

**The Relationship Between Social Media Dependency and Emotional Problems: The
Mediating Role of Sleep Quality**

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Abstract

Increased vulnerability for emotional problems and increased social media dependency is characterized for adolescence according to previous cross-sectional studies, including the effect of sleep quality. Despite cross-sectional evidence, little is known about whether there is a bidirectional relationship between social media dependency and emotional problems or a mediating effect of sleep quality. Therefore, this longitudinal quantitative research examined the bidirectional relationship between social media dependency and emotional problems and whether this is mediated by sleep quality. The sample consisted of 812 adolescents ($M_{\text{age}} = 12.64$, $SD_{\text{age}} = 0.734$, 49.9% boys, 50.1% girls). A hierarchical multiple regression analysis showed that adolescents with higher levels of social media dependency experienced more emotional problems. No significant relationship was found between emotional problems and social media dependency. The relationship between social media dependency and emotional problems was fully mediated by sleep quality. A direction for future research is exploring other underlying mediating factors of the relationship between social media dependency and emotional problems, because little is known about it longitudinally. In addition, efforts should be made to improve adolescents' sleep quality, because this could reduce emotional problems.

Keywords: social media dependency, emotional problems, sleep quality, mediation

Abstract

Een verhoogde kwetsbaarheid voor emotionele problemen en een verhoogde afhankelijkheid van sociale media is karakteriserend voor de adolescenten volgens cross-sectionele studies, inclusief het effect van slaapkwaliteit. Ondanks cross-sectioneel onderzoek is er weinig bekend of er een bidirectioneel verband is tussen sociale media afhankelijkheid en emotionele problemen of dat slaapkwaliteit een mediërend effect is. Daarom onderzocht dit longitudinaal kwantitatief onderzoek de bidirectionele relatie tussen sociale media afhankelijkheid en emotionele problemen en of deze gemedieerd wordt door slaapkwaliteit. De steekproef bestond uit 812 adolescenten ($M_{\text{leeftijd}} = 12.64$, $SD_{\text{leeftijd}} = 0.734$, 49.9% jongens, 50.1% meisjes). Een hiërarchische multiple regressieanalyse toonde aan dat adolescenten met een hoger niveau van sociale media afhankelijkheid meer emotionele problemen ondervonden. Er werd geen significant verband gevonden tussen emotionele problemen en sociale media afhankelijkheid. De relatie tussen sociale media afhankelijkheid en emotionele problemen werd volledig gemedieerd door slaapkwaliteit. Een richting voor toekomstig onderzoek is het onderzoeken van andere onderliggende mediërende factoren van de relatie tussen sociale media afhankelijkheid en emotionele problemen, omdat hier nog weinig longitudinaal over bekend is. Bovendien moeten pogingen worden ondernomen om de slaapkwaliteit van adolescenten te verbeteren, omdat dit emotionele problemen zou kunnen verminderen.

Kernwoorden: sociale media afhankelijkheid, emotionele problemen, slaap kwaliteit, mediatie

The Relationship between Social Media Dependency and Emotional Problems: The Mediating Role of Sleep Quality

Adolescence is characterized by increased vulnerability of emotional problems (Steinberg, 2005). Specifically, adolescence is a critical period for the reorganization of regular systems and the maturation of emotional symptoms (Yurgelun-Todd, 2007), resulting in both risks and opportunities (Steinberg, 2005). Emotional problems include anxiety disorders, mental health problems, major depression and bipolar disorders (Healthgrade, 2020). According to a study of Collishaw et al. (2010) there is a substantial increase in adolescents' emotional problems comparing 1986 and 2006. As emotional regulation plays such an important role during adolescence, it is important to examine predictors of emotional problems.

One predictor of emotional problems could be social media dependency (Fardouly et al., 2018). Social media dependency is defined as a characteristic or psychological state of a person who is dependent on a social media system (Li et al., 2019). The use of social media among adolescents continues to grow worldwide. From 2019 to 2020, adolescents' using social media have increased with 9.2% of the world's population (Dean, 2020). There are growing concerns about social media dependency, because social media dependency is associated with low levels of happiness and increased emotional problems (Twigg et al., 2020). This is especially harmful in adolescence, because it is a period of maturation of the emotional domains of functioning (Burnett et al., 2011). Therefore, it is important to examine social media dependency and its relationship with emotional problems.

One potential mechanism explaining why social media dependency may relate to stronger emotional problems may be lower sleep quality. Sleep quality is defined as one's satisfaction of the sleep experience, integrating aspects of sleep initiation, sleep maintenance, sleep quantity, and refreshment upon awakening (Mathew et al., 2019). Social media dependency was found to be associated with poor sleep quality (Vernon., 2015), which in turn resulted in more emotional problems (Roberts & Duong, 2014). Therefore, the aim of this study is to investigate and address the gaps by examining the bidirectional relationship between the social media dependency and emotional problems and if this relationship is mediated by sleep quality.

The Bidirectional Relationship Between Social Media Dependency and Emotional Problems

There are different explanations for a possible bidirectional relationship between social media dependency and emotional problems. This longitudinal quantitative research will focus on both theoretical directions.

Social Media Dependency and Emotional Problems

Research has found that social media dependency is linked to more emotional problems; experiencing social media dependency is linked to lower mental health, lower social well-being, more stress and therefore can lead to more emotional problems (Boer et al., 2020). Social media dependency can direct to a constant urge to be on social media in order not to miss anything. This can lead to negative consequences, such as emotional problems, like social anxiety and loneliness (Berryman et al., 2018).

Although scholars have paid attention to the negative impact of social media dependency on emotional problems in the theoretical framework, studies on the relationship between social media dependency and emotional problems have mainly been cross-sectional. So, there is hardly any evidence for longitudinal relationships.

There are several studies that found a positive association of the relationship between social media dependency and emotional problems (Bányai et al., 2017; Boer et al., 2020; Fardouly et al., 2018). A cross-sectional study of Bányai et al. (2017) among 6,664 youth aged between 15-22, found that there is a positive relationship between social media dependency (using the Bergen Social Media Addiction Scale) and emotional problems. Furthermore, a cross-sectional study of Boer et al. (2020) among 154,981 youth found that problematic users of social media reported more emotional problems, compared to non-problematic users of social media.

Emotional Problems and Social Media Dependency

According to Fabris et al. (2020) emotional problems are expected to be linked to more social media dependency. Adolescents with emotional problems such as depression, low levels of emotional stability or feeling alone, often feel an urge and are more motivated to constantly use social media (Claudia et al., 2020). These emotional problems, higher levels of stress and a lower mental well-being, can be a trigger for social media addiction and social media dependency (Fabris et al., 2020).

Although scholars have paid attention to the negative impact of emotional problems on social media dependency in the theoretical framework, studies on the relationship between

emotional problems and social media dependency have mainly been cross-sectional (Acar et al., 2017; Ünal-Aydin et al., 2020).

There are several studies that found a positive association of the relationship between social media dependency and more emotional problems (Acar et al., 2017; Ünal-Aydin et al., 2020; Kircaburun et al., 2020; Heffer et al., 2019). Similarly, a longitudinal study of Heffer et al. (2019) among 597 adolescents found that overtime, more emotional problems predicted more frequent social media use among adolescents over a period of two years. Furthermore, a cross-sectional study of Acar et al. (2017) among 221 adolescents found that adolescents with higher levels of emotional problems reported higher levels of social media dependency.

