

OBSERVATIONAL STUDY OF SLEEP HABITS AND ACTIVITY IN PRE-SCHOOL CHILDREN

INTRODUCTION

Although we did not discuss sleep needs at length in this course, I had the opportunity to attend a colloquium, presented by Dr. Brian Crosby, which detailed sleep needs for children. I was able to take notes at the colloquium and I also was able to access data reports from the National Sleep Foundation's (NSF) 2004 study of sleep in children. In addition, I found several research articles detailing the results of studies related to a number of aspects of sleep in children, specifically preschool-aged children.

Colloquium

In his colloquium, titled, *Sleep in Children: What we've Learned...What We Need to Find Out*, Dr. Brian Crosby discussed several factors which highlighted the developmental relevancy of sleep. Dr. Crosby explained the interaction of homeostatic and circadian processes on sleep schedules. The effect of homeostatic process is dependent on an individual's sleep-wake times; for example, if an individual regularly falls asleep at 8:00 PM, the individual's body will be more likely to fall asleep at 8:00 PM. Circadian processes operate on a 24-hour schedule and are marked by hormone releases and core body temperature; these factors contribute to sleep readiness. Additionally, Dr. Crosby discussed sleep architecture, which is defined as the proportion of REM to non-REM sleep. Newborn children have a very high proportion of REM sleep, and as they age their REM sleep decreases. For adults, approximately 25% of sleeping hours are spent in REM sleep and 75% of sleeping hours are spent in non-REM sleep. Dr. Crosby discussed napping habits in children by age and by race. According to his findings, children in America overall tended to stop napping between age four and five, but African-American children tended to continue to taking naps until age seven or eight. Dr. Crosby also noted that when kids don't get enough sleep their behavioral, social, emotional, and cognitive functions tended to be negatively impacted.

National Sleep Foundation Data

Each year, the NSF completes a large-scale study about sleeping habits of a certain demographic of the American population. The study I found most relevant is from 2004 and focuses on the sleeping habits of children from birth to age ten. The reports include several studies relevant to my observation research. Three individual studies which were particularly relevant to my observational research: a study of the amount of time it takes for children to fall asleep at night, a study of the percent of children by age who take naps, a study of children's usual bedtime routines, and a study of typical sleeping arrangements.

The study of sleep latency by the NSF measured the number of minutes it takes for children to fall asleep after "lights out." According to NSF data, it takes less than 5 minutes to fall asleep at bedtime for 5% of preschoolers, it takes between 5 and 9 minutes to fall asleep at bedtime for 19% of preschoolers, it takes fall asleep at bedtime between 10 and 14 minutes for 22% of preschoolers, it takes between 15 and 20 minutes to fall asleep at bedtime for 32% of preschoolers, and it takes more than 20 minutes to fall asleep at bedtime for 22% of preschoolers. Thus, a majority of preschoolers take more than 15 minutes to fall asleep. The mean amount of time it took for preschoolers to fall asleep at bedtime was 17.4 minutes, and the median amount of time it took for preschoolers to fall asleep at bedtime was 15 minutes.

An NSF study about nap-taking habits found that the percentage of children who take a nap every day decreases as age increases. The study reported that 57% of 3-year-olds, 26% of 4-year-olds, 15% of 5-year-olds, and 2% of 6-year-olds took a nap every day. The study also reported the average time preschoolers spent napping. A nap was operationally defined as time slept between 8:00 AM and 6:00 PM. According to the NSF, 48% of preschoolers took no nap, 5% slept for less than an hour, 24% slept for between 1 and 1.9 hours, 19% slept for between 2 and 2.9 hours, and 4% slept for more than 3 hours. The mean amount of time slept during naps was 1.6 hours, and the median amount of time slept during naps was 1.5 hours.

The study of usual bedtime routines for children conducted by the NSF found that 93% of preschoolers have a usual routine. Reading was a part of the routine for 72% of these preschoolers, brushing teeth was a part

of the routine for 53%, taking a bath/shower was part of the routine for 47%, watching TV or a video was part of the routine for 19%, saying prayers was part of the routine for 18%, and having a snack was part of the routine for 11%.

Another NSF study detailed the typical sleeping arrangements of children. This study reported that 43% of preschoolers sleep by themselves in their own room, 39% share a room when they sleep, and 20% share a bed when they sleep.

Additional Studies

Sleep and Adjustment in Preschool Children: Sleep Diary Reports by Mothers Relate to Behavior Reports by Teachers (Bates, Viken, Alexander, Beyers, & Stockton, 2002), studied the effects of sleep on behavior. This study found that children with disrupted sleep patterns were correlated with less optimal adjustment in preschool. Disrupted sleep patterns was operationally defined as “variability in reported amount of sleep, variability in bedtime, and lateness of bedtime.” Though family stress and family management practices were measured, these variables did not correlate with children’s sleep patterns.

