggs 2004: “Participation in exercise during college students’ discretionary time may be positively modified by targeting sedentary activities, as has been demonstrated in studies with children in which increased physical activity was an outcome of strategies to reduce time in sedentary behaviors.20 Based on our findings, college health promotion specialists should consider designing interventions that pose physical activities as more accessible and more rewarding than using the computer for male students and watching television for female students. Future research should include the development of instruments to detect a more extensive range of sedentary activities typical of college students, as Lee and King30 have done for older adults, that can be evaluated in terms of perceived choice and reinforcement value. Decreasing accessibility and rewards from major competing sedentary activities while increasing the accessibility and reinforcement values of exercise and physical activity can have immediate and long-term health benefits for college students.”

Trost et al. 1999 stated the following based on their research on 6th grade students: “These findings are consistent with previous studies using self-reported physical activity and suggest that interventions to increase physical activity in preadolescent youth should endeavor to boost physical activity self-efficacy by offering a wide selection of enjoyable, developmentally-appropriate physical activity options.”

Oginska & Pokorski 2007: “As Dement (1997) pointed out, although people get a great deal of information about two other health basics, nutrition and physical fitness, the society “remains a vast reservoir of ignorance about sleep deprivation and sleep disorders,” and “we must realize that we cannot be healthy unless our sleep is healthy.””

***Quote from Legget article 2016 pg 125 “Consistent with existing work (Devanand et al., 2002; Kessler, 1997; Kraaij et  al., 2002), stressful life events were associated with higher levels of depressive symptoms, and a time when individuals were experiencing above average levels of stress was also associated with more depressive symptoms. Similarly, restless sleep was associated with more depressive symptoms, and times when individuals reported worse sleep than was typical for them were associated with increased depressive symptoms. We uniquely find that variability over time in stress and sleep, and not just the average level of these factors, appeared to be related to depressive symptoms. In addition, we found a significant interaction between stressful life events and restless sleep at the within-person level showing that restless sleep strengthens the association between life events and depressive symptoms. In other words, those experiencing stress above what is typical for them are at particular risk for elevated depressive symptoms if they are sleeping more restlessly than usual. Sleeping restfully may therefore be allowing individuals the rejuvenation needed to manage their stress adaptively. Further, this association shows that stressors and risk factors may not always act independently of one another, and intervening on one risk factor, such as sleep disturbance, may have a positive impact on the entire pathway of biopsychosocial risk to depressive symptoms.”***

The current study looks at how sleep hygiene and physical activity mediates the relationship between stress and academic engagement. Research has shown that academic engagement is correlated with positive outcomes for achievement, and, in turn, future employment status (cite). With It calls into question whether the impact of other protective factors such as positive sleep behaviors, regular exercise, and if faced with similar stressors are the listed preventative factors associated or impact the likelihood of improved academic engagement? The implications of providing a predictive model of the likelihood of being academically engaged can be seen in being able to tease apart the protective factors that can be most highlighted for intervention.

\_\_\_\_\_\_\_\_\_\_\_\_ et al.’s inventory was in response to the conflicting research indicating that coping strategies were more complex than a two-pronged concept and that other proposed coping characteristics (denial, social support) were not falling under emotion-focused coping like several researcher proposed they belonged. Their inventory evaluated and broke down student course engagement (academic engagement) into several major factors including a four-factor pattern: Factor 1 included study skills, effort, work completion, attendance, and taking and reviewing notes; Factor 2 included emotional aspects such as desiring to learn and finding ways to make a course interesting or relevant to their lives; Factor 3 included participatory aspects such as participating in discussions, asking questions, and seeking help when necessary; and finally, Factor 4 included performance on tests, grades, and confidence about abilities in the specific course.

Methods

*Participants and Procedure*

The current research will be based on previously collected data. Participants included 206? undergraduate students who were part of the educational psychology research pool at a large southeastern university. The participating students were provided the option of completing a research review paper or participating in this study to fulfill a research requirement for their course. This option was provided to students in 3-4 classes over the course of multiple semesters. Volunteers were also obtained from other psychology and education courses.

