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Sleepiest Students in the World: Heavy Media use and Sleep Deprivation

by Meilan Zhang – May 12, 2014

The 2011 results of the Trends in International Mathematics and Science Study (TIMSS) and the Progress in International Reading Literacy Study (PIRLS) propelled some scholars to call for new educational reforms to improve U.S. students' score rankings. However, few seem to have noticed that U.S. students indeed ranked first on one measure: Sleepiness. U.S. students were reported to have the highest percentage of sleepiness in classrooms among all participating countries in TIMSS and PIRLS. Surprisingly, the prevalent sleep deprivation in U.S. students has largely been overlooked by educational researchers and policy makers. Drawing upon relevant literature, I argue that heavy media use may be one of the main reasons for sleepiness and, in turn, poor academic performance. Therefore, perhaps the top priority for improving U.S. students' academic performance is not new educational reforms, but awareness of and interventions to counter the detrimental impact of heavy media use on sleep. After all, schools, however reformed, if occupied by sleepy students, are not likely to be effective.

The 2011 results of the Trends in International Mathematics and Science Study (TIMSS) and the Progress in International Reading Literacy Study (PIRLS) renewed public interest in the achievement of U.S. students in an international context (Martin, Mullis, Foy, & Stanco, 2012; Mullis, Martin, Foy, & Arora, 2012; Mullis, Martin, Foy, & Drucker, 2012). The average score of U.S. fourth grade students ranked 7th in science, 11th in mathematics, and 6th in reading. The average score of U.S. eighth grade students ranked 10th in science and 9th in mathematics. These rankings received different interpretations by educational scholars. Some compared the performance of U.S. students to those of Asian countries and saw the needs for reforming U.S. schools (Biddle, 2012). Others argued that although not top performers, U.S. students have made steady progress in these international assessments over the years (Zhao, 2012).

Despite the different reactions, however, scholarly attention seems to focus mainly on the score rankings. Few have noticed that U.S. students indeed ranked first on one measure: *Sleepiness*. U.S. students are among the sleepiest in the world as represented by the countries that participated in TIMSS and PIRLS 2011. In the questionnaire administered in the two assessments, teachers were asked to what extent their instruction was limited by students suffering from lack of sleep. Overall, sleep deprivation in students is prevalent worldwide, particularly so in the US.

According to their teachers (Martin, et al., 2012; Mullis, Martin, Foy, & Arora, 2012; Mullis, Martin, Foy, & Drucker, 2012), 73% of U.S. fourth grade students were in classrooms where science and mathematics instruction was limited to

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the degree of “some” or “a lot” due to students who lacked sleep. The same was true for reading instruction for 76% of U.S. fourth grade students. In addition, science instruction was limited by lack of sleep for 85% of U.S. eighth grade students, as was mathematics instruction for 78%. These numbers are all much greater than the international averages, as shown in Table 1. To conclude, if their academic achievements in these international assessments are debatable, U.S. students are undoubtedly among the sleepest in the world.

Table 1. Percentage of students in classrooms where instruction was limited by lack of sleep and their average scores

		“Not at all”		“Some” or “A Lot”	
		% of students	Average score	% of students	Average score
Science	4 th US	27%	559	73% ¹	539
	International average	54%	492	46%	481
8 th grade	US	15%	534	85% ¹	529
	International average	42%	484	58%	473
Math	4 th US	27%	555	73% ¹	537
	International average	53%	497	47%	486
8 th grade	US	22%	543	78% ²	503
	International average	43%	477	57%	461
Reading	4 th US	24%	566	76% ³	553
	International average	51%	518	49%	507

Note. Science and mathematics data was from TIMSS 2011. Reading data was from PIRLS 2011.

¹The highest percentage among all TIMSS participants.

²The third highest percentage among all TIMSS participants. Palestinian reported 82%. Finland reported 81%.

