

## The Use of Technology by University Adolescent Students and Its Relation to Attention, Sleep, and Academic Achievement

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**Abstract: Aim:** The aim of the study was to investigate the relations between adolescents' self-reports of technology usage and their sleep patterns, attention difficulties, and academic achievement. **Background.** Many adolescents use the internet, cell phones, television, computer and video games on a daily basis. Therefore, an important question how is technology affecting adolescents sleep pattern, attention difficulties and their academic performance. **Methods.** The study was carried out in all seven faculties in Port Said city using a cross-sectional analytic design. A convenience sample of 683 students was recruited from the first and second grades of each faculty. Data were collected using two tools devised specifically for the study. **Results.** 84.5% of adolescents reported having computers at home and 50.1% in their bedrooms. There was a statistically significant relation between sleep insufficiency and nocturnal use of technology, particularly the use of SMS ( $p<0.001$ ). Higher attention scores were found among those with frequent use of educational internet ( $p=0.040$ ), and with rare sleep on TV ( $p=0.003$ ). GPA scores were higher among those with rare use of educational internet ( $p=0.025$ ), and those making calls after 10 pm ( $p=0.019$ ). The highest attention score was among those feeling getting enough sleep ( $p<0.001$ ), and the attention score had a decreasing trend with the decrease in scholastic achievement ( $p<0.001$ ). **Conclusion.** The findings point to the importance of giving more emphasis to research in the area of technology use among adolescents and its consequences. However, the findings should be interpreted cautiously given the possible bias associated with self-reporting.

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**Key words:** Academic performance, Adolescents, Attention difficulties, Sleep pattern, Technology use

### 1. Introduction

Adolescents tend to report using many different types of information and communication technology on a daily or weekly basis. Technology refers to the types of devices most commonly used for communication and entertainment purposes including computers (internet access, online games and other computer games), cell phones (phone calls and text messages), console video games and television (television shows and movies shown on television or played on a VCR or DVD player) (Dehmler 2009).

The internet is one of the technological advances that many adolescents use on daily basis (Gross 2004; Rogers et al 2006; Willoughby 2008). There are four basic categories of internet usage for adolescents. The first category is the website, which provides documents or collections of documents for informational purposes. E-mail, the second category, is a rapid form of electronic letter communication. The third category is chat rooms in which adolescents communicate with each other on the computer at the same time, typing messages to each other that scroll down the screen in real time. The fourth category, newsgroups, is like an electronic bulletin board (Hunley et al. 2005).

Studies of adolescents' online activities found that they predominately use the internet to communicate with friends by instant messenger and E-mail, for entertainment purposes, for social networking, and for playing online computer games (Rogers et al. 2006; Pew Internet and American Life Project 2005; Willoughby 2008).

Cell phones constitute another technological advance that adolescents use on a daily basis. In recent years, adolescent cell phone ownership has rapidly increased. In 2008 it was estimated that about 16 million teenagers own cell phones (Multimedia intelligence 2008). Another type of technology that adolescents use is digital games, which includes computer games and video games. According to Willoughby (2008), significantly more boys (80%) reported playing digital games or "gaming" than girls (29%). Griffiths et al. (2004) surveyed 540 online game players and also found that adolescent gamers were significantly more likely to be males (93%) than females (7%). Research on adolescents' television viewing habits is also extensive. One such study spanned for many decades and included varying factors that can affect an adolescent's life from attitudes about sexuality to academic achievement (Hampl 2004; Dohnt and Triggeman 2006).

Sleep is crucial for children and adolescents' learning, memory processes and school performance (Curcio and De Gennaro 2006). According to the national sleep foundation (2007) adolescents generally require at least eight and a half hours of sleep each night. Adolescents' internal biological clock tends to keep them awake later in the evening and sleep later in the morning than adults do. When students stay late at night, for any reason including nocturnal technology, which refers to usage between 10 pm and 6 am, it is difficult for them to wake up early in the morning for school and to perform to the best of their ability. Poor fragmented sleep, late bedtime and early wakeup seriously affect school performance, learning capacity, and neurobehavioral functioning (Wolfson and Carskadon 2003; Fallone 2006).

