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Children' Stress, Depression, Sleep, and Internet Use

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ABSTRACT

This study examines the connections between children's sleep, stress, depression, and internet use. Parents believe that sleep effectively reduces children's stress, while children instead insist that internet use is effective for reducing their stress. Based on that argument, this study has three purposes: to examine whether sleep or internet use is more effective at reducing children's stress, examine whether stress is related to depression, and examine whether sleep affects depression through children's stress as a mediating factor. To this end, this study gathered a sample of 1,796 children from 32 elementary schools—all fourth- to sixth-graders who volunteered to take the survey—and measured their stress level, depression level, sleep hours, and hours of internet use. The Daily Stress Scale of Korean Children, Korean Child Depression Scale, hours of sleep on average per day (sleep), and hours of using electronic devices per day (internet use) were used as the measurements. Regarding the statistical analysis methods used in this study, linear regression was used to examine the regression effect of both sleep and internet use on stress and the regression effect of stress on depression. Path analysis, one of the structural equation models, was also used to find direct, indirect, and mediating effects between variables. The study results show that (i) sleep, not internet usage, effectively relieves children's stress; (ii) stress is an important influence on depression; and (iii) sufficient sleep reduces stress, which reduces depression. It is recommended that future studies consider the quality of sleep and quantity of sleep for more valid data analysis and carry out follow-up research with wider age groups.

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Keywords:

Sleep, Internet use, stress, depression

1. Introduction

Children have increasingly begun reporting that their daily lives are full of stress. In an international comparison survey of adolescents' health status in Korea, the US, Japan, and China, Choi and Lee (2010) found that 87% of Korean adolescents reported having felt stressed in the past year; their sources of stress ranged from personal matters to their social relationships. Collins-Donnelly (2013) found that the common sources of stress in children and young people were academic worries, family relationships, problems at home, friendships, romantic relationships, bullying, and change. Breas (2020) derived five categories of stress among young people: environment, symptoms, school/occupation, relationship, and personality. In turn, children's stress often causes fearfulness, physical symptoms, illness, depression, withdrawal, underachievement, anger, and retaliation (Lee, 2015).

Naturally, people undergoing stress will attempt to reduce that stress. Children also learn to reduce stress early because they are distressed by many events that adults can generally manage without stress (MedicilePlus, n.d.). Parents aim to help their children relieve stress by encouraging physical activity, having dinner together, or seeking counselling advice. However, as children grow and become better able to behave independently, they often choose different paths from what their parents expect them to choose. One of the children's favourite ways to relieve stress today is to play with electronic devices such as computers or cellular

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phones equipped with internet access. For example, in their study examining the impact of smartphone usage, Kwon and Lee (2012) reported that more than 50% of children had cellular phones and that children who did not have cellular phones tended to be bullied.

Electronic devices offer various services, such as games, social networking, email, internet surfing, and watching entertainment such as TV and movies. When asked, children often claim that the internet relaxes them and reduces their stress, and a study by Julian (2008) showed that this was the case in adults. In that study, 143 adults were connected to brain monitors and asked to play internet games or search for online articles for 15 minutes. Compared to the participants who searched for online articles, those who played Bejeweled 2 showed 54% lower stress, those who played Peggle showed 66% lower stress, and those who played Bookworm Adventures showed a 43% reduction in depression symptoms (Julian, 2008).

In contrast with children's opinions, parents believe that sleep or exercise are the best ways to reduce their children's stress. Their contention is supported by the Council on Communications and Media (2016), which recommends that children aged two to six have no more than one hour of screen-time per day while recommending that older children have consistent limits on their screen time so that their sleep and physical activity are not disrupted. For these reasons, parents whose children try to relax with electronic devices may instead attempt to persuade their children to get sleep or exercise.

Many researchers have established a positive relationship between sleep and stress reduction. For example, Sarraf and Dubey (2016) studied sleep and stress in students aged 20 to 25 years and found higher stress scores among students who slept for shorter periods than those who slept for longer. Powell (2009) also studied sleep and stress and found that people who reported more fatigue and less sleep are more likely to show more stress; the author suggested a causal relationship between poor sleep and stress.