³The third highest percentage among all PIRLS participants. France reported 80%. Belgium reported 77%.

The prevalence of sleep deficit in U.S. students has been reported by sleep research. According to the study by the National Sleep Foundation (2006) that involved 1,602 adolescents aged 11-17 at grades 6-12 in the US, 45% of adolescents got an insufficient amount of sleep on weeknights (less than 8 hours). About half (51%) of the students felt too tired or sleepy during the day, and 19% fell asleep in school at least once a week. Yet only 9% of parents were aware of their children’s lack of sleep.

Surprisingly, the finding in TIMSS and PIRLS 2011 that the majority of U.S. students lacked sleep was largely overlooked by policy makers and educational researchers. This finding was not even included in the two widely-circulated reports by the National Center for Education Statistics: *Highlights from TIMSS 2011: Mathematics and science achievement of U.S. fourth and eighth grade students in an international context*

(Provasnik et al., 2012), and *Highlights from PIRLS 2011: Reading achievement of U.S. fourth grade students in an international context* (Thompson et al., 2012).

Moreover, the prevalent sleep deprivation in U.S. students has received little attention in educational research. Out of over 19,000 articles published by 25 of the most influential educational journals that publish a broad range of topics related to education (e.g., *Educational Researcher*, *American Educational Research Journal*) from 2000 to 2013, only two paid attention to student sleep by arguing for delayed school start time (Kirby, Maggi, & D'Angiulli, 2011; Mitru, Millrood, & Mateika, 2002).

The lack of attention to sleep deprivation in students by educational researchers is striking, considering the serious consequences of insufficient sleep on both academic performance and physical and mental health. In TIMSS and PIRLS 2011, students who lacked sleep had lower scores in mathematics, science, and reading than did their peers who had adequate sleep. This trend was true for both the U.S. students and the international average, as shown in Table 1. Research showed that insufficient sleep, poor sleep quality, and sleepiness affect one's cognitive and behavioral functions, including attention, memory, impulse control, and higher order executive functions, all of which are essential for school learning (Beebe, 2011; Curcio, Ferrara, & De Gennaro, 2006; Dewald, Meijer, Oort, Kerkhof, & Bögels, 2010; Shochat, Cohen-Zion, & Tzischinsky, 2014). These studies revealed a clear and consistent association between inadequate sleep in both quantity and quality and poor academic performance.

It is important to note that these studies were mainly reported in health and sleep research journals, such as *Sleep Medicine Reviews*. Citation analysis via Google Scholar indicates that educational researchers are largely unaware of these studies, as they have seldom been cited in educational research.

HEAVY MEDIA USE AND SLEEP DEPRIVATION

Although TIMSS and PIRLS 2011 did not point out what caused the prevalent sleep deprivation in both fourth and eighth grade students, substantial evidence suggests that heavy media use is one important contributor. Heavy media use, including televisions, computers, Internet, mobile phones, game consoles, and music players, is prevalent among U.S. children and adolescents. Youth spend many hours every day in front of screens. The Kaiser Family Foundation had studied youth's media use every five years since 1999. The latest study in 2009 involved a nationally representative sample of 2,002 youth from ages 8 to 18 in the US (Rideout, Foeh, & Roberts, 2010). This study found that children and adolescents spent 7.5 hours per day on media, and were exposed to 10.75 hours of media content, if taking into account the time they spent on more than one media concurrently. This represents one more hour's increase on media and two more hours of media content from the study in 2004.

Among different types of media use, game play is particularly prevalent among children and adolescents, and consumes a significant amount of their time. According to the Pew Research Center's study (Lenhart et al., 2008), 97% of adolescents aged 12-17 played games on computers or consoles, and 50% of them played games "yesterday." Some of them spend increasing amounts of time on games and show

addictive symptoms similar to those of substance users (Kuss & Griffiths, 2012a). A recent review of 30 studies found that the prevalent rates of online game addictions in children and adolescents ranged from 3% to 12% (Kuss & Griffiths, 2012b).