The Mediating role of Sleep Quality

Besides emotional problems is social media dependency also negatively linked to sleep quality. When experiencing social media dependency, there is a constant need to be active on social media. This creates a restless state of mind before going to sleep, which in turn leads to problematic sleep habits and sleep problems (Özceylan et al., 2018). Moreover, social media dependency is associated with headaches, ear aches and warmth sensations which could lead to a poor sleep quality and duration (Gladius Jennifer et al., 2018). A good sleep quality is expected to be linked to more emotional problems. With a better sleep quality, the body gets more time to relax physically and emotionally, recharge and lower adiposity indicators. This can lead to better academic achievement, better quality of life and well-being, which is associated with less emotional problems (Chaput et al., 2016). Poorer sleep quality increases the likelihood to experience sleep loss, concentration problems, exhaustion and sensitivity. This can lead to more emotional problems like depression and lower self-acceptance (Hamilton et al., 2007).

Overall, studies have found support for the negative relationship between social media dependency and sleep quality (Özceylan et al., 2018; Gladius Jennifer et al., 2018).). According to a cross-sectional study of Ibrahim et al. (2018) among 610 adolescents found that social media dependency problems lead to poor sleep quality. Moreover, in a cross-sectional study of Vernon et al. (2015) among 1,886 youth aged between 12-18 found that by minimizing social media dependency, sleep quality could be improved.

Additionally, other studies have found that higher sleep quality is related to less emotional problems (Chaput et al., 2016; Hamilton et al., 2007).). A cross-sectional study of Roberts and Duong (2014) among 4,175 youth aged between 11-17 found that poorer sleep quality increases the risk for major depression and emotional problems. Also, in a cross-

sectional study among 502 youth, it was found that by improving sleep quality is associated with less emotional problems (Hamilton et al., 2007).

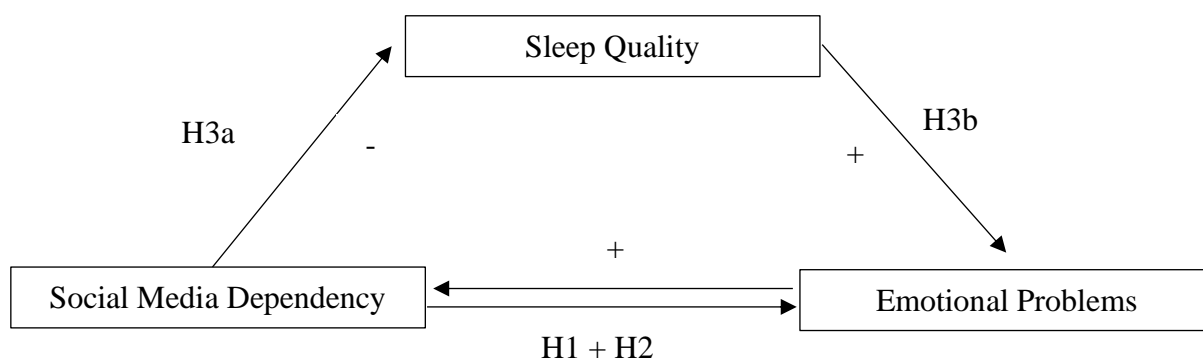
The Current Study

Although there is evidence that social media dependency is positively related to emotional problems and that sleep quality is a mediator in the relationship between social media dependency and emotional problems. Indeed, there are still important gaps that need to be addressed. First, existing studies are mainly cross-sectional. Second, the bidirectional relationship is not really investigated, only the relationship between social media dependency and emotional problems and the relationship between emotional problems and social media dependency. Third, there are no studies that investigate sleep quality as a mediator, the studies are only focusing on the first or the second part of the mediation. The current study will address these gaps by examining the bidirectional relationship between social media dependency and emotional problems and if this relationship is mediated by sleep quality.

The first sub-question is: To what extent is social media dependency related to emotional problems over time? The second sub-question is: To what extent are emotional problems associated with social media dependency over time? Third, to what extent does sleep quality mediate the relationship between social media dependency and emotional problems over time? It is hypothesized that social media dependency is related to emotional problems over time (H1) and emotional problems are related to social media dependency over time (H2). In addition, it is expected that the longitudinal association of social media dependency and emotional problems is mediated by sleep quality (H3), that social media dependency is negatively related to sleep quality over time (H3a) and sleep quality is positively related to emotional problems over time (H3b).

Figure 1

The Model on the Hypothesized Relationship Between Social Media Dependency, Sleep Quality, and Emotional Problems



Method

This research is part of a three wave longitudinal quantitative study with three to four-month interval conducted in 2014/2015. The data was collected among students who were in their first and second year of secondary school. The study was focused on the longitudinal relationship between media multitasking and sleep problems (van der Schuur et al., 2018).

Participants

The sample consisted of Dutch secondary education students aged between 11 and 15 years old. 1443 adolescents filled out the questionnaire. ($M_{age} = 12.61$, $SD_{age} = 0.749$, 50.1% boy and 49.1% girl). 58% were in their first year of secondary school and 42% were in their second year of secondary school. In wave 1, 1157 participants filled out the questionnaire, in wave 2 1150 participants filled out the questionnaire and in wave 3 1084 participants filled out the questionnaire. Participants were excluded from the data set if they had missing values on the variables that were needed for the research or when they did not participate in all three waves ($N_{Wave1\ missings} = 286$; $N_{Wave2\ missings} = 293$; $N_{Wave3\ missings} = 359$). The final sample consisted of 812 adolescents who participated in all three waves, with no missing values. 49.9% were boys and 50.1% were girls ($M_{age} = 12.64$, $SD_{age} = 0.734$). 420 participants were in their first year of secondary school and 392 participants were in their second year of secondary school.

To examine possible differences between those who had dropped out and those who had participated in all the waves, an attrition analysis was conducted. A linear regression analysis was used with a dummy variable (0 = participants in wave 2 and 1 = dropouts in wave 2) as the dependent variable. Social media dependency (W1), sleep quality (W1) and emotional problems (W1) were used as the independent variable. There were no significant differences between the group that participated and the group that dropped out. Another linear regression was done with the dummy variable (0 = participants in wave 3 and 1 = dropouts in wave 3) as the dependent variable and sleep quality (W2) as the independent variable. Once again, there were no significant differences between the group that participated and the group that dropped out.

Measurements

Social Media Dependency

The independent variable social media dependency was measured by a validated scale from the research of van der Schuur et al. (2019). Using a ten-items scale, with five items on emotional responses to social media use and five items which may indicate social media dependency. All items were rated on a 5-point scale, ranging from 0 = *completely not true* to 4 = *completely true*. A higher score indicated more social media dependency. Examples of

items are: ‘I felt tensed or restless when I could not use social media’ and ‘I felt disappointed when I did not get an immediate response if I posted something on social media’. The mean score of these 5 items of wave 1 and wave 3 will be used for this research. Cronbach’s α for this scale was very good to excellent in both waves (wave 1 Cronbach’s $\alpha = .894$ and wave 3 Cronbach’s $\alpha = .937$).

Emotional Problems

The dependent variable emotional problems was measured by five items of the Emotional Problems Scale of the Strength and Difficulties Questionnaire (Bøe et al., 2016). All items were rated on a 3-point scale, ranging from 0 = *not true* to 2 = *completely true*. A higher score indicated more emotional problems. Examples of items are: ‘I have often had headaches, stomach aches or nauseous when thinking about the last three months’ and ‘I was often unhappy, in the well or in tears when thinking about the last three months’. The mean score of these 3 items of wave 1 and wave 3 will be used for this research. Cronbach’s α for this scale was good to very good in both waves (wave 1 Cronbach’s $\alpha = .714$ and wave 3 Cronbach’s $\alpha = .768$).