Stress can also lead to physical and psychological distress. For instance, Bolger, DeLongis, Kessler, and Shilling (1989) reported that stress is closely connected to depression and has a highly influential relationship. Beck, Rush, Shaw, and Emery (1979) defined depression as an emotional disorder resulting from negative self-perceptions or poor adaptation to stress. Stress is one of the most influential predictors of depression in teenagers (Lim and Chung, 2009). The Ministry of Education (2018) reported increases of 35% to 40% in teenagers' stress awareness from 2015 to 2018 and that depression followed a similar trend. These findings indicate the need to investigate the relationship between stress and depression.

Considering the literature findings described above, there is a need to compare sleep and internet use to examine which one is more effective for reducing stress among children. Research in health and medicine regularly recommends that stress experienced by children in various human relationships and environments can be resolved by receiving sufficient sleep (Johnson, 2018), while children themselves prefer to play games or watch videos on electronic devices to reduce stress. In addition, as many studies have revealed that stress is associated with depression (Beck et al., 1979; Lim & Chung, 2009; Shiling, 1989), this study must analyse the association between children's stress and depression. Once the association is meaningfully established, it can then be determined whether sleep or internet use affects depression through stress as a mediating factor.

This study expects that sleep will have a positive effect on stress and depression reduction. Therefore, in the direction of the study's goal, the hypotheses of this study are as follows:

- Sleep is more effective at reducing children's stress than internet use through electric devices such as computers or cellular phones.
- Children's stress is related to depression.
- Sleep affects depression through children's stress as a mediating factor.

This study's findings can lead to a clearer understanding of the relationships among sleep, internet use, stress, and depression, which could help improve children's mental health outcomes.

2. Methodology

2.1. Research Model

The study examined the relationships between sleep, internet use, stress, and depression to infer possible causalities between those variables. The estimation of the relationships was mostly done through linear

regression. A structural equation modelling analysis was added last to investigate the mediating effect of stress on the relationship between sleep and depression.

2.2. Sample and Procedure

The sample for this study consisted of 1,796 children from 32 elementary schools in Pusan and Ulsan, two metropolitan areas located in southern South Korea. Before the survey, administrators at elementary schools in both cities were asked whether they were interested in participating in this study. The teachers and students who were interested agreed to participate. The students' homeroom teachers were provided with guidebooks explaining the study purpose and how to complete the survey form. For the survey, research staff members visited the committed schools and conducted the survey with fourth- to sixth-grade students; 52% ($n = 939$) were boys, and 48% ($n = 857$) were girls. The survey took 20 minutes to complete.

2.3. Measures

Stress: To measure stress in the students, the children were administered the Daily Stress Scale of Korean Children developed by Han and Yu (1995). Han and Yu (1995) performed factor analysis to verify the validity of the scale composition, and they primarily selected 77 items spread across six factors. After conducting a regression analysis for each sub-factor to increase the efficiency of item composition, the items with an increase in the explanatory power of less than 3% were excluded, and 42 items were ultimately selected. The scale consists of 42 items spread throughout six stress areas: parents (psychological burden or conflict stemming from parental actions or demands), home environment (dissatisfaction or psychological distress caused by the family environment), friends (problems in relationships with friends), learning (concerns or burdens related to academic performance and achievement), teachers and school (dissatisfaction with teacher's attitude and school life), and appearance (manner or style in social environment or circumstances a child is in contact with). The correlation coefficient between this Daily Stress Scale and the Quality of Life Scale developed by Olson and Barnes (1982) to estimate the criterion-related validity indicated that the validity of this scale was supported ($r = -0.52, p < 0.001$). Respondents rated each item on Likert scales ranging from 0 (*not at all agree*) to 3 (*strongly agree*) points, and higher scores indicate higher stress. The overall reliability coefficient of the scale was .92.