As adolescents' use of technology has increased, research has been conducted to explore its effect on adolescent school achievement. Chan and Robinowitz (2006); surveyed found that adolescents who play more than one hour of video or computer games daily were rated as having more attention difficulties than those who spent less than an hour each day playing the games. In addition, the amount of time of television viewing affected children's ability to attend in school (Dorey et al 2010). Nonetheless, according to some researchers, the impact of technology on adolescents' achievement tends to be influenced by various factors including the type of technology being used, the frequency and duration of use, as well as the socioeconomic and individual differences (Jackson et al. 2006; Willoughby 2008).

#### **Aim of the Study**

The present study aimed to investigate the relations between adolescents' self-reports of technology usage and their sleep patterns, attention difficulties, and academic achievement.

The research hypotheses were:

- Adolescents who report spending more time using technology will report spending less time sleeping;
- Adolescents who report spending more time using technology will report higher levels of attention difficulties;
- Adolescents who report spending more time using technology will report lower levels of academic achievement.

## **2. Subjects and Methods**

**Design:** The study used a cross-sectional analytic design.

**Setting:** The study was carried out in all seven faculties in Port Said governorate; these included the faculties of Commerce, Physical education, Kinder-garden, Engineering, Computer sciences, Science, and Nursing.

**Subjects:** Any student enrolled in the first and second grades of the aforementioned faculties was eligible for inclusion in the study sample. Faculties were categorized into human sciences (Science, Commerce, Physical education, Kinder-garden), mathematical sciences (Engineering, Computer sciences), and Nursing. A quota sample of respectively 400, 200, and 150 students from these three categories was planned. The recruitment of students from each faculty was by convenience sampling. The sample size was calculated to estimate any deficits of sleep, attention, or academic achievement of 20% or more, with 1.5% standard error, at 95% confidence level, taking into account a dropout rate of about 10%. This sample size was large enough to demonstrate any increase in these deficits in the exposed students with an Odds Ratio of 2, at 95% level of confidence, and 80% power.

**Data Collection Tools:** The researchers developed a self-administered questionnaire for data collection. It consisted of two parts. The first part involved biosocial data about adolescent's age, sex, birth order, number of siblings and type of study and grade. It also included questions about parents' level of education, occupation and income. The second part was adapted from Dehmler (2009)<sup>(1)</sup> This 26-item questionnaire measures technology usage, sleep patterns, and academic achievement. Fifteen items were added inquiring about attention difficulties based on the working memory scale from the Behavior Rating Inventory of Executive Function (BRIEF). The internal consistency of the Working Memory Scale is reported to be between .89 and .93 and test-retest reliability between .82 and .86.<sup>(18)</sup> Three of the questions about attention difficulties were based on the attention problems scale on the child Behavior Checklist<sup>(19)</sup>. The Chronbach alpha for the attention scale was 0.86, indicating good reliability. The process of translation-re-translation was used to ensure the validity of the second part of the tool.

**Pilot study:** A pilot study was carried out on a sample of adolescents from different faculties to test the clarity and reliability of the tool and feasibility of the study. The internal consistency of the tool was done, and Chronbach alpha coefficient was calculated to assess the reliability. Needed modifications were done in the form of re-phrasing of some items. The pilot subjects were not included in the main study sample.

**Fieldwork:** The researchers fulfilled the official steps required to get the approval for carrying out the study from the Vice-Chancellor for Education and Student Affairs in Port Said University. Letters were issued to the deans of the seven faculties asking for their permission to conduct the study. The researchers met with each Dean, and explained the purpose and procedures of the study. Students were approached in groups. After explanation of the aim of the study, and

informing them about their rights, those who provided their verbal consent to participate were handed the data collection tool for filling it out. The research team members were present all the time for any clarifications. The field work was carried out during November 2010.

**Ethical considerations:** The study protocol was approved by pertinent bodies in the University. Students were informed about their rights to refuse or withdraw at any time. The data collection tools were anonymous, and total confidentiality of the information obtained was ensured. The study maneuver could not carry any risk to participants.