The participants were asked to first complete a consent form and then multiple questionnaires either at home (if they were part of the educational psychology research pool), or for those students outside the research pool, during a period provided during their class period. Participants were asked to complete all questionnaire answers on a Scantron sheet and return them during the next class period. The participants were instructed to include their names only on the consent form, and on no other documents.

*Measures*

The included questionnaires were meant to determine the following: student’s demographics including age, ethnicity, class standing, and gender; the Undergraduate Stress Questionnaire (USQ) to measure recent stressful life events, the Sleep Hygiene Index (SHI) to measure positive sleep practices, the Leisure Time Exercise Questionnaire (LTEQ) to evaluate exercise habits; and the Student Course Engagement Questionnaire (SCEQ) to determine self-reported levels of academic engagement.

*Undergraduate Stress Questionnaire (USQ)*. Unlike other stress measures, the USQ is a self- report questionnaire specifically targeted toward college students, providing items relevant in the life of an undergraduate student (Crandall et al, 1992). As indicated by the research on stress, the questionnaire likewise shows positive correlations with physical symptoms and negative correlations with mood (Crandall et al., 1992). Although unlike other research?, the correlation with mood was only seen in females respondents. The USQ shows adequate validity and reliability.

An actigraph is a watch-like device that measures motor activity and information on sleep-wake patterns. Some of its measures include sleep duration, sleep latency, total sleep time excluding identified wake periods, and rising time. The actigraph has been shown to have good reliability and validity in laboratory settings (Wood et al., 2008). It also has been shown to be highly correlated with the biophysiological sleep measure of polysomnography (de Souza et al., 2003).

*Sleep Hygiene Index (SHI)*. In order to evaluate the use of sleep hygiene practices, the current study proposes to utilize the Sleep Hygiene Index (SHI). The SHI is a self-report measure comprised of 13 items rated on a five-point scale ranging from 0 (never) to 4 (always). It is a brief measure in comparison to previous, lengthier assessment instruments, showing satisfactory validity and reliability, including good test-retest reliability (Mastin et al. 2006; Cho et al., 2013). Items are based on “the diagnostic criteria for inadequate sleep hygiene in the International Classification of Sleep Disorders (American Sleep Disorders Association, 1990)” (Mastin et al. 2006). High scores indicate more maladaptive sleep hygiene practices, while lower scores demonstrate better sleep hygiene. The total score ranges from 0-52.

*Leasure Time Exercise Questionnaire (LTEQ).*  The LTEQ is a self-report questionnaire consisting of a 5-category rating range for three levels of physical activity: “Strenuous,” “Moderate,” and “Mild” exercise. The ratings range from A through E indicating “Never,” “1-2 times,” “3-4 times,” “5-6 times,” and “7 or more times” (per week). Subjects are asked about their average weekly exercise and how often they complete 15 or more minutes of either strenuous, moderate, or mild exercise during their free time. For the three levels of exercise, the questionnaire provides both descriptions of physical states one would experience at that level and specific activity examples (i.e. running for strenuous exercise and bowling for mild exercise). The LTEQ provides information on activity patterns and physical fitness (Godin & Shephard, 1985). A total leisure activity score is obtained by summing the (Talk to Dom about how the data was collected).

*Student Course Engagement Questionnaire (SCEQ).* Handelsman et al.’s (2005) SCEQ includes 23 items that are loaded onto four factors, including Factor 1 – Skills Engagement, Factor 2 – Emotional Engagement, Factor 3- Participation/Interaction Engagement, and Factor 4 – Performance Engagement. The measure shows reasonable reliability and internal consistency (Handelsman et al., 2005). The questions on this measure focus on academic engagement at the “micro” scale, and, consequently, items focus on academic achievement, interest in course content, showing effort and completing work, studying, participating in class discussion, and seeking help when needed among other items falling in a four-factor model. As indicated by Handelsman et al. (2005), items are rated on a 5-point rating scale, with the following instructions: “To what extent do the following behaviors, thoughts, and feelings describe you, in this course. Please rate each of them on the following scale: 1 = *not at all characteristic of me*, 2 = *not really characteristic of me*, 3 = *moderately characteristic of me*, 4 = *characteristic of me*, 5= *very characteristic of me*.”