Sleep Quality

The mediating variable sleep quality was measured by using the nine items of the Sleep Reduction Screening Questionnaire (SRSQ; Van Maanen et al., 2014). All items were rated on a 5-point scale, ranging from 0 = *never* to 4 = *very often*. A higher score indicated a lower sleep quality. Examples of items are: ‘I have difficulty getting up in the morning’ and ‘I feel sleepy during the day’. The mean score of these 5 items of wave 1 and wave 2 will be used for this research. Cronbach’s α for this scale was rather weak for both waves (wave 1 Cronbach’s $\alpha = .513$ and wave 2 Cronbach’s $\alpha = .566$). Therefore, Cronbach’s α if Item Deleted was considered. The Cronbach’s α if Item Deleted were higher for three items: *how often has this occurred in the last 3 months? “I am awake right away when I wake up”, “I have enough energy during the day to participate in everything” and “I am active during the day”*. Therefore, these items were deleted one by one to see if the Cronbach’s α changed. It was decided to delete all three items. After conducting another reliability analysis without these deleted items, the Cronbach’s α for this scale was good to very good in both waves (wave 1 Cronbach’s $\alpha = .790$ and wave 2 Cronbach’s $\alpha = .817$).

Sex

The independent variable sex was measured with the question: ‘Are you a boy or a girl?’ In the research this was used as a control variable and dummy variable in which 0 = boy and 1 = girl.

Age

The independent variable age was measured by the question: ‘What is your age? The answer options ranged from 11 to 15 years old and an answer option ‘else, namely’.

Procedure

Ethical approval was obtained from the ethical committee before the start of the study (van der Schuur et al., 2018). The secondary schools were contacted by mail or phone. In total, seven schools participated in the study. The questionnaire was conducted three times throughout the academic year 2014-2015: in October 2014, February 2015 and June 2015.

The study was conducted among early adolescents in the first and second class of secondary school. The participants were recruited via schools. After permission of the school, a passive informed consent was used for parents and an informed assent for adolescents. The participants filled out the online questionnaire in class, which took approximately 30 minutes to fill in. Also, it was very clearly stated that the participation was anonymous and voluntary.

Data-analysis

Hierarchical multiple regression analyses were used to examine the hypotheses. For the first hypothesis, social media dependency Wave 1 was used as independent variable and emotional problems wave 3 as dependent variable. Sex, age, emotional problems in wave 1 were used as control variables. For the second hypothesis, emotional problems wave 1 was used as the independent variable and social media dependency wave 1 as dependent variable. Sex, age, social media dependency in wave 1 were used as control variables. For the third hypothesis the Baron & Kenny method was used. Sleep quality wave 2 was used as the mediating variable. Sex, age, sleep quality wave 1, emotional problems wave 1, social media dependency wave 1 were used as control variables. For this research a significance level of $p \leq .05$ was used.

Assumptions

Before a hierarchical multiple regression could be interpreted, a number of assumptions were tested, and checks were performed. The normal distribution of residuals was checked by P-P plots of the standardized residuals and therein where the residuals normal distributed. Multicollinearity was checked with the VIF values. No values were found above 10. Also, the correlations between the variables were under .80 (see Table 2.). Therefore, the assumption of multicollinearity seemed to be met. Homoscedasticity was checked by a scatter plot; the residuals were equally distributed.

Results

Descriptive Statistics

The descriptive statistics of all the variables are presented in Table 1. The mean of social media dependency W1 was 0.90 ($SD = 0.69$). The mean of emotional problems W1 was 0.51 ($SD = 0.46$). Both means of the variables are below average. The mean of sleep quality W1 was 1.75 ($SD = 0.49$) this is near the mid-point of the scale.

Table 1

Descriptive Statistics of the Research Variables (N = 812)

Variables	Minimum	Maximum	<i>M</i>	<i>SD</i>
Age	11	15	12.64	0.73
Social media dependency W1	0.00	4.00	0.90	0.69
Sleep quality W1	0.00	4.00	1.75	0.49
Emotional problems W1	0.00	2.00	0.54	0.46
Sleep quality W2	0.00	4.00	1.78	0.53
Social media dependency W3	0.00	4.00	1.03	0.85
Emotional problems W3	0.00	2.00	0.57	0.48

Note. *n* = number of participants; *M* = mean; *SD* = standard deviation.

Correlations

In Table 2 the correlations between all the variables are presented. Social media dependency was both correlated with more emotional problems W3 and sleep quality W2. Indicating that more social media dependency correlated with more emotional problems and lower sleep quality. In addition, a better sleep quality W2 was significantly correlated with less emotional problems W3. Furthermore, age is only weakly correlated with key variables. Only for the control variable sleep quality W1 the correlation was significant. Since this is not in the main hypotheses, the variable age was no longer used as a control variable further on.

Table 2

Bivariate Correlations Between Social Media Dependency, Emotional Problems, Sleep Quality and Control Variables.

Variables	1	2	3	4	5	6	7	8
1. Sex	1.00							
2. Age	.023	1.00						
3. EMS W1	.203**	.010	1.00					
4. SMD W1	.145**	.006	.260**	1.00				
5. SQ W1	.104**	.082*	.367**	.425**	1.00			
6. SQ W2	.092**	.029	.254**	.287**	.485**	1.00		
7. EMS W3	.199**	-.015	.548**	.247**	.272**	.294 **	1.00	
8. SMD W3	.077*	.017	.122**	.459**	.206**	.234**	.425**	1.00

Note. The control variables are sex age, Social Media Dependency (SMD) W1, Sleep Quality (SQ) W1 and Emotional Problems (EMS) W1). The independent variable is Social Media Dependency W1 and the dependent variable is Emotional Problems W3. The mediating variable is Sleep Quality T2* $p \leq .05$, ** $p \leq .001$.

The Bidirectional Relationship Between Social Media Dependency and Emotional Problems

Analysis of Social Media Dependency and Emotional Problems

First, the effect of social media dependency W1 on emotional problems W3 was tested. Results showed that social media dependency significantly predicted more emotional problems, while controlling for sex and emotional problems at W1 (see Table 3), which is in line with hypothesis 1. Emotional problems T1 and sex predicted 31.0% of the variance in emotional problems W3, $F(2, 808) = 180.42$, $R^2 = 0.31$, $p < .001$. The addition of social media dependency W1 predicts another 1.0% of the variance in emotional problems W3. All the predictors together explained 32.0% of the variance in emotional problems W3, $F(3, 807) = 125.85$, $R^2 = 0.32$, $p < .001$. There was a small effect of social media dependency on emotional problems, $B = .07$, $t(3, 807) = 3.45$, $p < .001$, 95% CI = [0.03, 0.11], $f^2 = 0.02$.

Table 3

The Hierarchical Multiple Regression Analysis of the Effect of Social Media Dependency on Emotional Problems

Variable	<i>F</i>	<i>df</i>	<i>R</i> ²	Cohen's <i>f</i> ²	Adj. <i>R</i> ²	<i>R</i> ² change	B	95% CI for B		β	<i>t</i>	<i>p</i>
								<i>LL</i>	<i>UL</i>			
Step 1	180.42	(2, 832)	0.31	0.45	0.31	0.31						<.001
EMS W1							.55	0.49	0.61	.53	17.73	<.001
Sex							.09	0.03	0.14	.09	3.04	.002
Step 2	125.85	(3, 807)	0.32	0.47	0.32	0.01						<.001
EMS W1							.52	0.46	0.59	.51	16.53	<.001
Sex							.08	0.02	0.13	.08	2.70	.007
SMD W1							.07	0.03	0.11	.10	3.45	.001

Note. *N* = 812. The dependent variable is Emotional Problems (EMS) W3. Step 1 the predictors (Control Variables) are Emotional Problems W1 and Sex. Step 2 the predictors are Emotional Problems W1, Sex and Social Media Dependency (SMD) W1. Unstandardized (B) and Standardized (β) Regression Coefficients. CI = confidence level; *LL* = lower limit; *UL* = upper limit.