**Data Analysis:** Data entry and statistical analysis were done using SPSS 16.0 statistical software package. The use of various technologies was classified based on students' responses into rare if less than three times per week, and frequent if more often. Quantitative continuous data were compared using the non-parametric Mann-Whitney or Kruskal-Wallis tests since normal distribution of the data could not be assumed. Qualitative categorical variables were compared using chi-square test. Statistical significance was considered at  $p$ -value  $<0.05$ .

### 3. Results

A total of 683 completed forms were returned from 750, accounting for a response rate of 91.1%. The response was not different among the three categories of the faculties or the two grades. Students' mean age was 18.4%, and slightly more than half of them (56.8%) were females (Table 1). About two-fifth of the students (38.8%) were firstborn. Concerning parents' education, the majority the mothers and fathers had basic or secondary education. About half of the mothers (50.5%) were working, while 10.5% of the students had fathers who are not working.

As shown in table 2, the majority of students were having computers at home and 50.1% in their bedrooms. Almost all of them (98.4%) had their own cell phones. More than three-fourth of the students were frequently using social/entertainment internet (82.7%), making phone call after 10 pm (87.8%), and playing computer games (81.0%). On the other hand, the least used technology was the educational internet, as 41.4% of the students were rarely using it.

As for students' sleeping habits, Table 3 shows that more than one-third of the students (36.6%) went to bed between 2 and 3 am, while 37.2% reported waking up between 6:30 and 7:45 am. About two-thirds of the students (61.3%) reported sleeping while watching television. Meanwhile, only slightly more than half of the students (58.1%) were feeling they get enough sleep.

Examining the relation between sleep sufficiency and the use of technology, Table 4 indicates

a statistically significant association with nocturnal use of SMS ( $p < 0.001$ ). It is evident that the highest percentage of those feeling getting insufficient sleep (79.8%) was frequently using this technology. Similarly, the highest percentage of those feeling getting insufficient sleep was frequently using social and entertainment internet (86.9%), although the difference was of borderline significance ( $p = 0.06$ ).

Table 5 illustrates the relation between attention and GPA scores, and the use of technology. It shows statistically significantly higher attention scores among those with frequent use of educational internet ( $p = 0.040$ ), and with rare sleep on TV ( $p = 0.003$ ). As for GPA scores, they were statistically significantly higher among those with rare use of educational internet ( $p = 0.025$ ), and those making calls after 10 pm ( $p = 0.019$ ).

The relation between attention score and sleep and scholastic achievement is described in Table 6. It shows statistically significant relations with both. Thus, the highest attention score was among those feeling getting enough sleep ( $p < 0.001$ ). Also, the attention score demonstrates a decreasing trend with the decrease in scholastic achievement ( $p < 0.001$ ).

### 4. Discussion

Over the past decade, technology has become increasingly important in the lives of adolescents. The present study demonstrated very high percentages of ownership and utilization of various technologies among the adolescent students. This is in congruence with the previous research that reported that adolescents are heavy users of newer electronic communication forms such as instant messaging, e-mail, and text messaging, as well as communication-oriented internet sites such as blogs, sharing photos and videos (Subrahmanyam and Greenfield 2008).

The present study findings also showed a negative impact of the excessive use of technology on students' sleep, and consequently on their abilities to concentrate and their scholastic achievement. This constitutes a major problem since good sleep is essential for normal functioning, especially among adolescents. In congruence with this, the National Center on Sleep Disorders Research (2008), emphasized that while adequate sleep is essential for healthy functioning and survival, inadequate sleep and unhealthy sleep practices are common, especially among adolescents. A majority of adolescents report habitual sleep durations of fewer than seven hours each night during the week, with excessive daytime sleepiness associated with interference with daily activities including cognitive problems. This is of particular importance for students as sleep contributes to the process of memory, being mediator for memory

encoding, memory consolidation, brain plasticity and memory reconsolidation.