Statistical Analysis:

Look at research by McKnight et al. (2003) for comparisons of moderation vs mediation on a similar study.

McKnight: “Analyses for moderational effects of life satisfaction were conducted, following Baron and Kenny (1986) guidelines. The moderational effects of life satisfaction on the relationships between stressful life events and behavior (internalizing and externalizing) were tested in a series of two hierarchical multiple-regression analyses. In the first regression equation, three variables were entered sequentially into the regression equation: stressful life events, life satisfaction, and the interaction term (SLE Life Satisfaction). The findings demonstrated that the stressful life events Table 2 Hierarchical Regression Analysis Predicting Life Satisfaction Predictor Adjusted R2 F Value Significance of Change in Adjusted R2 Final Beta Value Block 1 Neuroticism .16 115.07 — .33 Extraversion .11 Block 2 Stressful Life Events .19 94.29 .001 .18 Relationships Among Stressful Life Events 683 significantly related to externalizing behavior (R2 .08, F-change (1196) 104.38, p .05). In addition, life satisfaction added significant linear variance (R2 .18, F-change 147.95, p .05); however, the interaction did not contribute significantly to externalizing behavior (R2 .18, F-change .03, p .05). In the second regression equation, the same three variables that were entered in the first regression equation were again entered in the same order; however, in the second equation, the dependent variable was internalizing behavior. The results revealed that the stressful life events related significantly to internalizing behavior (R2 .05, F-change 68.93, p .05) and that life satisfaction contributed significant additional linear variance (R2 .26, F-change 334.18, p .05); however, the interaction did not (R2 .26, F-change .34, p .05). Thus, there was no support for the hypothesis than an adolescent’s level of life satisfaction moderates the relationship between stressful life events and externalizing or internalizing behavior.”

McCullough et al. 2001: “As described earlier, event scores (i.e., positive daily, negative daily, positive major, and negative major) were computed for individual students based on the number of events reported by each student. The interrelationships of the life experiences, self-concept, and the subjective well-being measures were further analyzed by conducting three separate hierarchical regressions, one for each of the indices of well-being (i.e., positive affect, negative affect, and life satisfaction). In conducting the hierarchical regression analyses, three predictors were entered sequentially in the regression equations. The first variable entered was global self-concept. The second variable, which was composed of the set of major life events (positive and negative), was entered as a block in each equation. The third predictor block was composed of the minor daily events (positive and negative). The third block was entered after the second block on the basis of the presumed temporal order of occurrence of the events. The results from the hierarchical regression analysis with life satisfaction as the dependent variable are reported in Table 2. The results indicated that self-concept significantly predicted reports of life satisfaction, accounting for 21.9% of the variance. Adding the second block of predictor variables to the regression equation demonstrated that major life events cumulatively added significantly to the predictability of life satisfaction; an additional 8.6% of the variance in life satisfaction reports was explained. The third block of predictor variables (daily events) added another 12.9% to the variance accounted for. Looking specifically at the categories of life events most strongly related to life satisfaction, only positive daily events related significantly to reports of life satisfaction.”

Talk with Dom –

Using a linear model – multiple regression (I have to assume my observations are independent). If variables are continuous then looking for changes in slope. Heirarchical models are used for nested data to account for possible correlation data. I need to look up how to find an effect modifier. How do I know if the slope has really changed if I add the other variable. Interaction effect. Google effect modifier –so I am familiar with what I am finding and why I am finding it. Testing for the presence of an effect modifier using interaction terms in a linear model.