Sleep Patterns and Sleep Disruptions in School-Age Children (Sadeh, Raviv, & Gruber, 2000) studied the effect of age, gender, and psychosocial measures on sleep schedule and sleep quality. Sleep schedule was operationally defined as sleep onset time, sleep period, and morning awakening time. Sleep quality measures were based on the percentage of true sleep time and number of night wakings. The study found that a child’s sleep schedule is best predicted by the child’s age and the age of his/her parents. Younger children and children with younger parents were more likely to go to bed earlier and sleep for a longer period of time. The study also found that sleep quality was positively correlated with parents’ education level and negatively correlated with family stress.

METHODS

Sample

The class I observed had a total of 9 boys and 11 girls. These children are members of a class for children ages 3–6. The youngest child was just under 3.5 years of age, and the oldest child was just over 5.5 years of age. There were three children in the 3–3.9 age range; two of these children were females, and one was a male. There were eight children in the 4–4.9 age range; five of these children were females, and three were males. There were nine children in the 5–5.9 age range; four of these children were females, and five were males.

Procedure & Measures

I measured several dependant variables in my observations: activity level, sleep length (amount of time each child slept), and sleep latency (how long it took for each child to fall asleep). I have organized these using two “independent variables” child’s age and gender (I use scare quotes around the phrase “independent variables” because I was not actually able to control the age and gender of the children, so these two variables are not truly independent). I observed and recorded activity levels and naptime data a total of three times.

I developed my observational method based loosely on a study reported in *Child Development: “Sleep and Adjustment in Preschool Children: Sleep Diary Reports by Mothers Relate to Behavior Reports by Teachers”* (Bates, Viken, Alexander, Byers, & Stockton, 2002). This study collected data from samples of children from four different preschools in Indiana. Data was collected for a month from samples 1, 2, and 4, and for four months from sample 3. Information was gathered from mothers about the child to help experimenters gauge family cohesion, family stress, home adjustment, and child-rearing practices. Mothers were also asked to provide a daily record of what time their child fell asleep and woke up. Teachers were asked to rate the children’s positive behavior using the Preschool Adjustment Questionnaire (PAQ; Jewsuwan, Luster, & Kostelnik, 1993) and negative behavior using the Preschool Behavior Questionnaire (PAQ; Behar, 1977). Clearly, the breadth of my data collection is not nearly as thorough as the methods used in this study; I collected data from only one preschool, and I collected data over a span of only three days. I did not conduct home interviews or parent/teacher logs of

behavior. I chose, instead, to code the behavior of the children myself. Additionally, I was not coding for positive and negative behaviors, but for activity levels as I observed each child's behavior. Unlike the experiment my methods were based upon, I did not request records of how long each child slept at home; I only collected data of how long each child slept during naptime at school.

Naptime begins at 12:30 PM in the classroom I observed. Each day, the teachers and aides record the time each child falls asleep and the time each child wakes up. In order to measure sleep length and sleep latency, I am relying on data supplied by the teachers and aides in the classroom. To calculate sleep latency, I subtracted the time value of 12:30 PM from the time when the child falls asleep. To calculate sleep length, I subtracted the time when the child wakes up from the time when the child falls asleep.

I decided to use the data supplied by the teachers because I would not be able to determine when each child falls asleep and wakes up from the observation booth. In addition, gathering this data would be very time consuming. However, there are several issues with using the data supplied by the teachers. Because getting the children ready for naptime is an involved process that includes finishing snack time, letting the children go to the bathroom, and having the children brush their teeth, the exact time that naptime starts is variable. The use of a daily pre-naptime routine is likely helpful in preparing the children for sleep, as NSF data found that 93% of children have a usual pre-bedtime routine. In fact, even the pre-naptime activities are similar to several of the typical pre-bedtime activities noted by the NSF. As previously mentioned, brushing teeth is a part of the pre-bedtime routine for 72% of preschool children, and eating a snack is part of the routine for 11%. Although teachers agreed that naptime generally starts around 12:30 PM, my sleep latency data may be slightly inaccurate because on any given day the children could have gone down for their nap at 12:25 PM or 12:35 PM. Also, the pre-naptime process differs in length for each child. However, the general trends of sleep latency were probably not significantly affected by the use of 12:30 PM as the value representing the beginning of naptime.