**Table 1: Demographic characteristics of students and their parents (n=683)**

	Frequency	Percent
<b>Age (years):</b>		
17	47	6.9
18	338	49.5
19+	298	43.6
<b>Mean±SD</b>	18.4±0.7	
<b>Sex:</b>		
Male	295	43.2
Female	388	56.8
<b>Birth order:</b>		
1	265	38.8
2-3	329	48.2
4+	89	13.0
<b>Mother education:</b>		
Illiterate	63	9.2
Read/write	34	5.0
Basic	296	43.3
Secondary	277	40.6
University	13	1.9
<b>Mother job status:</b>		
Housewife	338	49.5
Working	345	50.5
<b>Father education:</b>		
Illiterate	29	4.2
Read/write	29	4.2
Basic	252	36.9
Secondary	344	50.4
University	29	4.2
<b>Father job status:</b>		
Working	611	89.5
Retired/Unemployed	72	10.5
<b>Family income:</b>		
Sufficient	410	60.0
Insufficient	273	40.0

**Table 2: Ownership and usage of technology as reported by students (n=683)**

	Frequency	Percent
<b>Have computer:</b>		
At home	577	84.5
In own bedroom	342	50.1
<b>Have own cell phone:</b>	672	98.4
<b>Use social/ entertainment internet:</b>		
Rare (<3 times/week)	118	17.3
Frequent (most days)	565	82.7
<b>Use educational internet:</b>		
Rare (<3 times/week)	283	41.4
Frequent (most days)	400	58.6
<b>Use SMS after 10 pm:</b>		
Rare (<3 times/week)	185	27.1
Frequent (most days)	498	72.9
<b>Make calls after 10 pm:</b>		
Rare (<3 times/week)	83	12.2
Frequent (most days)	600	87.8
<b>Sleep on TV:</b>		
Rare (<3 times/week)	264	38.7
Frequent (most days)	419	61.3
<b>Play computer games:</b>		
Rare (<3 times/week)	130	19.0
Frequent (most days)	553	81.0
<b>Play computer games after 10 pm:</b>		

<b>Rare (&lt;3 times/week)</b>	265	38.8
<b>Frequent (most days)</b>	418	61.2

**Table 3: Sleeping habits and sufficiency as reported by students (n=683)**

	Frequency	Percent
<b>Bedtime during weekdays:</b>		
<b>Irregular</b>	10	1.5
10-<12	77	11.3
12-<2	169	24.7
2-<3	250	36.6
3+	177	25.9
<b>Time of waking up during weekdays:</b>		
5:00-<6:30	98	14.3
6:30-<7:45	254	37.2
7:45-<9:45	246	36.0
9:45-<11:00	43	6.3
11:00-12:00	42	6.1
<b>Sleep on TV:</b>		
Rare (<3 times/week)	264	38.7
Frequent (most days)	419	61.3
<b>Feeling of getting enough sleep:</b>		
More than enough	73	10.7
Enough	397	58.1
Insufficient	213	31.2

Most of the students in the present study reported going to bed late, waking up early, and not feeling they get enough sleep. Also, about two thirds of them had the habit of sleeping while watching TV. Therefore, both the amount and quality of sleep are negatively affected. This might be explained by the high percentages of nocturnal use of technology, and the presence of such technologies in students' bedrooms. In fact, the present study revealed a statistically significant relation between the feeling of sleep insufficiency and the nocturnal use of technology, particularly the use of SMS, and social internet. These results are consistent with previous research which showed that when adolescents have cell phones, televisions or computers in their bedrooms, they are exposed to higher ambient low frequency noise while they sleep. Furthermore, if they fall asleep with the television on, or if the cell phone rings while they are sleeping, the noise is likely to disrupt their sleep cycle, negatively impact the quality of sleep, and consequently impair their daytime functioning (Freedman et al. 2001; Loberge 2001).

On the same line, Bulck (2004); indicated that television viewing, computer game playing and internet use all lead to getting bed later and to spending less time in bed. Furthermore, Dade (2008) found that teenagers who excessively use their cell phone are more prone to disrupted sleep restlessness, stress, and fatigue.

The present study has also shown an increasing trend of sleep insufficiency with frequent use of computer games, although the difference did not reach statistical significance. In this regard, it has been claimed that playing computer games before bedtime

can delay sleep latency and Rapid Eye Movement (REM) sleep. Since REM sleep provides energy to the brain and the body and supports daytime performance,

any activity that delays the onset of REM sleep can be said to negatively impact sleep quality (Higuchi et al, 2005).