Depression: The students in this study were also administered the Korean Child Depression Scale to measure their levels of depression. The original version of the scale was developed by Kovacs (1981) and revised by Jo and Lee (1990) for Korean circumstances. Students consider how they have felt over the last two weeks to answer 27 items spread across five depression areas: depressive emotion (depressed mood or loneliness), behavioural disorder (aggressive behaviour or interpersonal disorder), loss of interest (loss of interest or pleasure in everyday life), self-deprecation (sense of worthlessness or negative self-image), and physiological symptoms (insomnia, loss of appetite, fatigue, or other symptoms). To estimate the criterion-related validity, the correlation coefficient between the Korean Child Depression Scale and the Korean form of the state-trait anxiety inventory for children of Cho and Choi (1989) was examined (Shin and et al., 2001). The statistical results showed that the validity of this scale was supported ($r = 0.88, p < 0.05$). The items were rated on 3-point Likert scales ranging from 0 to 2, and the overall reliability coefficient of the scale was .88.

Sleep: Hours of sleep on average per day.

Internet Use: Hours of use of electronic devices per day such as computers, cellular phones, or television for games, chatting through SNS, emailing, watching TV programs or movies, or surfing the internet.

2.4. Data Analysis

The data analysis of this study began with describing the variables and finding the correlations among them. Next, linear regression was used to examine the regression effect of both sleep and internet use on sleep (Analysis 1) and the regression effect of stress on depression (Analysis 2). Lastly, path analysis, one of the structural equation models, was used to determine the direct, indirect, and mediating effects between variables (Analysis 3). SPSS 26 was used for major statistical analysis, and SPSS PROCESS v.3.3 by Andrew F. Hays was used for the structural equation modelling analysis. Figure 1 below illustrates the whole data analysis process.

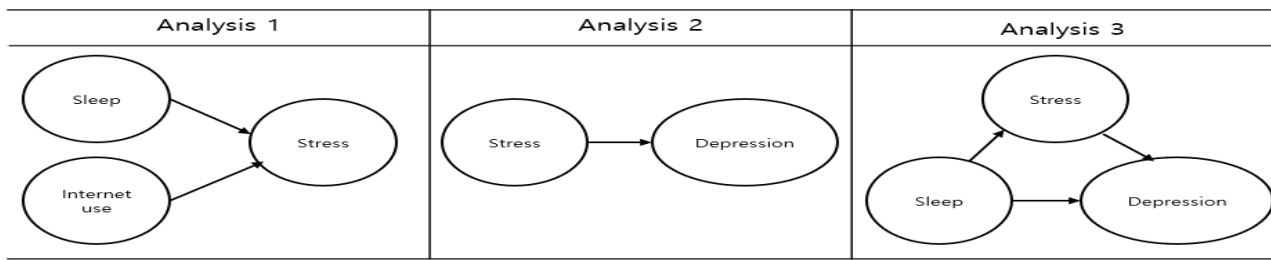


Figure 1. Analysis Process

3. Findings

3.1. Descriptive Statistics

Table 1 below presents the descriptive statistics for the children’s sleep, internet use, stress, and depression. The students in this study averaged 7.87 hours of sleep per night and 4.10 hours of internet use per day. Table 1 also presents the zero-order correlation between variables, which were significant aside from those for internet use and depression. Sleep and stress were negatively correlated ($r = -0.12, p < .01$), while internet use and stress were positively correlated ($r = 0.16, p < .01$).

Table 1. Means, Standard Deviations, and Zero-Order Correlations

	M	SD	1.	2.	3.	4.
1. Sleep	7.87	1.61	–			
2. Internet Use	4.10	2.34	-.05*	–		
3. Stress	.75	.48	-.12**	.16**	–	
4. Depression	.92	.11	-.08*	-.01	.07**	–

* $p < .05$. ** $p < .01$.

3.2. Analysis of Stress

Table 2 below lists the results of the simple linear regressions of sleep and internet use on stress. First, there was a significantly negative association between sleep and stress ($\beta = -.12, p < 0.001$): The more students slept, the less stress they felt. There was also a statistically significant positive association between internet use and stress ($\beta = .16, p < 0.001$); The children’s stress levels increased as their internet use increased.