An example of my coding sheet is included as Table 1. I used the Observational System for Recording Physical Activity in Children-Preschool Version, or the OSRAC-P (Brown, Pfeiffer, McIver, Dowda, Almeida, & Pate, 2006) to determine levels of activity. The OSRAC-P is a five point scale used to code activity level. According to the OSRAC-P, the lowest level of activity (defined as “stationary or motionless with no major joint movements”) would be coded as a one. Activity coded as a two is defined as “stationary with easy movement of limb(s) or trunk without translocation.” Activity coded as a three is defined as “translocation at a slow and easy pace.” Activity coded as a four is defined as “translocation at a moderate pace.” The highest level of activity (defined as “translocation at a fast or very fast pace”) would be coded as a five. I recorded an activity level for each child ten times over a period of an hour. Thus, my observations were recorded on approximately six minute intervals. I observed the children from 4:00 PM to 5:00 PM because at this time the children were playing on the playground. Because of the nature of playground activity the children’s activity levels were not governed by classroom structure, and thus were probably most accurate. For example, if I had observed the children during the time when a teacher was reading to them, the children would be limited to sitting on the floor, which would be classified as an activity level of one or, if the child is fidgeting incessantly, maybe an activity level of two. During one of the days I observed, half the children were in the classroom and half were on the playground. This was a result of hot outside temperatures. I noticed that several of the most active kids were located inside the classroom. Although they still demonstrated activity levels higher than average, they were, for the most part, less active than they had been outside.

Table 1: Coding Sheet

Child Name	Activity level	Activity level	Activity level	Activity level	Activity level	Activity level	Activity level	Activity level	Activity level	Activity level	START NAP	END NAP
Justin												
Fiona												
Anna												
Catherine												
Miranda												
Jason												
Laura												
Evan												
Anastasia												
Mia												
Devin												
Joe												
Mandy												
Tyler												
Elijah												
Steven												
Marissa												
Ariana												
Owen												
Elana												

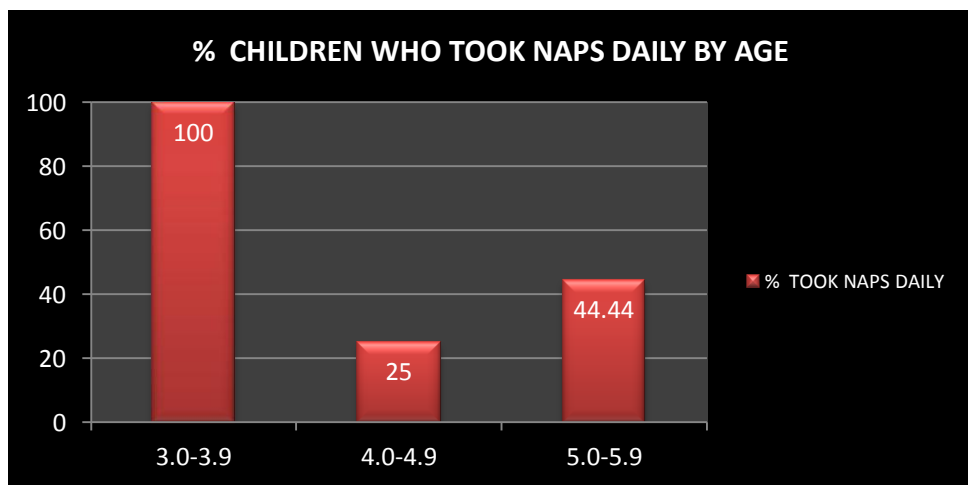
Because teachers and aides listed naptime data according to each child’s name, in order to produce accurate data, it was necessary that I be able to differentiate between each child using his/her name. In order to distinguish between the children, I spent time looking at the children’s pictures. I took a few notes on distinguishing features, and used these notes to complete my observations. The playground was a good venue to do this because many of the children were wearing the same jacket each time I observed. Also, on the

playground, many of the children were calling each other by name and, on occasion, an adult would call a child by name. I am confident that my activity level records for each child accurately match to his/her name.

RESULTS

Observed Correlations Between Age, Activity, And Sleep Patterns

The correlation I observed between age and the percent of children who took a daily nap is somewhat consistent with the NSF findings. There are several discrepancies, but I believe the discrepancies are a result of the conditions of my observations. The sample size of children in the 3–3.9 age range was very small; had my sample size been larger, I would likely have observed results more consistent with the NSF findings. Also, a number of children in the 5–5.9 age range were absent for one of the days I observed; had these children been present every day, they may not have taken a daily nap, and I would likely have observed results more consistent with the NSF findings. Additionally, across all age ranges, this data accounts for only school days. It is possible that some of these children nap five days a week in the classroom and do not nap on weekends; if this were true, and since my observations do not take into account what the child does outside of the classroom setting, a child who might appear to be on a daily nap schedule would not in reality be napping daily. The graph below illustrates my observations of the correlation between age and percent of children who took a daily nap.



Activity level seemed to remain somewhat constant regardless of age. The children in the 4–4.9 age range had a slightly higher average activity level than their classmates. However, all three age ranges had an average activity level of around 3.0. The child with the highest average activity level rated a 4.267 on the OSRAC-P scale was just over 4.9 years old. The two children with the lowest average activity levels rated a 2.467 on the OSRAC-P; one child was nearly 3.9 years old, and the other child was nearly 4.7 years old. If my observations are indicative of the larger population, children’s activity level does not vary significantly as age increases from age 3–5.9. The graph below illustrates my observations of the lack of correlation between age and average activity level. Because my results showed no correlation, I have included a summary of each individual child’s average activity level organized by age in Table 2.