**Table 4: Relation between technology use and feeling getting enough sleep**

Use of technology	Feeling of getting enough sleep						X <sup>2</sup> Test	p-value
	>enough		Enough		Insufficient			
	No.	%	No.	%	No.	%		
<b>Use social/ entertainment internet:</b>								
Rare (<3 times/week)	18	24.7	62	18.1	38	13.1		
Frequent (most days)	55	75.3	325	81.9	185	86.9	5.53	0.06
<b>Use educational internet:</b>								
Rare (<3 times/week)	27	37.0	160	40.3	96	45.1		
Frequent (most days)	46	63.0	237	59.7	117	54.9	1.97	0.37
<b>Use SMS after 10 pm:</b>								
Rare (<3 times/week)	32	43.8	110	27.7	43	20.2		
Frequent (most days)	41	56.2	287	72.3	170	79.8	15.58	<0.001*
<b>Make calls after 10 pm:</b>								
Rare (<3 times/week)	12	16.4	51	12.8	20	9.4		
Frequent (most days)	61	83.6	346	87.2	193	90.6	2.96	0.23
<b>Sleep on TV:</b>								
Rare (<3 times/week)	21	28.8	157	39.5	86	40.4		
Frequent (most days)	52	71.2	240	60.5	127	59.6	3.41	0.18
<b>Play computer games:</b>								
Rare (<3 times/week)	19	26.0	74	18.6	37	17.4		
Frequent (most days)	54	74.0	323	81.4	176	82.6	2.74	0.25
<b>Play computer games after 10 pm:</b>								
Rare (<3 times/week)	28	38.4	159	40.1	78	36.6		
Frequent (most days)	45	61.6	238	59.9	135	63.4	0.69	0.71

(\*) Statistically significant at  $p < 0.05$

**Table 5: Relation between technology use and student's attention and GPA scores**

Use of technology	Attention score				GPA score			
	Mean	SD	Mann Whitney test	p-value	Mean	SD	Mann Whitney test	p-value
<b>Use social/ entertainment internet:</b>								
Rare (<3 times/week)	73.1	9.1			2.6	1.0		
Frequent (most days)	72.4	10.5	0.529	0.467	2.5	0.9	0.525	0.469
<b>Use educational internet:</b>								
Rare (<3 times/week)	71.5	10.5			2.6	1.0		
Frequent (most days)	73.2	10.0	4.247	0.040*	2.4	0.9	5.076	0.025*
<b>Use SMS after 10 pm:</b>								
Rare (<3 times/week)	72.0	10.4			2.4	1.0		
Frequent (most days)	72.7	10.2	0.614	0.434	2.5	0.9	0.567	0.452
<b>Make calls after 10 pm:</b>								
Rare (<3 times/week)	72.5	9.7			2.3	0.8		
Frequent (most days)	72.5	10.4	0.000	1.000	2.5	1.0	5.538	0.019*
<b>Sleep on TV:</b>								
Rare (<3 times/week)	74.0	10.2			2.4	0.9		
Frequent (most days)	71.6	10.2	9.108	0.003*	2.5	1.0	1.825	0.177
<b>Play computer games:</b>								
Rare (<3 times/week)	71.8	10.2			2.5	1.1		
Frequent (most days)	72.7	10.3	0.800	0.371	2.5	0.9	0.250	0.617
<b>Play computer games after 10 pm:</b>								
Rare (<3 times/week)	72.6	9.9			2.4	1.0		
Frequent (most days)	72.4	10.5	0.082	0.775	2.5	0.9	1.711	0.191

**Table 6: Relation between students' attention scores and sleep and scholastic achievement**

	Attention score	Kruskal Wallis Test	p-value
	Mean±SD		
<b>Feeling of getting enough sleep:</b>			
<b>More than enough</b>	70.2±9.7		
<b>Enough</b>	73.9±10.2	19.01	<0.001*
<b>Insufficient</b>	70.8±10.3		
<b>Grade:</b>			
<b>Excellent</b>	75.7±11.0		
<b>Very good</b>	73.1±10.0		
<b>Good</b>	72.3±9.9	24.66	<0.001*
<b>Fair</b>	69.1±10.5		
<b>Fail</b>	66.9±8.7		

(\*) Statistically significant at  $p < 0.05$

According to the results of the current study, adolescents' excessive use of technology seems to have a negative impact on their attention. This has been shown in relation sleeping while watching TV. This is certainly intermediated through the effect of these activities on sleep. In confirmation of this, the present study found a significant association between the feeling of sleep sufficiency and the attention score, with the adolescents who reported feeling getting enough amount of sleep having higher attention scores. However, the frequent use of the internet for educational reasons was associated with higher concentration scores.