Analysis of Emotional Problems and Social Media Dependency

Second, the effect of emotional problems W1 on social media dependency W3 was tested. Results showed that emotional problems were not significantly related to social media dependency, while controlling for sex and social media dependency at W1 (see Table 4), which is not in line with hypothesis 2. Social media dependency W1 and sex predicted 21.0% of the variance in emotional problems W3, $F(2, 809) = 180.24, R^2 = 0.21, p < .001$. The addition of emotional problems W1 predicts no variance in social media dependency W3. Only the control variables explained variance in social media dependency W3, $F(3, 808) = 72.07, R^2 = 0.21, p < .001$. Emotional problems seem unrelated to social media dependency, $B = .01, t(3, 808) = 0.02, p = .986, 95\% \text{ CI} = [0.00, 0.02]$.

Table 4

The Hierarchical Multiple Regression Analysis of the Effect of Emotional Problems on Social Media Dependency

Variable	<i>F</i>	<i>df</i>	<i>R</i> ²	Cohen's <i>f</i> ²	Adj. <i>R</i> ²	ΔR^2	B	95% CI for B		β	<i>t</i>	<i>p</i>
								<i>LL</i>	<i>UL</i>			
Step 1	108.24	(2, 809)	0.21	0.27	0.21	0.21						<.001
SMD W1							.56	0.49	0.64	.46	14.50	<.001
Sex							.02	-0.09	0.12	.01	0.34	.734
Step 2	72.07	(3, 808)	0.21	0.27	0.21	0.00						<.001
SMD W1							.56	0.49	0.64	.46	14.01	<.001
Sex							.02	-0.09	0.12	.01	0.33	.741
EMS W1							.01	-0.12	0.12	.00	0.02	.986

Note. *N* = 812. The dependent variable is Social Media Dependency (SMD) W3. Step 1 the Predictors (Control Variables) are Social Media Dependency W1 and Sex. Step 2 the predictors are Social Media Dependency W1, Sex and Emotional Problems W1. Unstandardized (B) and Standardized (β) Regression Coefficients. CI = confidence level; *LL* = lower limit; *UL* = upper limit.

The Mediating Role of Sleep Quality

First, the effect of social media dependency W1 on emotional problems W3 was tested. This has already been tested in hypothesis 1. Results showed that social media dependency significantly predicted emotional problems, while controlling for sex and emotional problems at W1 ($p < .001$).

Second, the effect of social media dependency at W1 on sleep quality in W2 was tested. Results showed that social media dependency significantly predicted less sleep quality, while controlling for sex and sleep quality at W1 (see Table 5). All the predictors together explained 41.0% of the variance in sleep quality W2, $F(3, 808) = 183.77$, $R^2 = 0.41$, $p = .035$. There was a small effect of social media dependency on sleep quality, $B = .08$, $t(3, 808) = 2.11$, $p = .035$, 95% CI = [0.00, 0.15], $f^2 = 0.03$.

Table 5

The Hierarchical Multiple Regression Analysis of the Effect of Social Media Dependency on Sleep Quality

Variable	<i>F</i>	<i>df</i>	<i>R</i> ²	Cohen's <i>f</i> ²	Adj. <i>R</i> ²	ΔR^2	B	95% CI for B		β	<i>t</i>	<i>p</i>
								<i>LL</i>	<i>UL</i>			
Step 1	272.27	(2, 890)	0.40	0.66	0.40	0.40						<.001
SQ W1							.68	0.62	0.73	.63	23.05	<.001
Sex							.05	-0.37	0.14	.03	1.14	.254
Step 2	183.77	(3, 808)	0.41	0.69	0.40	0.01						<.001
SQ W1							.65	0.58	0.71	.60	19.66	<.001
Sex							.04	-0.05	0.13	.03	.91	.365
SMD W1							.08	0.00	0.15	.07	2.11	.035

Note. *N* = 812. The dependent Variable is Sleep Quality (SQ) W2. Step 1 the predictors (Control Variables) are Sleep Quality W1 and Sex. Step 2 the predictors are Sleep Quality W1, Sex and Social Media Dependency (SMD) W1. Unstandardized (B) and Standardized (β) Regression Coefficients. CI = confidence level; *LL* = lower limit; *UL* = upper limit.

Third, the effect of sleep quality at W2 on emotional problems in W3 was tested. Results showed that sleep quality was significant related to emotional problems, while controlling for sex and emotional problems at W1 (see Table 6). All the predictors together explained 36.0% of the variance in emotional problems W3, $F(3, 807) = 149.98$, $R^2 = 0.36$, $p < .001$. There was a small effect of social media dependency on sleep quality, $B = .13$, $t(3, 807) = 7.87$, $p < .001$, 95% CI = [0.10, 0.17], $f^2 = 0.11$.

Table 6*The Linear Regression of The Effect of Sleep Quality on Emotional Problems*

Variable	<i>F</i>	<i>df</i>	<i>R</i> ²	Cohen's <i>f</i> ²	Adj. <i>R</i> ²	ΔR^2	B	95% CI for B		β	<i>t</i>	<i>p</i>
								<i>LL</i>	<i>UL</i>			
Step 1	180.42	(2, 808)	0.31	0.45	0.31	0.31						<.001
EMS W1							.55	0.49	0.61	.53	17.73	<.001
Sex							.09	0.03	0.14	.09	3.04	.002
Step 2	149.98	(3, 807)	0.36	0.56	0.36	0.05						<.001
EMS W1							.48	0.42	0.54	.46	15.40	<.001
Sex							.08	0.02	0.13	.08	2.84	.005
SQ W2							.13	0.10	0.17	.23	7.87	<.001

Note. *N* = 812. The dependent variable is Emotional Problems (EMS) W3. Step 1 the predictors (Control Variables) are Emotional Problems W1 and Sex. Step 2 the predictors are Emotional Problems W1, Sex and Sleep Quality (SQ) W2. Unstandardized (B) and Standardized (β) Regression Coefficients. CI = confidence level; *LL* = lower limit; *UL* = upper limit.

Fourth the effect of social media dependency W1 on the model was tested. Results showed that social media dependency W1 was no longer a significant predictor for emotional problems W3, while controlling for sex, emotional problems at T1, sleep quality W1 and the mediator sleep quality W2 (see Table 7). This suggests that the relationship between social media dependency and emotional problems is fully mediated by sleep quality (see figure 2). A Sobel test suggested a significant mediation effect ($p = .039$).

Table 7

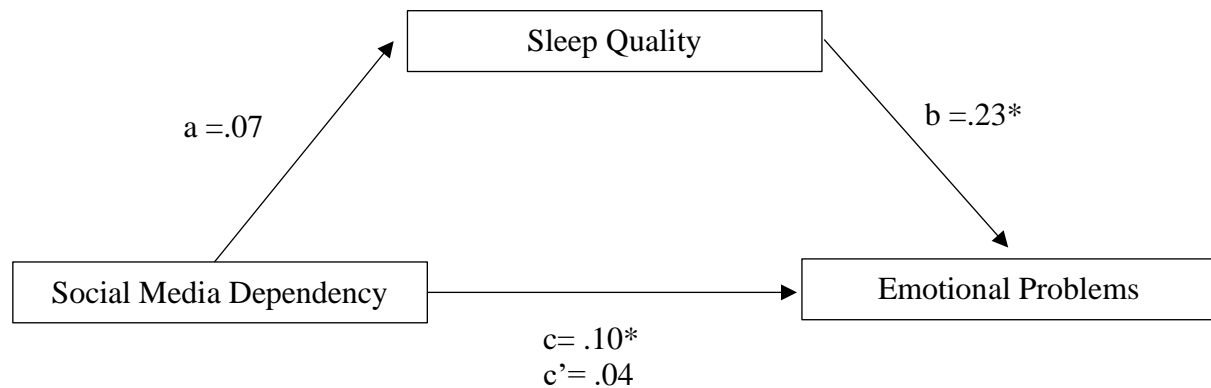
The Hierarchical Multiple Regression Analysis of the Effect of Social Media Dependency on Emotional Problems Mediated by Sleep Quality