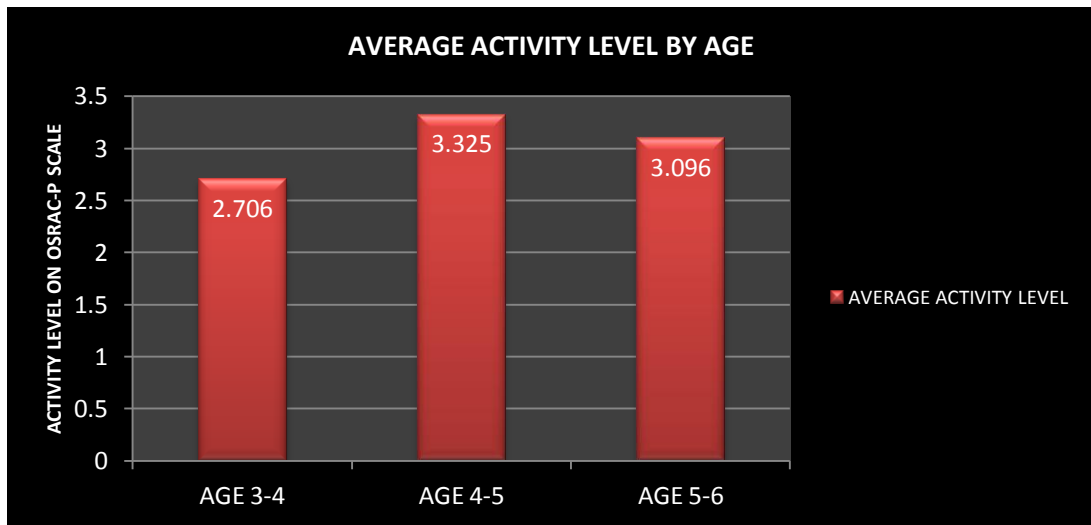


Table 2: Average Activity Level by Age

AGE	3.461	3.897	3.919	4.097	4.425	4.553	4.675	4.692	4.833	4.872	4.911	5.031	5.042	5.042	5.089	5.114	5.136	5.147	5.158	5.553
AVERAGE ACTIVITY LEVEL	2.800	2.467	2.850	3.200	3.200	3.000	2.467	3.433	3.167	3.867	4.267	2.900	2.850	2.500	3.750	3.433	3.133	2.700	3.100	3.500

According to my observations, children in the 3–3.9 age range had the highest average sleep length and the highest average sleep latency. However, using data only from when a child took naps to measure average sleep length, children in the 3–3.9 age range had the lowest average sleep length, while children in the 5–5.9 age range had the highest average sleep length. If these observations are indicative of the larger population, it can be assumed that as children age, they tend to take fewer naps, but the naps they do take are longer. However, my

data was likely altered by the especially small sample size in the 3–3.9 age range and the fact that several of the children in the 5–5.9 age range were absent for one or more of the days I conducted my observations. The graph below illustrates my observations of the correlation between age and average sleep patterns. I have also included a summary of each individual child’s average sleep patterns organized by age in Table 3.

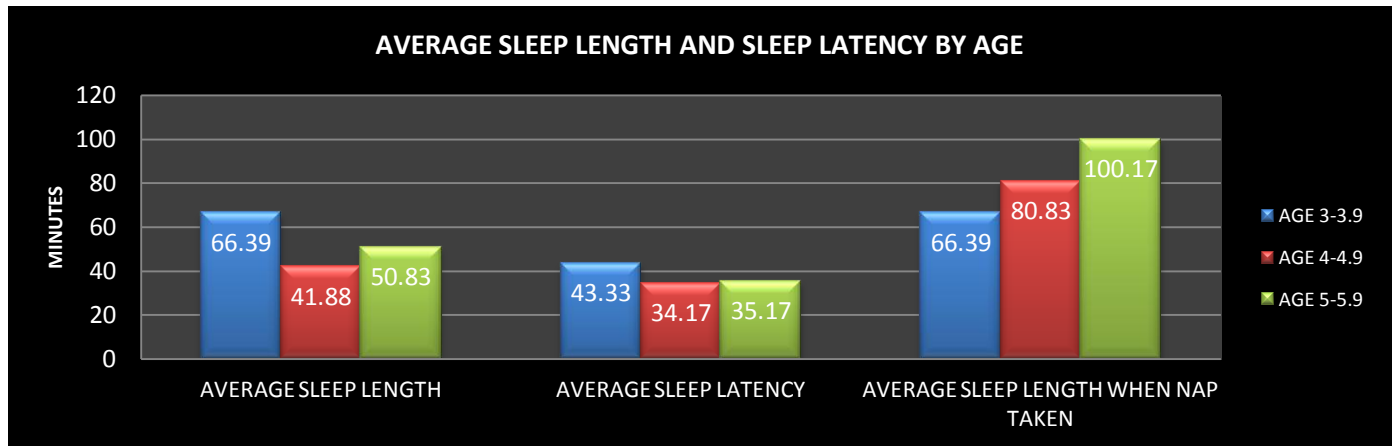
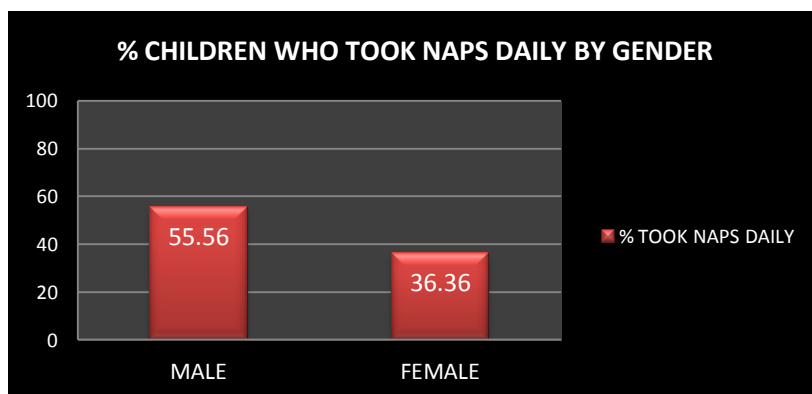