Research Question #1: Statistical Evaluation

Null Hypothesis:

**2.2.1. Stress**

**The Undergraduate Stress Questionnaire (USQ; Crandall, Preisler,**

**& Aussprung, 1992) contains a list of 82 common life stressors that**

**undergraduate students may encounter. Participants are instructed to**

**indicate whether they have experienced each life event within the**

**past semester by checking “yes” or “no.” The USQ demonstrated good**

**reliability in the current study (α=.89).”**

(Legget et al., 2003) “The sample includes 3,597 adults aged 25 years or older who were surveyed up to five times over 25 years. Multilevel models were run to examine between- and within-person variability in sleep disturbance and life event stress as predictors of depressive symptoms, and an interaction to test sleep disturbance as a moderator is included in a second step.”

Discussion

Although, based on the current research it is difficult to make a claim of cause and effect. For instance, are the students who practice healthier personal care through sleep and exercise intrinsically the same individuals who are likely to actively participate and do well in school, or is there some aspect of sleep hygiene and physical activity that promotes a student’s academic engagement? Based on research that indicates increases in achievement, self-esteem, etc. following interventions of increased physical activity or improved sleep hygiene habits (cite) the benefit of practices and interventions to promote these behaviors becomes evident.

Fedewa: may be useful as part of discussion: the effect of physical activity programs was largest when a small-group intervention was conducted, followed by a moderate effect for a medium-group intervention (10–30 children). Research investigating the promotion of physical activity in children point to the effect of peer influence—perhaps a reason for the small group effect found in this analysis. According to these findings, using small group physical activities will result in higher cognitive and achievement outcomes than even medium group (i.e., classroom size) interventions.”

In addition to the ten proposals to enhance student engagement outlined by Zepke & Leach (2010), the current study presents evidence for emphasizing self-care practices at the college level. (look to see if this fits into any of there proposals)

References

Ash, C., & Huebner, E.S. (2001). Environmental events and life satisfaction reports of

adolescents: A test of cognitive mediation. *School Psychology International, 22,* 320–326. Retrieved from: http://journals.sagepub.com/doi/abs/10.1177/0143034301223008

Banks, S. & Dinges, D.F. (2007). Behavioral and physiological consequences of sleep

restriction.  *Journal of Clinical Sleep Medicine, 3(5),* 519-528. Retrieved from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1978335/

Buckworth, J. & Nigg, C. (2004). Physical Activity, Exercise, and Sedentary Behavior in College

Students. *Journal of American College Health, 53:1*, 28-34. doi: 10.3200/JACH.53.1.28-

34 **(Gender issues and exercise)**

-Brown, F. & Buboltz, W. (2002). Applying sleep research to university students:

Recommendations for developing a student sleep education program. *Journal of College Student Development, 43,* 411–416.

Brown, F., Buboltz, W., & Soper, B. (2002). Relationship of sleep hygiene awareness, sleep

hygiene practices, and sleep quality in university students. *Behavioral Medicine, 28,* 33–39. doi: 10.1080/08964280209596396

(disordered sleep – prevalence) Brown, F.C., Buboltz Jr., W.C., & Soper, B. (2006).

Development and Evaluation of the Sleep Treatment and Education Program for Students (STEPS). *Journal of American College Health, 54(4),* 231-237. doi: 10.3200/JACH.54.4.231-237

Brown, F.C., Buboltz Jr., W.C., & Soper, B. (2001). Prevalence of delayed sleep phase

syndrome in university students. *College Studies Journal, 35,* 472–476. Retrieved from: http://zp9vv3zm2k.scholar.serialssolutions.com/?sid=google&auinit=FC&aulast=Brown&atitle=Prevalence+of+delayed+sleep+phase+syndrome+in+university+students&title=College+student+journal&volume=35&issue=3&date=2001&spage=472&issn=0146-3934

Buboltz, W., Brown, F., & Soper, B. (2001). Sleep habits and patterns of college students: A

preliminary study. *Journal of American College Health, 50,* 131–135. doi: 10.1080/07448480109596017