The effect of excessive use of technology on student's scholastic achievement seems to be mediated by the effect on their ability to concentrate. This is postulated based on the statistically significant association between attention and GPA scores, which is in line with previous studies that indicated a significant relation between academic achievement and attention deficit in adolescents (Dulcan, 1997; Jackson & Linda, 2008).

Nonetheless, the direct relation between technology use and GPA scores gives controversial results, with lower GPA scores among those with excessive use of the internet for educational purposes. This indicates that the excessive use of technology even for educational purposes has a negative impact on school achievement. In congruence with this, Willoughby (2008); found that adolescents who reported moderate internet use tended to report more positive academic achievement compared to adolescents who reported high levels of internet use. Meanwhile, a number of studies showed that owning a home computer and the use of informational technology is positively related to academic achievement (Rocheleau 1995; Dulcan 1997; Wolfson and Carskadon (2003) Bussiere and Gluszynskip 2004).

The present study also showed lower GPA scores among students making less calls after 10 pm. The finding might be attributed to confounding factors such as making calls related to study. In disagreement with this, Bulck (2007) demonstrated that adolescents who used cell phones after lights out reported being more tired than those who did not.

## 5. Conclusion and Recommendations

The study findings lead to acceptance of its hypotheses of the negative impact of the excessive technology usage on adolescents' sleep, and consequently on their attention abilities and school achievement. Since the majority of adolescents' students do have personal computers and cell phones, the prevalence of their related problems is expected to be high.

Based on these results it is recommended to initiate national programs directed to adolescents to provide them information about the proper technology usage to avoid its negative impacts on sleep; and consequently on their attention and school achievement. These programs should be led by health professionals, especially nurses. Teachers should also be made aware of these hazards in order to deliver the message to students. The supervisory role of the parents at home is crucial. Future research is proposed to assess the effectiveness of educational programs for adolescents in wise use of technology, and to monitor the impact on sleep and academic achievement.

## References

1. Achenbach, T., Rescorla, L. (2001) Manual for the ASEBA School-Age Forms and Profiles. Burlington, VT: University of Vermont, Research Center for Children, Youth and Families. 2001.
2. Badre, G., (2008) Excessive mobile phone use affects sleep in teens. Sleep, science daily, June 9.
3. Blanton, W., Moorman, G., Hayes, B. (1997) Effects of participation in the fifth dimension on far transfer. Journal of Educational Computing Research, 16:371-396.
4. Bulck, V. (2004) Media use and dreaming: the relationship among television viewing, computer game play, and nightmares or pleasant dreams. Dreaming, 14 (1): 43-49.
5. Bulck, V. (2007) Adolescent use of mobile phones for calling and for sending text messages after lights out: results from a prospective cohort study with a one-year follow-up. Sleep, 30(9):1220-1223.
6. Bussiere, Gluszynskip (2004) The impact of computer use on reading achievement of 15-year olds (SP-599-05-04E). Working Paper. Human Resources and Skills Development Canada.