Table 3: Average Sleep Length and Sleep Latency by Age

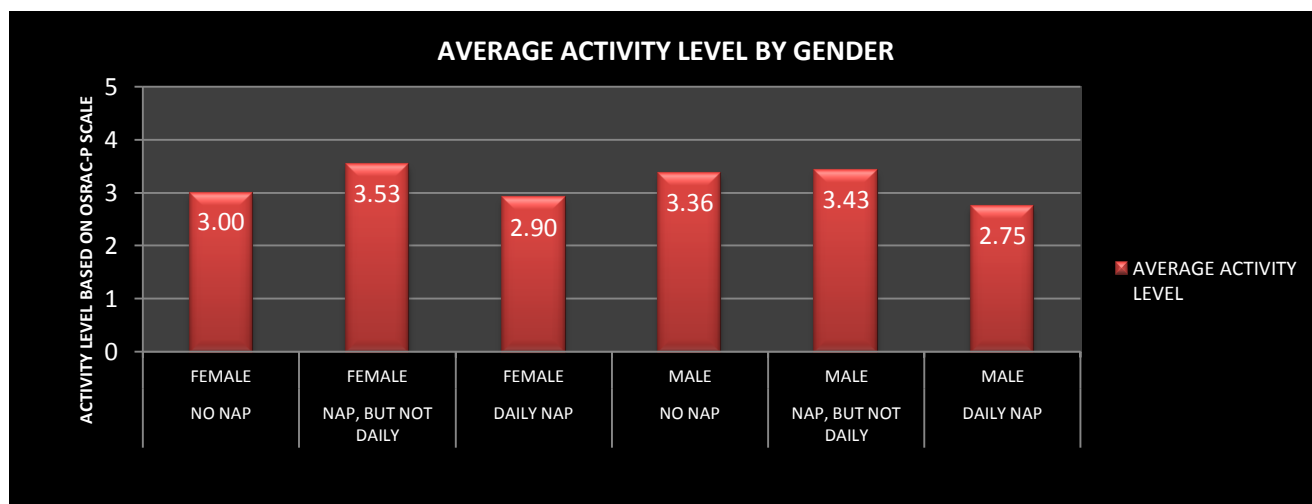
AGE	3.461	3.897	3.919	4.097	4.425	4.553	4.675	4.692	4.833	4.872	4.911	5.031	5.042	5.042	5.089	5.114	5.136	5.147	5.158	5.553
AVERAGE SLEEP LATENCY	23.333	36.667	70.000	36.667	30.000	NO NAP	NO NAP	27.500	NO NAP	30.000	46.667	25.000	NO NAP	NO NAP	17.500	35.000	NO NAP	NO NAP	63.333	35.000
AVERAGE SLEEP LENGTH	88.333	73.333	37.500	101.667	45.000	NO NAP	NO NAP	45.000	NO NAP	48.333	95.000	120.000	NO NAP	NO NAP	142.500	21.667	NO NAP	NO NAP	80.000	93.333
AVERAGE SLEEP LENGTH WHEN NAP TAKEN	88.333	73.333	37.500	101.667	67.500	NO NAP	NO NAP	67.500	NO NAP	72.500	95.000	120.000	NO NAP	NO NAP	142.500	65.000	NO NAP	NO NAP	80.000	93.333

OBSERVED CORRELATIONS BETWEEN GENDER, ACTIVITY, AND SLEEP PATTERNS:

In the classroom I observed, a higher percentage of males took naps than females. The graph below illustrates my observation of the correlation between gender and percent of children who took a daily nap.