Burton, L. J., & VanHeest, J. L. (2007). The importance of physical activity in closing the

achievement gap. *Quest, 59,* 212–218. doi: 10.1080/00336297.2007.10483549

Castelli, D. M., Hillman, C. H., Buck, S. M., & Erwin, H. (2007). Physical fitness and

academic achievement in third- and fifth-grade students. *Journal of Sport and Exercise*

*Psychology, 29,* 239–252. Retrieved from: <https://doi.org/10.1123/jsep.29.2.239>

(figure out how to cite) Chapman, 2003. Assessing Student Engagement Rates. Retrieved from:

http://files.eric.ed.gov/fulltext/ED482269.pdf

Cho, Sungkun, Gye-Seok Kim, & Jang-Han Lee (2013). Psychometric evaluation of the sleep

hygiene index: a sample of patients with chronic pain. *Health and Quality of Life Outcomes,* 11(213), 1-7. doi:10.1186/1477-7525-11-213

Coe, D., Pivarnik, J. M., Womack, C. J., Reeves, M. J., & Malina, R. M. (2006). Effects of

physical education and activity levels on academic achievement in children. *Medicine & Science in Sports & Exercise, 38,* 1515–1519. Retrieved from: https://pdfs.semanticscholar.org/dbd7/21411962b61b1f57ef16df7655f71a3318c2.pdf

Colcombe, S. J., Kramer, A. F. (2003). Fitness effects on the cognitive function of older adults: A

meta-analytic study. *Psychological Science, 14,* 125–30. Retrieved from: http://journals.sagepub.com/doi/pdf/10.1111/1467-9280.t01-1-01430

Crandall, C. S., Preisler, J. J., & Aussprung, J. (1992). Measuring Life Event Stress in the Lives

of College Students: The Undergraduate Stress Questionnaire (USQ). *Journal of Behavioral Medicine, 15(6),* 627-662. doi: https://doi.org/10.1007/BF00844860

Dencker, M., Bugge, A., Hermansen, B., & Andersen, L. B. (2010). Objectively measured

daily physical activity related to aerobic fitness in young children. *Journal of Sports Sciences, 28,* 139–145. DOI: 10.1080/02640410903460726

Dewald, J.F., Meijer, A.M., Oort, F.J., Kerkhof, G.A., & Bögels, S.M. (2010). The influence of

sleep quality, sleep duration and sleepiness on school performance in children and adolescents: A meta-analytic review. *Sleep Medicine Reviews, 14,* 179–189.  doi:10.1016/j.smrv.2009.10.004

-\*(book chapter?) Dunn A L, Trivedi M H, O'Neal H A. Physical activity dose-response effects on outcomes of depression and anxiety. Medicine and Science in Sports and Exercise 2001; 33(Supplement 6): S587-S597.

Etnier, J. L., Nowell, P. M., Landers, D. M., & Sibley, B. A. (2006). A meta-regression to

examine the relationship between aerobic fitness and cognitive performance. *Brain Research Reviews, 52,* 119–130. doi: <https://doi.org/10.1016/j.brainresrev.2006.01.002>

Etnier, J. L., Salazar, W., Landers, D. M., Petruzzello, S. J., Han, M., & Nowell, P. (1997). The

influence of physical fitness and exercise upon cognitive functioning: A meta-analysis. *Journal of Sport & Exercise Psychology, 19,* 249–277. doi: <https://doi.org/10.1123/jsep.19.3.249>

\*(do library request) Eveland-Sayers, B. M., Farley, R. S., Fuller, D. K., Morgan, D. W., &

Caputo, J. L. (2009). Physical fitness and academic achievement in elementary school children. *Journal of Physical Activity and Health, 66,* 99–104. doi: 10.1123/jpah.6.1.99

### Fedewa, A. L., & Ahn, S. (2011). The Effects of Physical Activity and Physical Fitness on

### Children's Achievement and Cognitive Outcomes. *Research Quarterly for Exercise and Sport, 82(3),* 521-535. doi: 10.1080/02701367.2011.10599785

-(Find this book in library!) Froh, R. C., & Hawkes, M. (1996). Assessing student involvement in learning. In R. J. Menges, M. Weimer, & Associates (Eds.), Teaching on solid ground: Using scholoarship to improve practice (pp. 125-153). San Francisco: Jossey-Bass.