Excessive media use inevitably interferes with sleep. The National Sleep Foundation (2011) surveyed 1,508 individuals between the ages of 13 and 64 in the US, and found pervasive use of media in the hour before bedtime and prevalent sleep deprivation. In particular, adolescents aged 13-18 were the heaviest users of technology in the hour before bedtime among all age groups in the study. Specifically, 72% of adolescents brought cell phones to their bedroom and used them when they were trying to go to sleep. Also, 71% surfed the Internet at least a few nights per week in the hour before sleep.

Consequently, adolescents were also least likely to get an adequate amount of sleep among the age groups, particularly on weeknights (National Sleep Foundation, 2011). The majority of adolescents (61%) slept less than the recommended eight hours. About half (46%) reported that they rarely or never got a good night's sleep on weeknights, and 59% woke up in the morning feeling un-refreshed.

Heavy media use interferes with sleep by reducing sleep duration, making it harder to fall asleep, and lowering sleep quality. In a review of 36 studies that examined the relationship between media use and sleep in children and adolescents (Cain & Gradisar, 2010), media use was consistently associated with delayed bedtime and shorter sleep duration across the studies. Research showed that unstructured leisure activities in evenings were negatively related to good sleep patterns. Children with televisions, computers, game consoles, or mobile phones in their bedrooms went to bed later and spent fewer hours in bed, compared to children without those devices in their bedrooms (Cain & Gradisar, 2010; Calamaro, Mason, & Ratcliffe, 2009; Chahal, Fung, Kuhle, & Veugelers, 2013; Wethington, Pan, & Sherry, 2013). These studies recommended that such electronic devices should be kept out of bedrooms to promote healthy sleep habits.

In addition to shortened sleep duration, excessive media use also disrupts circadian rhythms and makes it harder for one to fall asleep. Exposure to the artificial light emitted from bright screens in evenings changes the natural sleep-onset process, suppresses the release of the sleep-promoting hormone melatonin, and increases the time needed to fall asleep after going to bed (Cajochen et al., 2011).

Laboratory research showed that playing video games resulted in substantial increases in heart rate, blood pressure, and respiratory rate in children aged 7 to 10 (Wang & Perry, 2006). Such a higher level of arousal in the central nervous system is not conducive to sleep. Another study found that playing computer games before sleep reduced the amount of slow-wave sleep, a deeper level of sleep that is essential for recovery, and caused significant decline in verbal cognitive performance (Higuchi, Motohashi, Liu, & Maeda, 2005).

Also, according to the National Sleep Foundation (2011), 28% of adolescents slept with their cell phone ringers on in the bedrooms, and 18% were awakened at least a few nights per week in the middle of their sleep by phone calls, text messages or emails on their cell phones. The median number of texts that adolescents sent on a typical day was 60

(Lenhart, 2012).

CONCLUSION

School-aged children spend only about 20% of their waking hours in school, as U.S. public schools operate on a school year of 180 six-hour days (Osborne & Dillon, 2007). How students perform in classrooms has much to do with what they do outside of classrooms. Daytime dysfunction might be symptoms of nighttime problems. Perhaps the top priority for improving U.S. students' academic performance is not new school reforms, as some have suggested (Biddle, 2012). After all, schools, however reformed, if occupied by sleepy students, are not likely to be effective.

Improving student sleep deserves more attention than is currently received in public discourse and national agendas for education. Researchers, policy makers, teachers, health care practitioners, parents, and students themselves should be better aware of the prevalence of sleep deprivation in students, its negative consequences, and the heavy media use that contributes to sleep deprivation. Interventions should be developed to promote healthy sleep habits and reduce the detrimental impact of media use on sleep. It is likely that when the sleepiness ranking of U.S. students go down, their science, mathematics, and reading score rankings will move up in the next TIMSS and PIRLS.

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