Variable	<i>F</i>	<i>df</i>	<i>R</i> ²	Cohen' <i>s f</i> ²	Adj. <i>R</i> ²	ΔR^2	<i>B</i>	95% CI for <i>B</i>		β	<i>t</i>	<i>p</i>
								<i>LL</i>	<i>UL</i>			
Step 1	132.42	(3, 807)	0.33	0.49	0.33	0.33						<.001
EMS W1							.48	0.42	0.55	.46	14.42	<.001
Sex							.08	0.03	0.14	.09	2.96	.003
SQ W1							.10	0.06	0.14	.16	5.05	<.001
Step 2	112.51	(4, 806)	0.36	0.56	0.36	0.03						<.001
EMS W1							.48	0.41	0.54	.46	14.47	<.001
Sex							.08	0.02	0.13	.08	2.84	.005
SQ W1							.02	-0.3	0.06	.03	0.65	.516
SQ W2							.13	0.08	0.17	.22	5.98	<.001
Step 3	90.34	(5, 805)	0.36	0.56	0.36	0.00						<.001
EMS W1							.48	0.41	0.54	.45	14.34	<.001
Sex							.08	0.02	0.13	.08	2.71	.007
SQ W1							.00	-0.42	0.05	.01	0.27	.787
SQ W2							.13	0.08	0.16	.22	5.87	<.001
SMD W1							.03	-0.02	0.07	.04	1.19	.235

Note. $N = 812$. The dependent variable is Emotional Problems (EMS) W1. Step 1 the predictors (Control Variables) are Emotional Problems W1, Sleep Quality (SQ) W1 and Sex. Step 2 the predictors are Emotional Problems W1, Sleep Quality W1, Sex and Sleep Quality W2. Step 3 the predictors are Emotional Problems W1, Sleep Quality W1, Sex, Sleep Quality W2 and Social Media Dependency (SMD) W1. Unstandardized (B) and Standardized (β) Regression Coefficients. CI = confidence level; LL = lower limit; UL = upper limit.

Figure 2

Hypothesis Three, the Effect of Social Media Dependency on Emotional Problems Mediated by Sleep Quality



Note. * $p \leq .001$.

Discussion

To the best of my knowledge, this is the first longitudinal study that examined if the relationship between social media dependency and emotional problems is mediated by sleep quality. Furthermore, it was examined if there was a bidirectional relationship between social media dependency and emotional problems. Results suggest that adolescents with more social media dependency report significantly more emotional problems at W3. This relationship was not bidirectional, because adolescents with more emotional problems did not significantly report more social media dependency at W3. In addition, results showed that the relationship between social media dependency and emotional problems was fully mediated by sleep quality.

The finding that social media dependency was a significant predictor for emotional problems is in line with hypothesis 1. This is consistent with previous studies (Barry et al., 2017; Acar et al., 2020; Müller et al., 2016; Thomée et al., 2011) which found that social media dependency was related to overall emotional problems, as ODD, anxiety, depressive symptoms, impulsivity and psychosocial stress. In the current study, a significant effect was found, but the model only explained 1% of the variance in emotional problems. Social media dependency is only one out of many influential factors on emotional problems. For example, Edwards and Bromfield (2010) showed that neighborhood influences adolescents; poor neighborhood safety can lead to emotional problems.

Emotional problems were not a significant predictor of social media dependency. This is not in line with hypothesis 2 or previous research that indicated that adolescents who

reported more emotional problems tended to report more social media dependency (Acar et al., 2017; Ünal-Aydin et al., 2020; Kircaburun et al., 2020). Future research should focus more on specific aspects of emotional problems (e.g. anxiety, avoidance, extraversion and neuroticism), because these aspects may have an effect on social media dependency. However, a difference in outcomes was found for these different aspects. Social media dependency was predicted by anxiousness and avoidance, but extraversion and neuroticism only predicted social media use and not dependency (Blackwell et al., 2017).

The effect of social media dependency on emotional problems was fully mediated by sleep quality, which is in line with hypothesis 3. This is consistent with previous studies, that found that social media dependency is negatively associated with sleep quality and disturbed sleep. (Garett et al. 2018; Levenson et al. 2016). Whereby poor sleep quality resulted in greater stress, more emotional problems and harder time accepting and coping with emotional problems (Sandru & Vionscu., 2014; Doane & Thurston., 2014). In this current study, a significant negative effect was found, but the model only explained 1% of the variance of social media dependency in sleep quality. This indicates that there are other factors that may influence sleep quality. According to Cain and Gradisar (2010), social media dependency has often been considered to have a negative impact on the sleep of children and adolescents, but they found that there is a difference in which media is usage. It is therefore interesting for future research to focus on different social media platforms to see if this differs.

Strength and Limitations

First, one strength of the current study was its longitudinal design and a large sample. Therefore, causal relationships could be examined. Second, all the scales that are used have a high reliability. Another strength is that those who completed three waves and those who dropped out did not significantly differ on the variables in this study. Therefore, the missing's could be left out.

Besides these strengths, there are also some limitations that should be named. First, for this study, only the data was used of the participants who filled out the questionnaire for every wave and each used variable. But not all participants filled out the questionnaire at all three waves, therefore a lot of participants dropped off, whereby the sample was halved. Consequently, potentially interesting information may have been lost. Second the variable emotional problems are a broad concept, for future research it would be interesting to investigate whether the effects of social media dependency and sleep quality differ for different types of emotional problems, to make it more specific and to examine whether it is still mediated by sleep quality. For example, maybe sleep quality is a stronger predictor for

depression as for burn-out. Third, self-reported questionnaires were used for this research, which could have led to bias. It is possible that the adolescents filled it out differently, because they interpreted the questions in the wrong way or did not answer honestly. Social media and emotional problems are an actual topic among the target group. So, it is possible that the values may have turned out differently because of the self-reports. In addition, more research needs to be done into the mediation effect of sleep quality on a larger sample, a different age group and different countries.

Conclusions and Implications

The current study provides insights in the relationship between social media dependency and emotional problems and if the relationship was mediated by sleep quality. Results showed that the relationship between social media dependency and emotional problems was not bidirectional, but that this relationship was fully mediated by sleep quality. The findings provide first evidence of the meditative role of sleep quality for social media dependency and emotional problems. This study provides a basis on which future research can continue, for example, investigating specific emotional problems. The new knowledge of this study can be used for interventional trainings to raise awareness of adolescents' emotional problems including the influence of social media dependency and sleep quality. In addition, efforts should be made to improve adolescents' sleep quality, because this could reduce emotional problems.

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Appendix 1

*First deleted all the variables that I was not going to use in my dataset. So I only had sex, age, school, social media dependency W1 + W3, sleep quality W1 + W2 and emotional problems W1 + W3

*Participants before removing the missings of the dataset. The mean age, SD and percentages

```
FREQUENCIES VARIABLES=SEX AGE
/STATISTICS=STDDEV SEMEAN MEAN
/ORDER=ANALYSIS.
```

*The deviation of first and secondary school

```
DATASET ACTIVATE DataSet1.
FREQUENCIES VARIABLES=GRADE
/ORDER=ANALYSIS.
```

*Wave 1

I looked at the missings at each variable of Wave 1 and made three new variables. Then combine them to 1 and made a dummy variable for Wave 1 0= the participants who filled in each questions of each variable necessary for Wave 1

```
COMPUTE sum_EMS=(EMS1 + EMS2 + EMS3 + EMS4 + EMS5).
EXECUTE.
```

```
COMPUTE sum_SMD=(SMD1 + SMD2 + SMD3 + SMD4 + SMD5 + SMD6 + SMD7 +
SMD8 + SMD9 + SMD10).
EXECUTE.
```

```
COMPUTE sum_SRQ=(SRQ1 + SRQ2 + SRQ3 + SRQ4 + SRQ5 + SRQ6 + SRQ7 + SRQ8
+ SRQ9).
EXECUTE.
```

```
COMPUTE sum_wave_1=(sum_EMS + sum_SMD + sum_SRQ).
```

EXECUTE.