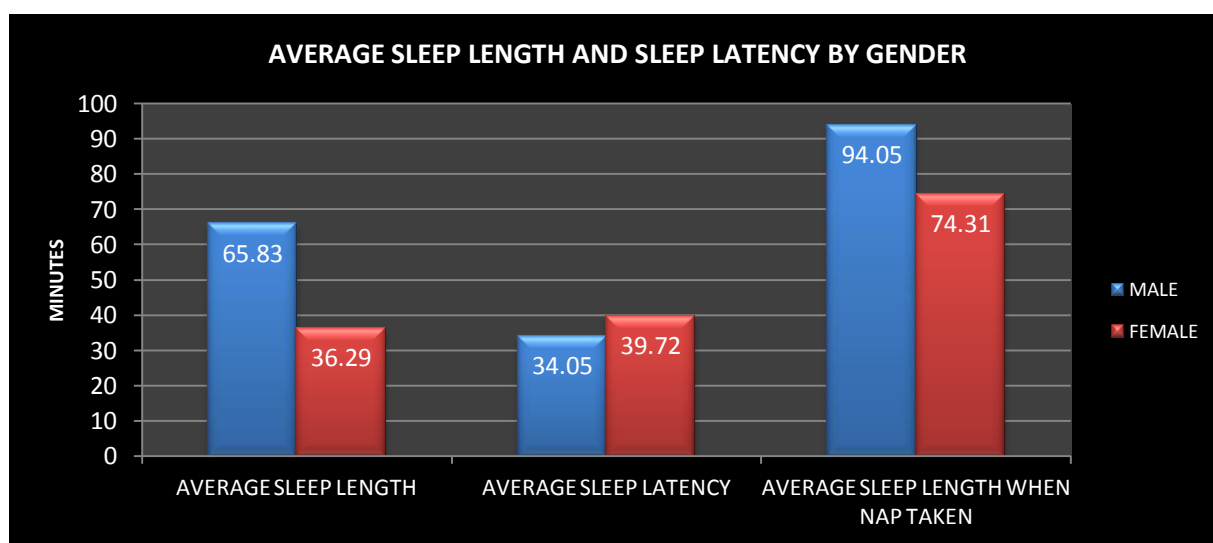


According to my observations, the highest activity levels were posted by children who took naps, but not daily; of these children, females had slightly higher levels than males. The lowest activity levels were posted by children who took daily naps; of these children, males had slightly lower levels than females. In total, males had slightly higher activity levels than females, as males posted an average activity level of 3.24, and females posted an average activity level of 3.07. The graph below illustrates my observation of the correlation between gender and average activity level.



In the sample I observed, males had a higher average sleep length than females and, on average, it took females slightly longer to fall asleep than males. The average sleep latency for the whole class was 36.67 minutes. This number is not consistent with the NSF data regarding sleep latency in children. As previously stated, it took only 22% of preschool age children in the NSF study more than 20 minutes to fall asleep after lights out at bedtime; in my observations, only one child took less than 20 minutes to fall asleep. This is likely a result of the setting in which the children are taking their naps. Although the children are supposed to be quiet during naptime and the teachers turn the lights off and play soothing music, there is still more stimulation in the classroom setting than in the home setting. Also, the NSF study measured sleep latency at bedtime. Perhaps if the NSF had measured sleep latency at naptime, they would have been found children take longer to fall asleep in the afternoon. The average sleep length for the whole class was 49.58 minutes, but considering only data from when children took naps, the average sleep length was 84.94 minutes. Considering data only from when the children

took naps, 45% of the children I observed slept for an average of less than an hour, 45% slept for an average of 1–1.9 hours, and 10% slept for an average of 2–2.9 hours; no children slept for an average of more than 3 hours. This, too, is not consistent with NSF data. The NSF findings indicated that only 5% of preschoolers napped for less than an hour, 24% napped for 1–1.9 hours, 19% napped for 2–2.9 hours, and 4% napped for more than 3 hours. This discrepancy in findings could be a result of my small sample size, or it could have to do with the age distribution of my sample size; 3-year-olds need more sleep than their older classmates, and the class I observed had only 3 children in the 3–3.9 age range. The graph below illustrates my observation of the correlation between gender and average sleep patterns.



Observed Correlations Between Activity And Sleep Patterns

In my observational data, I found little evidence of a correlation between activity levels and sleep patterns. According to my observations, children who slept an average of 1–50 minutes during naptime posted average activity levels slightly higher than children who slept longer or took no nap at all. Children who took an average of 26–50 minutes to fall asleep posted average activity levels slightly higher than their classmates who took less than 26 minutes or more than 51 minutes to fall asleep. When considering data only from when a child took naps to measure average sleep length, children who slept an average of 76–150 minutes per nap posted average activity levels slightly higher than their classmates who slept for a shorter period of time per nap or did not nap at all. The three graphs below illustrate my observations of the lack of correlation between average

activity and average sleep patterns. I have also included a summary of each individual child's average sleep patterns organized by average activity level in Table 4.