Gilbert, S. P. & Weaver, C. C. (2010). Sleep Quality and Academic Performance in University

Students: A Wake-Up Call for College Psychologists. *Journal of College Student Psychotherapy, 24:4,* 295-306. doi: 10.1080/87568225.2010.509245

Gomes, A. A., Tavares, J., & de Azevedo, M. H. P. (2011). Sleep and Academic Performance in

Undergraduates: A Multi-measure, Multi-predictor Approach. *Chronobiology International, 28(9),* 786-801. doi: 10.3109/07420528.2011.606518

Forquer, L. M. , Camden, A. E., Gabriau, K. M., & Johnson, C. M. (2008). Sleep Patterns of

College Students at a Public University. *Journal of American College Health, 56(5),* 563-565. doi: 10.3200/JACH.56.5.563-565

Galper, D. I., Trivedi, M. H., Barlow, C. E., Dun, A.L., & Kampert, J. B. (2006). Inverse

Association between Physical Inactivity and Mental Health in Men and Women. *Medicine & Science in Sports & Exercise, 38(1),* 173–178. doi: 10.1249/01.mss.0000180883.32116.28

Gaultney, J. F. (2010). The Prevalence of Sleep Disorders in College Students: Impact on

Academic Performance. *Journal of American College Health, 59(2),* 91-97. doi: 10.1080/07448481.2010.483708

Godin, G. & Shephard, R. J. (1985). A simple method to assess exercise behavior in the

community. *Canadian Journal of Applied Sport Sciences, 10,* 141-146. Retrieved from: https://s3.amazonaws.com/academia.edu.documents/38737335/CJASS-1985.pdf?AWSAccessKeyId=AKIAIWOWYYGZ2Y53UL3A&Expires=1509757468&Signature=1rXsY3QSjaXbjc61kwK5OK8BjC4%3D&response-content-disposition=inline%3B%20filename%3DA\_simple\_method\_to\_assess\_exercise\_behav.pdf

Handelsman, M. M., Briggs, W. L., Sullivan, N., & Towler, A. (2005). A Measure of College

Student Course Engagement. *The Journal of Educational Research, 98,* 184-191. doi: <http://dx.doi.org/10.3200/JOER.98.3.184-192>

Hicks, R. A., Lucero-Gorman, K., Bautista, J. (1999). Ethnicity, sleep hygiene knowledge, and

sleep hygiene practices. *Percept Mot Skills., 88,* 1095–1096. doi: <https://doi.org/10.2466/pms.1999.88.3c.1095>

Hillman, C. H., Erickson, K. I., & Kramer, A. F. (2008). Be smart, exercise your heart:

Exercise effects on brain and cognition. *Science and Society, 9,* 58–65. doi:10.1038/nrn229

Hillman, C. H., Kramer, A. F., Belopolsky, A. V., & Smith, D. R. (2004). Physical activity,

aging, and executive control: Implications for increased cognitive health. *Medicine & Science in Sports & Exercise, 36,* 274–274. doi: 10.1080/02701367.2004.10609149

Hillman, C. H., Kramer, A. F., Belopolsky, A. V., & Smith, D. R. (2006). A cross-sectional

examination of age and physical activity on performance and event-related brain potentials in a task switching paradigm*. International Journal of Psychophysiology, 59(1),* 30–39. doi:10.1016/j.ijpsycho.2005.04.009

Irish, L. A., Kline, C. E., Gunn, H. E., Buysse, D. J., Hall, M. H. (2015). The role of sleep

hygiene in promoting public health: A review of empirical evidence. *Sleep Medicine Reviews, 22,* 23-36. doi: http://dx.doi.org/10.1016/j.smrv.2014.10.001

Kim, J. K., Conger, R. D., Elder, G. H., & Lorenz, F. O. (2003). Reciprocal influences between

stressful life events and adolescent internalizing and externalizing problems. *Child Development, 74,* 127-143. doi: 10.1111/1467-8624.00525