RECODE sum_wave_1 (SYSMIS=1) (ELSE=0) INTO Dummy_wave_1.

EXECUTE.

*Wave 2

I looked at the missing for the variable and made a new variable. Then made a dummy for Wave 2 0= the participants who filled in each questions of each variabele necessary for Wave 2

COMPUTE sum_SRQ_2=(SRQ1_2 + SRQ2_2 + SRQ3_2 + SRQ4_2 + SRQ5_2 + SRQ6_2 + SRQ7_2 + SRQ8_2 + SRQ9_2).

EXECUTE.

RECODE sum_SRQ_2 (SYSMIS=1) (ELSE=0) INTO Dummy_wave_2.

EXECUTE.

*Wave 3

I looked at the missings at each variabele of Wave 3 and made two new variables. Then combine them to 1 and made a dummy variable for Wave 3 0= the participants who filled in each questions of each variabele necessary for Wave3

COMPUTE sum_EMS_3=(EMS1_3 + EMS2_3 + EMS3_3 + EMS4_3 + EMS5_3).

EXECUTE.

COMPUTE sum_SMD_3=(SMD1_3 + SMD2_3 + SMD3_3 + SMD4_3 + SMD5_3 + SMD6_3 + SMD7_3 + SMD8_3 + SMD9_3 + SMD10_3).

EXECUTE.

COMPUTE sum_wave_3=(sum_EMS_3 + sum_SMD_3).

EXECUTE.

RECODE sum_SMD_3 (SYSMIS=1) (ELSE=0) INTO Dummy_wave_3.

EXECUTE.

*Then I looked at how much of each wave participated in the sample and how much of each wave were missing

```
FREQUENCIES VARIABLES=Dummy_wave_1 Dummy_wave_2 Dummy_wave_3
/ORDER=ANALYSIS.
```

*Attrition analyses

First I am going to make wave 1 without any missings and look at the variables social media dependency, sleep quality and emotional problems of wave 1 as the independent variable and the dummy variable of wave 2 as the dependent variable

```
DATASET ACTIVATE DataSet1.
SORT CASES BY Dummy_wave_1(A).
```

*Now there are no missing in Wave 1, I am going to do a linear regression now

```
REGRESSION
/MISSING LISTWISE
/STATISTICS COEFF OUTS R ANOVA
/CRITERIA=PIN(.05) POUT(.10)
/NOORIGIN
/DEPENDENT Dummy_wave_2
/METHOD=ENTER sum_wave_1.
```

*Now I am going to remove the missing out of wave 2 and look at wave 3 as the dependent and social media dependency, sleep quality and emotional problems of wave 2 as the independent variable

```
SORT CASES BY Dummy_wave_2(A).
```

```
REGRESSION
/MISSING LISTWISE
```

```

/STATISTICS COEFF OUTS R ANOVA
/CRITERIA=PIN(.05) POUT(.10)
/NOORIGIN
/DEPENDENT Dummy_wave_3
/METHOD=ENTER sum_SRQ_2.

```

*At last I removed the participants who did not filled in the questionnaire of in wave 3, so I have all the participants removed who did not filled in the questionnaire with all variables I need. The total is 812 who filled in the questionnaire

```

SORT CASES BY Dummy_wave_3(A).

```

*Look at the statistics of the total sample who participated in all three waves and each necessary variable, age, sex, grade

```

FREQUENCIES VARIABLES=SEX AGE GRADE
/ORDER=ANALYSIS.

```

```

DESCRIPTIVES VARIABLES=AGE
/STATISTICS=MEAN STDDEV MIN MAX.

```

*Measurements

*Social Media Dependency Wave 1 and Wave 3 the Cronbach Alpha

*First Wave 1

RELIABILITY

```

/VARIABLES=SMD1 SMD2 SMD3 SMD4 SMD5 SMD6 SMD7 SMD8 SMD9 SMD10
/SCALE('ALL VARIABLES') ALL
/MODEL=ALPHA.

```

*Second wave 3

RELIABILITY

```

/VARIABLES=SMD1_3 SMD2_3 SMD3_3 SMD4_3 SMD5_3 SMD6_3 SMD7_3
SMD8_3 SMD9_3 SMD10_3
/SCALE('ALL VARIABLES') ALL
/MODEL=ALPHA.

```

*Emotional problems Wave 1 and Wave 3 the Cronbach Alpha

*First wave 1

RELIABILITY

```

/VARIABLES=EMS1 EMS2 EMS3 EMS4 EMS5
/SCALE('ALL VARIABLES') ALL
/MODEL=ALPHA.

```

*Second wave 3

RELIABILITY

```

/VARIABLES=EMS1_3 EMS2_3 EMS3_3 EMS4_3 EMS5_3
/SCALE('ALL VARIABLES') ALL
/MODEL=ALPHA.

```

*Sleep quality wave 1 and wave 2 the cronbachs Alpha

*First wave 1

RELIABILITY

```

/VARIABLES=SRQ1 SRQ2 SRQ3 SRQ4 SRQ5 SRQ6 SRQ7 SRQ8 SRQ9
/SCALE('ALL VARIABLES') ALL
/MODEL=ALPHA.

```

Second wave 2

RELIABILITY

```

/VARIABLES=SRQ1_2 SRQ2_2 SRQ3_2 SRQ4_2 SRQ5_2 SRQ6_2 SRQ7_2 SRQ8_2
SRQ9_2
/SCALE('ALL VARIABLES') ALL
/MODEL=ALPHA.

```

*Concludes, the Cronbach Alpha of sleep quality is low, but this will be further in the result section

*First I am going to compute the variables of the ones I am using

```

COMPUTE total_EMS=(EMS1 + EMS2 + EMS3 + EMS4 + EMS5)/5.
EXECUTE.

```

```

COMPUTE total_SMD=(SMD1 + SMD2 + SMD3 + SMD4 + SMD5 + + SMD7 + SMD8 +
SMD9 + SMD10)/10.
EXECUTE.

```

```

COMPUTE total_SRQ=(SRQ1 + SRQ2 + SRQ3 + SRQ4 + SRQ5 + SRQ6 + SRQ7 + SRQ8
+ SRQ9)/9.
EXECUTE.

```

```

COMPUTE total_SRQ_2=(SRQ1_2 + SRQ2_2 + SRQ3_2 + SRQ4_2 + SRQ5_2 + SRQ6_2
+ SRQ7_2 + SRQ8_2 +
SRQ9_2)/9.
EXECUTE.

```

```

COMPUTE total_EMS_3=(EMS1_3 + EMS2_3 + EMS3_3 + EMS4_3 + EMS5_3)/5.
EXECUTE.

```

```

COMPUTE total_SMD_3=(SMD1_3 + SMD2_3 + SMD3_3 + SMD4_3 + SMD5_3 +
SMD6_3 + SMD7_3 + SMD8_3 + SMD9_3
+ SMD10_3)/10.
EXECUTE.