7. Chan, P., Rabinowitz, T. (2006) A cross-sectional analysis of video game and attention deficit hyperactivity disorder symptoms in adolescents. *Annals of General Psychiatry*, 5(16).
8. Curcio, G., De Gennaro, L. (2006) Sleep loss, learning capacity and academic performance. *Sleep Medicine Reviews*, 10:323-337.
9. Dehmler, K. (2009) Adolescent technology usage during sleep-time: Does it influence their quality of sleep, Attention difficulties and academic performance? Published master thesis, rochester institute of technology, college of liberal arts.
10. Dohnt, H., Triggerman, M. (2006) The contribution of peer and media influences to the development of body satisfaction and self-esteem in young girls: a prospect study. *Developmental Psychology*. 42(5):929-936.
11. Dulcan, M. (1997) Practice parameters for the assessment and treatment of children, adolescents, and adults with attention-deficit/hyperactivity disorder. *American Academy of child and Adolescent Psychiatry. Journal of the American Academy of Child and Adolescent Psychiatry*, 36(10):85s-121s.
12. Dorey, E., et al (. 2010) Children and television watching: a qualitative study of New Zealand parents' perceptions and views. *Child Care Health Dev*, May;36(3):414-20.
13. Fallone, G., Owens, J., Deane, J. (2006) Sleepiness in children and adolescents: clinical implications, *Sleep Medicine Reviews*, 6:287-306.
14. Freedman, N., et al (2001): Abnormal sleep/wake cycles and the effect of environmental noise on sleep disruption in the intensive care unit. *American Journal of Respiratory and Critical Care Medicine*, 163(2): 451-457.
15. Gioia, G., (2008) BRIEF: Behavior Rating Inventory of Executive Function: professional manual. Lutz, F: Psychological Assessment Resources.
16. Griffiths, M., Davies, M., Chapel, D. (2004) Online computer gaming: A Comparison of adolescent and adult gamers. *Journal of Adolescence*, 27:87-96.
17. Gross, E., (2004) Adolescent internet use: what we expect, what adolescents report. *Applied Developmental Psychology*, 25:633-649.
18. Hampl, J., et al (2004) Primetime televisions impacts on adolescents' impressions of bodyweight, sex appeal, and food and beverage consumption. *British Nutrition Foundation*, 29:92-98.
19. Higuchi, S., Motohashi, Y., Liu, Y., Maeda, A. (2005) Effects of playing a computer game using a bright display on presleep physiological variables, sleep latency, slow wave sleep and REM sleep. *J Sleep Res*, Sep;14(3):267-73.
20. Hunley, S., (2005) Adolescent computer use and academic achievement. *Adolescence*, 40.
21. Jackson, L., Linda, A., (2008) Race, gender and information technology use: the new digital divide "Cyber Psychology and Behavior, 11(4): 437-442.
22. Jackson, L., et al (2006): Does home internet use influence the academic performance of low-income children? *Developmental Psychology*, 42(3):429-435.
23. Loberge, L. (2001) development of sleep patterns in early adolescence. *Journal sleep Research*, 10:59-67.
24. Multimedia intelligence. (2008) the maturing wireless teen market: 12-17 US wireless teens.
25. National Center on Sleep Disorders Research (2008) Normal sleep, sleep restriction and health consequences. Retrieved July 20, from <http://www.nhlbi.nih.gov/health/prof/sleep/res-plan/section4.html>.
26. National Sleep Foundation. (2007): How much sleep is enough? Retrieved July 20, 2008 from <http://www.sleepfoundation.org/site/c.hu1XKJMOI/XF/b.2419131/K.6c.23/how-much-sleep-is-enough.htm>.
27. Pew Internet and American Life Project (2008) Adolescents and technology: youth are leading the transition to a fully wired and mobile nation, Retrived April 21, from <http://www.pewinternet>.
28. Rocheleau, B. (1995) Computer use by school-age children: trends, patterns and predictors. *Journal of Educational Computing Research*, 1:1-17
29. Rogers, M., et al (2006) Parental restriction on adolescent internet uses. *Pediatrics*, 118(4) :1804-1805.
30. Subrahmanyam, K., Greenfield, P., kraut, R. (2001) The impact of computer use on children's and adolescents development. *Applied Developmental Psychology*, 22:7-30.
31. Subrahmanyam, K., Greenfield, P. (2008) Communication and technology, interpersonal relations in adolescence. *The Future of Children*, 18(1): 119-146.
32. Willoughby, T. (2008) A Short-Term longitudinal study of internet and computer game use by adolescent boys and girls: prevalence, frequency of use and psychosocial Predictors. *Developmental Psychology*, 44(1):195-204.
33. Wolfson, A., Carskadon, M. (2003) Understanding adolescents, sleep patterns and school performance: a critical appraisal. *Sleep Medicine Reviews*, 7:491-506.

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