Kristjánsson, A. L., Sigfúsdóttir, I. D., & Allegrante, J. P. (2008). Health

Behavior and Academic Achievement Among Adolescents: The Relative Contribution of Dietary Habits, Physical Activity, Body Mass Index, and Self-Esteem. *Health Education & Behavior, 37(1),* 51-64. doi: <https://doi.org/10.1177/1090198107313481>

-Manger, T. A., & Motta, R. W. (2005). The Impact of an Exercise Program on Posttraumatic

Stress Disorder, Anxiety, and Depression. International Journal of Emergency Mental Health, 7*(1)*, 49-57.

Marks, H. M. (2000). Student Engagement in Instructional Activity: Patterns in the Elementary,

Middle, and High School Years. *American Educational Research Journal Spring, 37(1),* 153-184. doi: <https://doi.org/10.3102/00028312037001153>

Mastin, D. F., Bryson, J., & Corwyn, R. (2006). Assessment of Sleep Hygiene Using the Sleep

Hygiene Index. *Journal of Behavioral Medicine, 29(3),* 223-227. doi: 10.1007/s10865-006-9047-6

McCullough, G., Huebner, E. S., & Laughlin, J. E. (2000). Life events, self-concept, and

adolescents’ positive subjective well-being. *Psychology in the Schools, 3,* 1–10. doi: 10.1002/(SICI)1520-6807(200005)37:3<281::AID-PITS8>3.0.CO;2-2

McKnight, C. G., Huebner, E. S., & Suldo, S. M. (2002). Relationships among stressful life

events, temperament, problem behavior, and global life satisfaction in adolescents. *Psychology in the Schools,* *39*, 677–687. doi: 10.1002/pits.10062

Mindell, J. A., Meltzer, L. J., Carskadon, M. A., & Chervin, R. D. (2009). Developmental

aspects of sleep hygiene. Findings from the 2004 National Sleep Foundation Sleep in America Poll. *Sleep Medicine, 10,* 771–779. doi:10.1016/j.sleep.2008.07.016

-(check rest of authors and how to cite) \*Minkel, J. D., Banks, S., Htaik, O., Moreta, M. C.,

Jones, C. W., McGlinchey, E. L., . . . Dinges, D. F. (2012). Sleep deprivation and stressors: Evidence for elevated negative affect in response to mild stressors when sleep deprived. Emotion, 12(5), 1015-1020. doi: [10.1037/a0026871](http://psycnet.apa.org/doi/10.1037/a0026871)

-National Survey of Student Engagement. (2000). The NSSE report: National benchmarks of effective educational practice. Bloomington: Indiana University Center for Postsecondary Research and Planning.

Nelson, T. F., Gortmaker, S. L., Subramanian, S. V., & Wechsler, H. (2007).

Vigorous physical activity among college students in the United States. *Journal of Physical Activity and Health, 4,* 495–508. doi: <https://doi.org/10.1123/jpah.4.4.496>

Oginska, H. & Pokorski, J. (2006). Fatigue and Mood Correlates of Sleep Length in Three Age‐

Social Groups: School Children, Students, and Employees. *Chronobiology International, 23(6),* 1317-1328. doi: 10.1080/07420520601089349

Orzech, K. M., Salafsky, D. B., & Hamilton, L.A. (2011). The State of Sleep Among College

Students at a Large Public University. *Journal of American College Health, 59(7),* 612-619. doi: 10.1080/07448481.2010.520051

Pilcher, J. J., Ginter, D. R., & Sadowsky, B. (1997). Sleep quality versus sleep quantity:

Relationships between sleep and measures of health, well being and sleepiness in college students. *Journal of Psychosomatic Research, 42,* 583-596. doi: <https://doi.org/10.1016/S0022-3999(97)00004-4>

Pagel, J.F. & Kwiatkowski, C. F. (2010). Sleep complaints affecting school performance at

different educational levels. *Frontiers in Neurology 1(125)*, 1-6. doi:

10.3389/fneur.2010.00125

Pilcher, J. J. & Walters, A. S. (1997). How Sleep Deprivation Affects Psychological Variables

Related to College Students' Cognitive Performance. Journal of American College Health, 46(3), 121-126. doi: 10.1080/07448489709595597

Pontifex, M. B., Hillman, C. H., Fernhall, B., Thompson, K. M., & Valentini, A. M. (2009). The

Effect of Acute Aerobic and Resistance Exercise on Working Memory. *Medicine & Science in Sports & Exercise, 41(4),* 927–934. doi: 10.1249/MSS.0b013e3181907d69

Puterman, E., Lin, J., Blackburn, E., O’Donovan, A., Adler, N., et al. (2010). The Power of

Exercise: Buffering the Effect of Chronic Stress on Telomere Length. *PLoS ONE, 5(5)*, 1-6. doi:10.1371/journal.pone.0010837

Sibley, B. A., & Etnier, J. L. (2003). The relationship between physical activity and cognition in

children: A meta-analysis. *Pediatric Exercise Science, 15,* 243–256. doi: 10.1123/pes.15.3.243

Spence, J. C., McGannon, K. R., & Poon P. (2005). The effect of exercise on global self-esteem:

a quantitative review. *Journal of Sport and Exercise Psychology, 27,* 311–334. doi: 10.1123/jsep.27.3.311

Stepanski, E. J. & Wyatt, J. K. (2003). Use of sleep hygiene in the treatment of insomnia. *Sleep*

*Medicine Reviews, 7(3)*, 215-225. doi:10.1053/smrv.2001.0246

Suldo, S. M., & Huebner, E. S. (2004a). Does life satisfaction moderate the effects of stressful

life events on psychopathological behavior during adolescence? *School Psychology Quarterly,* *19*, 93–105. doi: http://psycnet.apa.org/doi/10.1521/scpq.19.2.93.33313

Trockel, M. T., Barnes, M. D., & Egget, D. L. (2000). Health-Related Variables and Academic

Performance Among First-Year College Students: Implications for Sleep and Other Behaviors. *Journal of American College Health, 49(3),* 125-131. doi: 10.1080/07448480009596294

Troiano, R. P., Berrigan, D., Dodd, K. W., Masse, L. C., Tilert, T., & McDowell, M. (2008).

Physical activity in the United States measured by accelerometer. *Medicine & Science in Sports & Exercise, 40,* 181–188. doi: l0.l249/mss.0b013e31815a5lb3

Trost, S. G., Pate, R. R., Ward, D. S., Saunders, R., & Riner, W. (1999). Correlates of Objectively

Measured Physical Activity in Preadolescent Youth. *American Journal of Preventive Medicine, 17(2),* 120–126. doi: <https://doi.org/10.1016/S0749-3797(99)00056-2>

Trudeau, F., & Shephard, R. J. (2010). Relationships of physical activity to brain health and the

academic performance of schoolchildren. *American Journal of Lifestyle Medicine, 4,* 138–150. doi: <https://doi.org/10.1177/1559827609351133>

VanKim, N. A. & Nelson, T F. (2013). Vigorous Physical Activity, Mental Health, Perceived

Stress, and Socializing Among College Students. *American Journal of Health Promotion, 28(1),* 7-15. doi: 10.4278/ajhp.111101-QUAN-395

Voinescu, B. I. & Szentagotai-Tatar, A. (2015). Sleep hygiene awareness: its relation to sleep

quality and diurnal preference. *Journal of Molecular Psychiatry, 3(1),* 1-7. doi:10.1186/s40303-015-0008-2

Zepke, N. & Leach, L. (2010). Improving student engagement: Ten proposals for action. *Active*

*Learning in Higher Education, 11(3)*, 167-177. doi: 10.1177/1469787410379680

\*Don’t have the article yet. Found it in citations from another article. May or may not use it.

-needs a correction to the citation or a doi/reference found

Footnotes