```

*Result section

*Cronbach Alpha check

*Social media dependency wave 1

RELIABILITY

```
/VARIABLES=SMD1 SMD2 SMD3 SMD4 SMD5 SMD6 SMD7 SMD8 SMD9 SMD10
/SCALE('ALL VARIABLES') ALL
/MODEL=ALPHA.
```

RELIABILITY

```
/VARIABLES=SMD1 SMD2 SMD3 SMD4 SMD5 SMD6 SMD7 SMD8 SMD9 SMD10
/SCALE('ALL VARIABLES') ALL
/MODEL=ALPHA
/STATISTICS=DESCRIPTIVE SCALE
/SUMMARY=MEANS.
```

Sleep quality wave 2

RELIABILITY

```
/VARIABLES=SRQ1_2 SRQ2_2 SRQ3_2 SRQ4_2 SRQ5_2 SRQ6_2 SRQ7_2 SRQ8_2
SRQ9_2
/SCALE('ALL VARIABLES') ALL
/MODEL=ALPHA.
```

RELIABILITY

```
/VARIABLES=SRQ1_2 SRQ2_2 SRQ3_2 SRQ4_2 SRQ5_2 SRQ6_2 SRQ7_2 SRQ8_2
SRQ9_2
/SCALE('ALL VARIABLES') ALL
/MODEL=ALPHA
/STATISTICS=DESCRIPTIVE SCALE
/SUMMARY=MEANS.
```

*Emotional problems wave 3

RELIABILITY

/VARIABLES=EMS1_3 EMS2_3 EMS3_3 EMS4_3 EMS5_3

/SCALE('ALL VARIABLES') ALL

/MODEL=ALPHA.

RELIABILITY

/VARIABLES=EMS1_3 EMS2_3 EMS3_3 EMS4_3 EMS5_3

/SCALE('ALL VARIABLES') ALL

/MODEL=ALPHA

/STATISTICS=DESCRIPTIVE SCALE

/SUMMARY=MEANS.

*Cronbach Alpha was low for Sleep Quality so checked the differences if item deleted

RELIABILITY

/VARIABLES=SRQ1_2 SRQ2_2 SRQ3_2 SRQ4_2 SRQ5_2 SRQ6_2 SRQ7_2 SRQ8_2
SRQ9_2

/SCALE('ALL VARIABLES') ALL

/MODEL=ALPHA

/SUMMARY=TOTAL.

*Three items

*First delete with the highest if item deleted = item 3

COMPUTE total_SRQ_2_delete_item_3=(SRQ1_2 + SRQ2_2 + SRQ4_2 + SRQ5_2 +
SRQ6_2 + SRQ7_2 + SRQ8_2 +
SRQ9_2)/8.

EXECUTE.

RELIABILITY

```

/VARIABLES=SRQ1_2 SRQ2_2 SRQ4_2 SRQ5_2 SRQ6_2 SRQ7_2 SRQ8_2 SRQ9_2
/SCALE('ALL VARIABLES') ALL
/MODEL=ALPHA
/SUMMARY=TOTAL.

```

*Second delete item 5

```

COMPUTE total_SRQ_2_delete_item_3_5=(SRQ1_2 + SRQ2_2 + SRQ4_2 + SRQ6_2 +
SRQ7_2 + SRQ8_2 +
SRQ9_2)/7.
EXECUTE.

```

RELIABILITY

```

/VARIABLES=SRQ1_2 SRQ2_2 SRQ4_2 SRQ6_2 SRQ7_2 SRQ8_2 SRQ9_2
/SCALE('ALL VARIABLES') ALL
/MODEL=ALPHA
/SUMMARY=TOTAL.

```

*Third delete item 6

```

COMPUTE total_SRQ_2_delete_item_3_5_6=(SRQ1_2 + SRQ2_2 + SRQ4_2 + SRQ7_2 +
SRQ8_2 + SRQ9_2)/6.
EXECUTE.

```

*Cronbach's Alpha for wave 2

RELIABILITY

```

/VARIABLES=SRQ1_2 SRQ2_2 SRQ4_2 SRQ7_2 SRQ8_2 SRQ9_2
/SCALE('ALL VARIABLES') ALL
/MODEL=ALPHA
/SUMMARY=TOTAL.

```

RELIABILITY

```

/VARIABLES=SRQ1_2 SRQ2_2 SRQ4_2 SRQ7_2 SRQ8_2 SRQ9_2
/SCALE('ALL VARIABLES') ALL
/MODEL=ALPHA
/STATISTICS=DESCRIPTIVE SCALE
/SUMMARY=MEANS.

```

*Delete all three items, cronbach alpha was .817 then

```

COMPUTE new_total_SRQ_delete_item_3_5_6=(SRQ1 + SRQ2 + SRQ4 + SRQ7 + SRQ8 +
SRQ9)/6.
EXECUTE.

```

*Cronbach's Alpha for wave 1

RELIABILITY

```

/VARIABLES=SRQ1 SRQ2 SRQ4 SRQ7 SRQ8 SRQ9
/SCALE('ALL VARIABLES') ALL
/MODEL=ALPHA.

```

*Descriptive Statistics

```

DATASET ACTIVATE DataSet1.
FREQUENCIES VARIABLES=SEX AGE GRADE
/ORDER=ANALYSIS.

```

*Descriptives of all the variables

```

DATASET ACTIVATE DataSet1.
DESCRIPTIVES VARIABLES=SEX AGE total_EMS total_SMD
new_total_SRQ_delete_item_3_5_6
  new_total_SRQ_2_delete_item_3_5_6 total_EMS_3 total_SMD_3
/STATISTICS=MEAN STDDEV MIN MAX.

```

*Correlation matrix of all the variables

CORRELATIONS

```

/VARIABLES=SEX AGE total_EMS total_SMD new_total_SRQ_delete_item_3_5_6
  new_total_SRQ_2_delete_item_3_5_6 total_EMS_3 total_SMD_3
/PRINT=TWOTAIL NOSIG
/STATISTICS DESCRIPTIVES
/MISSING=PAIRWISE.

```

*I am going to use a multiple linear regression so I need to check the assumptions for this analyses

*Assumptions multiple regression

*Linearity

```

DATASET ACTIVATE DataSet1.

```

```

MEANS TABLES=total_EMS_3 BY total_SMD

```

```

/CELLS=MEAN COUNT STDDEV
/STATISTICS LINEARITY.

```

```

MEANS TABLES=new_total_SRQ_2_delete_item_3_5_6 BY total_SMD

```

```

/CELLS=MEAN COUNT STDDEV
/STATISTICS LINEARITY.

```

```

MEANS TABLES=total_EMS_3 BY new_total_SRQ_2_delete_item_3_5_6

```

```

/CELLS=MEAN COUNT STDDEV
/STATISTICS LINEARITY.

```

```

MEANS TABLES=total_SMD_3 BY total_EMS

```

```

/CELLS=MEAN COUNT STDDEV
/STATISTICS LINEARITY.

```

*Homoscedasticity + VIF

REGRESSION

```
/MISSING LISTWISE
/STATISTICS COEFF OUTS R ANOVA COLLIN TOL
/CRITERIA=PIN(.05) POUT(.10)
/NOORIGIN
/DEPENDENT total_EMS_3
/METHOD=ENTER total_SMD total_EMS SEX
/SCATTERPLOT=(*ZRESID ,*ZPRED)
/RESIDUALS HISTOGRAM(ZRESID) NORMPROB(ZRESID).
```

REGRESSION

```
/MISSING LISTWISE
/STATISTICS COEFF OUTS R ANOVA COLLIN TOL
/CRITERIA=PIN(.05) POUT(.10)
/NOORIGIN
/DEPENDENT new_total_SRQ_2_delete_item_3_5_6
/METHOD=ENTER total_SMD new_total_SRQ_delete_item_3_5_6 SEX
/SCATTERPLOT=(*ZRESID ,*ZPRED)
/RESIDUALS HISTOGRAM(ZRESID) NORMPROB(ZRESID).
```

REGRESSION

```
/MISSING LISTWISE
/STATISTICS COEFF OUTS R ANOVA COLLIN TOL
/CRITERIA=PIN(.05) POUT(.10)
/NOORIGIN
/DEPENDENT total_EMS_3
/METHOD=ENTER new_total_SRQ_2_delete_item_3_5_6 total_EMS SEX
/SCATTERPLOT=(*ZRESID ,*ZPRED)
/RESIDUALS HISTOGRAM(ZRESID) NORMPROB(ZRESID).
```

REGRESSION

```
/MISSING LISTWISE
/STATISTICS COEFF OUTS R ANOVA COLLIN TOL
/CRITERIA=PIN(.05) POUT(.10)
```

```

/NOORIGIN
/DEPENDENT total_SMD_3
/METHOD=ENTER total_SMD total_EMS SEX
/SCATTERPLOT=(*ZRESID ,*ZPRED)
/RESIDUALS HISTOGRAM(ZRESID) NORMPROB(ZRESID).