Table 2. Simple Linear Regression Results of Sleep and Internet Use on Stress

Dependent Variable	Independent Variable	Unstandardised Beta Coefficients	Standard Error	Standardised Beta Coefficients	t	p	
Stress	(constant)	1.04	.06		18.66	<.001	
	Sleep	-.04	.01	-.12	-5.21	<.001	
	F=27.18 ($p < .001$), $R^2 = .02$						
	(constant)	.62	.02		27.68	<.001	
	Internet Use	.03	.01	.16	6.92	<.001	
	F=47.94 ($p < .001$), $R^2 = .03$						

3.3. Analysis of Relationship between Stress and Depression

First, simple linear regression was used to analyse the causal relationship between stress and depression. Table 3 below presents the results of regression analysis, where it can be seen that there was a significant positive association between stress and depression ($\beta = 0.07, p < 0.01$). Specifically, young people’s depression increased as their reported stress increased.

Table 3. Simple Linear Regression Results of Stress on Depression

Dependent Variable	Independent Variable	Unstandardised Beta Coefficients	Standard Error	Standardised Beta Coefficients	t	p
Depression	(constant)	.91	.01		191.38	<.001
	Stress	.02	.01	.07	2.78	<.01
F= 7.73($p < .01$), $R^2 = .00$						

The mediation effect of stress was examined to verify stress as a mediator between sleep and depression. The effect of internet use was excluded in this mediation effect analysis because, as presented in Table 1 above, the

zero-order correlation of internet use with depression was not significant. As listed in Table 4 below, all passes showed statistical significance between variables. Sleep negatively affected both stress ($B = -0.0364$, $t = -5.2565$, $p < 0.001$) and depression ($B = -0.0049$, $t = -3.1380$, $p < 0.01$). As hypothesised, stress did have a positive effect on depression ($B = 0.0127$, $t = 2.3796$, $p < 0.05$). The results indicate that less sleep increases children’s stress, which in turn increases their depression.

Table 4. Results of Pass Analysis between Sleep, Stress, and Depression

	pass		B	se	t	p	LLCI	ULCI
Sleep	→	Stress	-.0364	.0069	-5.2565	.0000	-.0500	-.0228
Sleep	→	Depression	-.0049	.0016	-3.1380	.0017	-.0080	-.0019
Stress	→	Depression	.0127	.0053	2.3796	.0174	.0022	.0231

As presented in Table 5 below, the total effect of sleep on depression was significant ($B = -0.0054$, $t = -3.4531$, $p < 0.001$), and the direct effect of mediation was supported ($B = -0.0049$, $t = -3.1380$, $p < 0.01$). Bootstrapping was used to examine the mediation effect of stress in the causal relationship between sleep and depression. An iterative sampling of 5,000 samples indicated that the pass from sleep to depression by mediating stress did not include 0 at 95% confidence intervals (CIs); that is, the mediation effect was meaningful ($B = -0.0005$, 95% CI = -0.0010 , -0.0001).

Table 5. Total, Direct, and Indirect Effects

	Effect	se	t	p	LLCI	ULCI
Total Effect	-.0054	.0016	-3.4531	.0006	-.0085	-.0023
Direct Effect	-.0049	.0016	-3.1380	.0017	-.0080	-.0019
Indirect Effect	-.0005	.0002			-.0010	-.0001

4. Discussion and Conclusion

The purpose of this study was to compare and analyse two opposite arguments regarding stress reduction in children: the children’s argument that internet use reduces their stress and the parents’ argument that sleep is the best stress reducer for adolescent students. The study results revealed that sleep was more effective in relieving young students’ stress than the internet. The children’s stress increased with increasing use of electronic devices that allowed them to access the internet, and sleep was effective in reducing their stress, which was consistent with the findings outlined by Minkel and Banks (2012); those authors studied the effect of one night of sleep deprivation on subjective stress, in a setting in which sleep was managed in a controlled laboratory environment, and stressor intensity was manipulated by the difficulty of cognitive tasks, time pressure, and performance feedback. The sleep-deprived participants showed greater subjective stress than the controlled resting participants (Minkel and Banks, 2012). Despite such findings, children still insist that using electronic devices relax them (Kim and Davis, 2009), and many eventually display problematic internet use. Shotton (1991) described problematic internet use as a behavioural problem of concern related to human interactions with information and communication technologies, particularly among adolescents. George and Lenihan (2014) stated that such usage led to internet addiction, a recognised disorder.