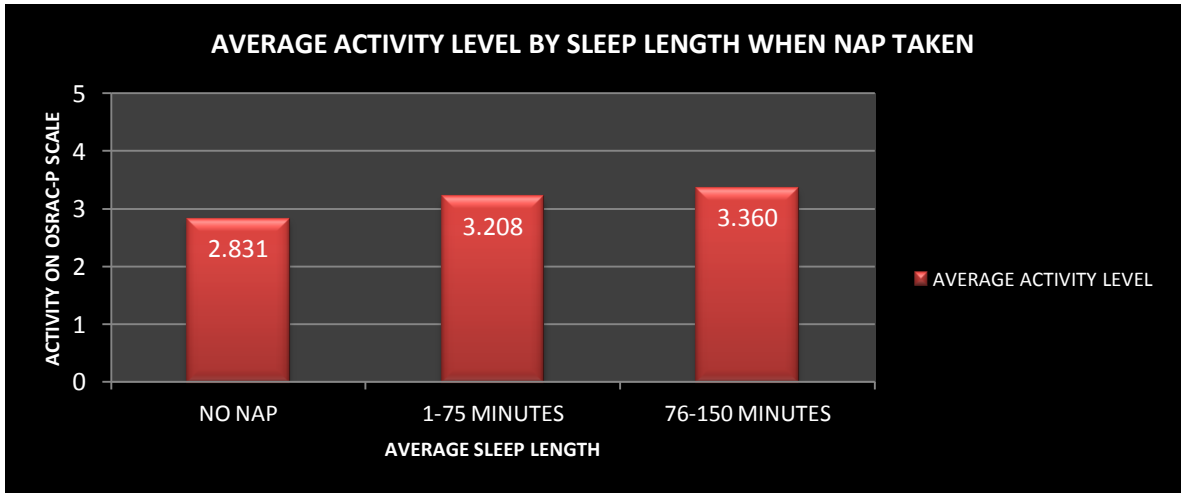
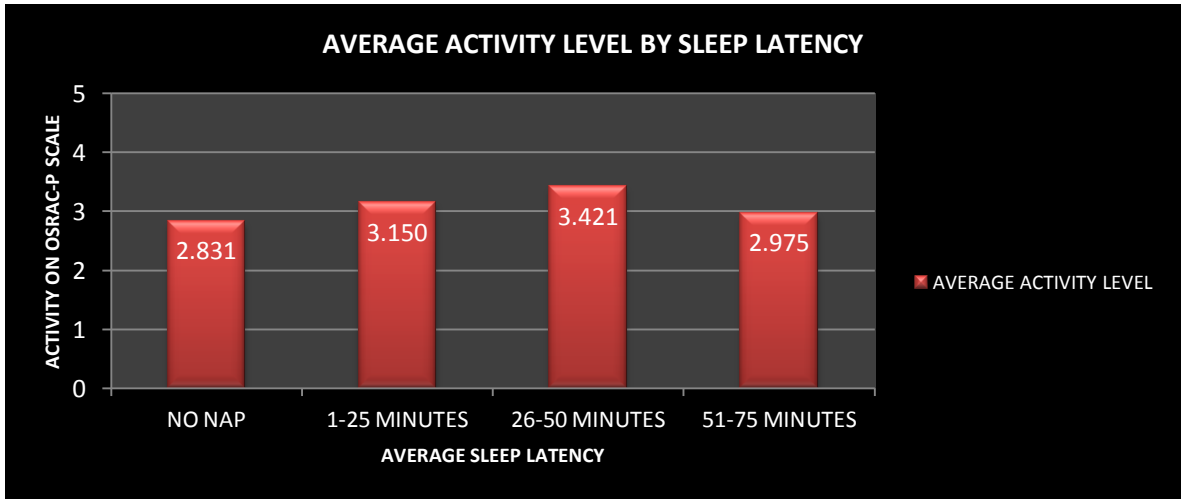
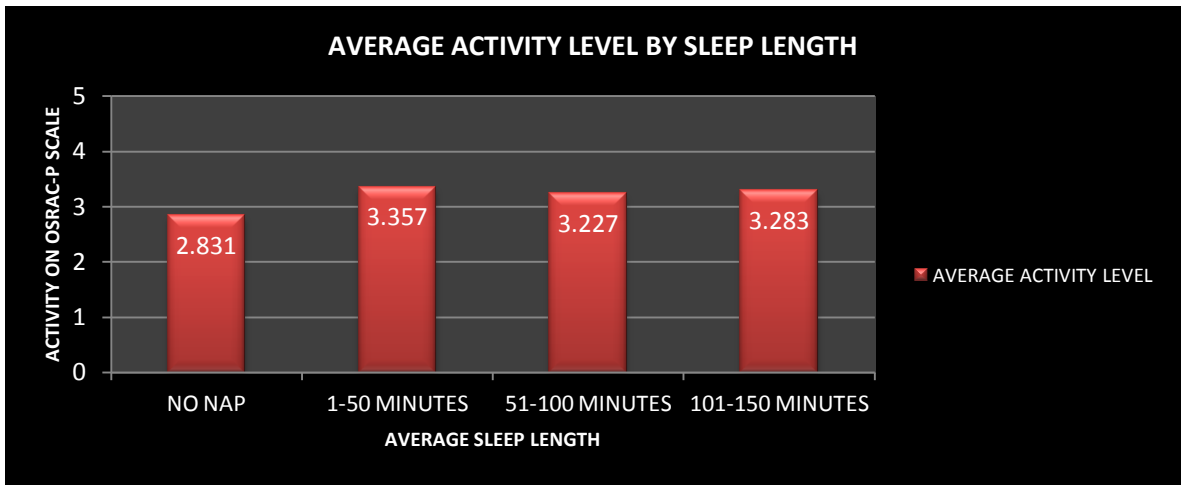