```

*Results

*Linear regression between social media dependency wave 1 and emotional problems wave 3

*Control variables: sex, emotional problems wave 1

Independent variable: social media dependency wave 1

Dependent variable: emotional problems wave 3

*First only the dependent and the control variables

REGRESSION

```

/DESCRIPTIVES MEAN STDDEV CORR SIG N
/MISSING LISTWISE
/STATISTICS COEFF OUTS CI(95) R ANOVA CHANGE
/CRITERIA=PIN(.05) POUT(.10)
/NOORIGIN
/DEPENDENT total_EMS_3
/METHOD=ENTER SEX total_EMS.

```

*Second add the independent variable to the dependent and the control variables

REGRESSION

```

/DESCRIPTIVES MEAN STDDEV CORR SIG N
/MISSING LISTWISE
/STATISTICS COEFF OUTS CI(95) R ANOVA CHANGE
/CRITERIA=PIN(.05) POUT(.10)
/NOORIGIN
/DEPENDENT total_EMS_3

```

/METHOD=ENTER SEX total_EMS total_SMD.

*Linear regression between emotional problems wave 1 and social media dependency wave 3

*Control variables: sex, social media dependency wave 1

Independent variable: emotional problems wave 1

Dependent variable: social media dependency wave 3

*First only the dependent and the control variables

REGRESSION

/DESCRIPTIVES MEAN STDDEV CORR SIG N

/MISSING LISTWISE

/STATISTICS COEFF OUTS CI(95) R ANOVA CHANGE

/CRITERIA=PIN(.05) POUT(.10)

/NOORIGIN

/DEPENDENT total_SMD_3

/METHOD=ENTER SEX total_SMD.

*Second add the independent variable to the dependent and the control variables

REGRESSION

/DESCRIPTIVES MEAN STDDEV CORR SIG N

/MISSING LISTWISE

/STATISTICS COEFF OUTS CI(95) R ANOVA CHANGE

/CRITERIA=PIN(.05) POUT(.10)

/NOORIGIN

/DEPENDENT total_SMD_3

/METHOD=ENTER SEX total_SMD total_EMS.

*Mediation

*Linear regression

*First look at the main effect, social media dependency wave 1 and emotional problems wave 3

*Control variables: sex, emotional problems wave 1
 Independent variable: social media dependency wave 1
 Dependent variable: emotional problems wave 3

*First only the dependent and the control variables

REGRESSION

```
/DESCRIPTIVES MEAN STDDEV CORR SIG N
/MISSING LISTWISE
/STATISTICS COEFF OUTS CI(95) R ANOVA CHANGE
/CRITERIA=PIN(.05) POUT(.10)
/NOORIGIN
/DEPENDENT total_EMS_3
/METHOD=ENTER SEX total_EMS.
```

*Second add the independent variable to the dependent and the control variables

REGRESSION

```
/DESCRIPTIVES MEAN STDDEV CORR SIG N
/MISSING LISTWISE
/STATISTICS COEFF OUTS CI(95) R ANOVA CHANGE
/CRITERIA=PIN(.05) POUT(.10)
/NOORIGIN
/DEPENDENT total_EMS_3
/METHOD=ENTER SEX total_EMS total_SMD.
```

*Second look at social media dependency wave 1 and sleep quality wave 2

*Control variables: sex, sleep quality wave 1
 Independent variable: social media dependency wave 1
 Dependent variable: sleep quality wave 2

*First only the dependent and the control variables

REGRESSION

```
/DESCRIPTIVES MEAN STDDEV CORR SIG N
/MISSING LISTWISE
/STATISTICS COEFF OUTS CI(95) R ANOVA CHANGE
/CRITERIA=PIN(.05) POUT(.10)
/NOORIGIN
/DEPENDENT new_total_SRQ_2_delete_item_3_5_6
/METHOD=ENTER SEX new_total_SRQ_delete_item_3_5_6.
```

*Second add the independent variable to the dependent and the control variables

REGRESSION

```
/DESCRIPTIVES MEAN STDDEV CORR SIG N
/MISSING LISTWISE
/STATISTICS COEFF OUTS CI(95) R ANOVA CHANGE
/CRITERIA=PIN(.05) POUT(.10)
/NOORIGIN
/DEPENDENT new_total_SRQ_2_delete_item_3_5_6
/METHOD=ENTER SEX new_total_SRQ_delete_item_3_5_6 total_SMD.
```

*Third look at sleep quality wave 2 and emotional problems wave 3

*Control variables: sex, emotional problems wave 1

Independent variable: sleep quality wave 2

Dependent variable: emotional problems wave 3

*First only the dependent and the control variables

REGRESSION

```
/DESCRIPTIVES MEAN STDDEV CORR SIG N
```

```

/MISSING LISTWISE
/STATISTICS COEFF OUTS CI(95) R ANOVA CHANGE
/CRITERIA=PIN(.05) POUT(.10)
/NOORIGIN
/DEPENDENT total_EMS_3
/METHOD=ENTER SEX total_EMS.

```

*Second add the independent variable to the dependent and the control variables

REGRESSION

```

/DESCRIPTIVES MEAN STDDEV CORR SIG N
/MISSING LISTWISE
/STATISTICS COEFF OUTS CI(95) R ANOVA CHANGE
/CRITERIA=PIN(.05) POUT(.10)
/NOORIGIN
/DEPENDENT total_EMS_3
/METHOD=ENTER SEX total_EMS new_total_SRQ_2_delete_item_3_5_6.

```

*Fourth look at partial or complete mediation

Control variables: sex, emotional problems wave 1, sleep quality wave 1, social media dependency wave 1

Independent variable: sleep quality wave 2

Dependent variable: emotional problems wave 3

*First only the dependent and the control variables

REGRESSION

```

/DESCRIPTIVES MEAN STDDEV CORR SIG N
/MISSING LISTWISE
/STATISTICS COEFF OUTS CI(95) R ANOVA CHANGE
/CRITERIA=PIN(.05) POUT(.10)
/NOORIGIN
/DEPENDENT total_EMS_3
/METHOD=ENTER SEX total_EMS new_total_SRQ_delete_item_3_5_6.

```

*Second add the independent variable to the dependent and the control variables

REGRESSION

```

/DESCRIPTIVES MEAN STDDEV CORR SIG N
/MISSING LISTWISE
/STATISTICS COEFF OUTS CI(95) R ANOVA CHANGE
/CRITERIA=PIN(.05) POUT(.10)
/NOORIGIN
/DEPENDENT total_EMS_3
/METHOD=ENTER SEX total_EMS new_total_SRQ_delete_item_3_5_6
new_total_SRQ_2_delete_item_3_5_6.

```

*Third put in the social media dependency wave 1 variable to see if it is a complete or partial mediation

REGRESSION

```

/DESCRIPTIVES MEAN STDDEV CORR SIG N
/MISSING LISTWISE
/STATISTICS COEFF OUTS CI(95) R ANOVA CHANGE
/CRITERIA=PIN(.05) POUT(.10)
/NOORIGIN
/DEPENDENT total_EMS_3
/METHOD=ENTER SEX total_EMS new_total_SRQ_delete_item_3_5_6
new_total_SRQ_2_delete_item_3_5_6
total_SMD.

```