To analyse the effect of stress on depression, an important factor in adolescents’ mental health, regression analysis for depression showed that stress was an important influence on depression; the higher children’s stress, the more depression they report. Depression is a dangerous symptom in adolescent mental health. Kim (2020) revealed that depression could cause social atrophy in adolescents, difficulties in interpersonal relationships, maladjustment in peer relationships, and delinquency. Given such findings, it is necessary to reduce the stress that causes depression in adolescent students. The American Psychological Association (2019) proposed the following activities for stress reduction: sleeping, exercise, talking with trusted adults, making time for fun and quiet, and getting outside to enjoy nature. Among these suggestions, the results of this study verified the importance of sleep.

Pass analysis verified that stress mediated the link between sleep and depression; sufficient sleep reduces stress, reducing depression. Becker, Adams, Orr, and Quilter (2008) found similar results indicating that poor sleep quality was associated with higher levels of stress and depression, both of which have reciprocal negative impacts on sleep. The unique contribution of this study is the testing of a relatively untried causal relationship between sleep, stress, and depression; researchers have previously focused on the idea that stress lowers the

quality of sleep. For example, Hanson and Chen (2008) reported that stress was harmful to sleep, and in a laboratory study, Kim and Dimsdale (2007) determined that exposure to laboratory stressors causes sleep disturbance.

By contrast, the findings in this study showed that sleep lowers stress, which in turn contributes to lowering depression. Children who got sufficient sleep showed less stress, which reduced their probability of depression; better sleep leads to better mental health. Consistent with these results, Mousseau, Lund, Liang, Spencer, and Walsh (2016) reported that insufficient sleep was associated with potentially severe mental health problems, including anxiety, stress, emotional concerns, and suicidal ideation. Mousseau et al. (2016) also found that adequate sleep was associated with numerous benefits, including improved psychological health and academic performance.

To conclude, this study has demonstrated that stress and depression are major factors in improving children's mental health and that both are well controlled with adequate sleep. The benefits identified in this study are not necessarily limited to the children who were the research subjects; instead, this information should be useful regardless of a person's age. Sufficient sleep reduces stress, decreasing depression, and it is recommended for all ages to maintain sound mental health. One last piece of practical advice for parents, teachers, and educational professionals to keep in mind from the results of this education-related study is that, in this study, the variable of internet use is conceptualised against that of sleep, which implies a desirable factor of stress and depression reduction for children. Although it was set up as a concept that does not help relieve stress and depression, internet use can also have many positive effects in real life. It is regarded as a major axis of educational, cultural, social, and emotional support for children. Therefore, it is not appropriate to solely focus on the findings showing that sleep is the top priority for relieving children's stress and depression while neglecting the positive value that internet use can give to children.

5. Recommendations for Future Research

The results of this study suggest ideas for future research. First, this study focused on the quantity of sleep, which means time spent lying in bed. Calculating sleeping hours in this way may not be an accurate method of computing children's sleeping time. For this reason, the concept of sleeping quality needs to be added to the calculation of sleeping time. Sleep quality refers to shorter sleep latencies, fewer awakenings, and reduced wake after sleep onset (Ohayon, 2017). It is necessary to investigate sleep quality to secure a more valid effect of sleep on stress and depression reduction. Second, it may not be appropriate to generalise the study results to adolescents, college students, and even adults, because it was only conducted on 4th- to 6th- grade children. Therefore, a meaningful follow-up study would expand the age range to adolescents, college students, and adults to examine whether similar results appear in the other age groups.

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