Table 4: Average Activity Level by Average Sleep Length and Sleep Latency

AVERAGE ACTIVITY LEVEL	2.47	2.47	2.50	2.70	2.80	2.85	2.85	2.90	3.00	3.10	3.13	3.17	3.20	3.20	3.43	3.43	3.50	3.75	3.87	4.27
AVERAGE SLEEP LATENCY	36.67	NO NAP	NO NAP	NO NAP	23.33	70.00	NO NAP	25.00	NO NAP	63.33	NO NAP	NO NAP	36.67	30.00	27.50	35.00	35.00	17.50	30.00	46.67
AVERAGE SLEEP LENGTH	73.33	NO NAP	NO NAP	NO NAP	88.33	37.50	NO NAP	120.00	NO NAP	80.00	NO NAP	NO NAP	101.67	45.00	45.00	21.67	93.33	142.50	48.33	95.00
AVERAGE SLEEP LENGTH WHEN NAP TAKEN	73.33	NO NAP	NO NAP	NO NAP	88.33	37.50	NO NAP	120.00	NO NAP	80.00	NO NAP	NO NAP	101.67	67.50	67.50	65.00	93.33	142.50	72.50	95.00

DISCUSSION

I was surprised at the lack of correlation between my variables. However, I may have been able to reach better conclusions if I had been conducting a study with a larger sample size and a longer period of observation. Although I noticed the children tended to have fairly constant activity levels, the sleep times I observed were more varied. Much of the research I found concerning children's sleep habits took into account factors that cannot be observed in the school setting. For example, in my observations, I had no way of knowing how much sleep each child gets at home or details about the child's home life. For example, if the child normally sleeps in his/her own room alone, it might be more difficult for the child to fall asleep in the classroom setting with nineteen other children. Or, perhaps children who sleep in their own room at night find falling asleep in the classroom setting difficult in the beginning of the school year, but habituate after several months. There are a number of factors which could help to explain the lack of correlation in my observational findings and, if studied, could lead to interesting findings about children's napping habits.

If I were to repeat this study and make changes to gain more relevant and informative observational data, I would do several things differently. First, I would spend more time gathering pilot data. I think my pilot data was effective in gaining an understanding of whether or not my data collection system would be effective, but if I were to repeat this study, I would spend more time becoming familiar with the children's so I could better match names to faces. I found that, given enough time, it was simple to figure out which child was which because teachers called students by name and children often communicated with each other using first names. However, I still was forced to spend much time in my first observation setting trying to discriminate between children. If I had spent more time doing this during my pilot data, I would have been more efficient in gathering my data. Additionally, I

found that once I recognized the children by name, I did not need a full six minutes to observe activity levels for the children. If I were to repeat the study, I would make my observation intervals shorter (perhaps using three or four minute intervals). If I were to make my observation intervals shorter, I would be able to gather more activity data in the same amount of time. Another change I would make is to gather more data about each child's sleep patterns (when each child fell asleep and woke up from his/her nap). As I noted earlier, although the activity levels were fairly stable from one observation to the next, sleep length and sleep latency data was not. More data would be helpful in constructing more accurate averages to define children's sleep patterns. This could be achieved fairly easily, since the teachers track when each child falls asleep and wakes up on a daily basis. No additional observation of the children would be required, just a few quick stops into the classroom to take note of the numbers the teachers have recorded. Finally, I am interested in paying attention to the difference in AM activity and PM activity. For example, it is possible that some of the children I observed are especially active in the morning, but not in the afternoon. According to my observational data, these children would have a low average activity level because I only observed the children from 4:00 PM to 5:00 PM. It would be interesting to compare the average morning activity levels to average evening activity levels. Does one gender or age range tend to be more active in the morning? There are many questions that, with further observation, could begin to be answered.

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