Sleeping in the Digital Age: Investigating the Association Between Problematic Social Media Use and Sleep Among Dutch Adolescents, Moderated by Gender and Peer Support

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This thesis has been written as a study assignment under the supervision of a Utrecht University teacher. Ethical permission has been granted for this thesis project by the ethics board of the Faculty of Social and Behavioural Sciences, Utrecht University, and the thesis has been assessed by two university teachers. However, the thesis has not undergone a thorough peer-review process so conclusions and findings should be read as such.

Abstract

The increasing prevalence of social media use among adolescents has raised concerns about its potential impact on various aspects of their well-being, including sleep quality. This study aims to contribute to the existing literature by examining the association between problematic social media use and sleep quality in Dutch adolescents, while also exploring the moderating effects of gender and perceived peer support. The present study draws from data collected with the Health Behaviour in School-aged Children (HBSC) study in 2021. Data from adolescents in the Netherlands aged 11 to 17 years old ($n = 6{,}820$) were examined. Statistical analyses, including regression models and moderation analyses, were conducted to examine the associations between problematic social media use, sleep quality, gender and peer support. The results indicated a significant negative association between problematic social media use and sleep quality. The moderating effects of gender and perceived peer support on this relation were found to be non-significant in the current study. These findings underscore the need for further research to explore additional factors that may influence the association between problematic social media use and sleep quality in adolescents, which will help shape future policies aimed at healthier social media usage and improving sleep quality in young adolescents.

Keywords: problematic social media use, sleep quality, adolescents, peer support, gender

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Social media has become strongly embedded in the everyday lives of numerous young people, with platforms like Youtube, Instagram, Snapchat, TikTok and WhatsApp being their favorite leisure-time activity (Oosterveer, 2021). Approximately 96% of the 2.7 million Dutch adolescents between the ages of 12 and 25 were online (almost daily) in 2019 and 97% of them had an account on one or more social media platforms (CBS, 2020). Concerns have been expressed about the possible detrimental effects of social media on youths' health and well-being, including the influence on sleep (Abrams, 2023; Moyer, 2022). Sleep is an essential component of a healthy lifestyle and is important for both physical and mental health in youth (Clement-Carbonell et al., 2021). Concerning physical health, insufficient or disturbed sleep is linked to increased energy intake, unhealthy eating habits, decreased immunity and reduced physical activity (Colley et al., 2012; Ferranti et al., 2016). Moreover, it appears that long-term sleep disturbances are associated with an increased risk of cardiovascular diseases, diabetes and obesity (Rodrigues et al., 2021; Verhulst et al., 2008). Also, sleep disturbances have substantial implications for mental health, as sleep disturbances are associated with mood disturbances and lower life satisfaction (Shen et al., 2018; Zhang et al., 2017) and lower academic performance (Hershner, 2020). Unfortunately, sleep issues are quite prevalent among youth, with 20% of girls and 14% of boys aged 12 to 18 years old experiencing sleep problems in 2022 in the Netherlands (CBS, 2023).

The impact of social media use on sleep has been shown in numerous studies, including studies focusing on shorter sleep durations (Pea et al., 2012) and later bedtimes and wake-up times (Shochat et al., 2010). While studies frequently measure adolescents' social media use by time spent, they ignore the intricacies of problematic social media use. Unlike those who merely spend a lot of time

online, adolescents with problematic social media use struggle to control their impulses, experience anxiety when constrained and are constantly obsessed with social media (Van den Eijnden et al., 2018). Moreover, adolescents with problematic social media use might experience increased emotional distress and ruminating, which impairs their capacity to relax and sleep (Zhang et al., 2024). Furthermore, prior studies have mostly focused on college and university students, creating a knowledge gap about the effects of social media use on the sleep quality of younger adolescents aged between 11 and 17. Since early adolescence is a critical developmental stage characterized by significant changes in social, emotional and cognitive domains (Steinberg & Morris, 2001), furthering our understanding of the impact of problematic social media on sleep of this population is essential in order to promote healthier development and improve the well-being of young adolescents.

However, little is known about the possible factors influencing the relation between problematic social media use and sleep in adolescents (Kaur et al., 2021). Two potential factors that may influence this association are gender and perceived peer support. Adolescence is characterized by increased vulnerability to peer influence (Laursen & Veenstra, 2021), which makes peer support an interesting element to investigate. Adolescents often seek approval and social comparison from their peers, which can impact their behavior regarding social media use. Also, gender-specific social expectations and developmental changes around puberty may influence how problematic social media use affects sleep differently in boys and girls. By considering both peer support and gender as potential influencing factors, a more nuanced understanding of how problematic social media use affects sleep in adolescents can be developed. Therefore, the current study aims to assess the following research question: *'What is the association between problematic social media use and sleep quality in adolescents aged 11 to 17 years old from the Netherlands, and is this association moderated by gender and perceived peer support?'*

Understanding the relation between problematic social media use and adolescent sleep with gender and peer support as influencing factors in this relation is important for society. This knowledge may serve as a novel addition to the Public Health Youth Care (JGZ) guidelines for Healthy Sleep and Sleep Problems in Children (Vlasblom et al., 2016). Thus, this can provide policymakers, educators and healthcare professionals to design adapted interventions for promoting healthy social media use and improving sleep, for example by supporting young adolescents in regulating their social media use. If peer support is found to buffer the negative effects of problematic social media use, interventions can focus on strengthening peer relationships. Furthermore, gender-specific differences can contribute to the creation of interventions tailored to each gender, ultimately promoting healthier social media use and improved sleep among adolescents.

Theoretical Framework

Sleep Quality

In the literature, the concept 'sleep' lacks definitional consensus. The term 'sleep' is frequently used to refer to a person's physical and psychological state that occurs naturally and is characterized by altered consciousness, decreased sensory activity and inhibition of voluntary muscles (Buysse, 2014; Foster, 2020; Kryger et al., 2011). It is an essential process that helps with memory consolidation (Klinzing et al., 2019), energy restoration (Woods & Scott, 2016) and general health and well-being (Ohayon et al., 2017). Unlike sleep quantity, which focuses on sleep length, measuring sleep quality refers to an individual's overall satisfaction with every aspect of their sleep experience. One key aspect of sleep quality is sleep latency, which refers to how long it takes for an individual to fall asleep after beginning the sleep phase (Nelson et al., 2021). Sleep latency is a core component of sleep, providing crucial information about the

effectiveness of sleep onset, the individual's subjective experience and perception of sleep onset and possible sleep problems (Kushida, 2013).

Problematic Social Media Use and Sleep Quality

Problematic social media use can be defined as a social media addiction, compulsive social media use (Boer, 2022) or a lack of control over one's social media use (Van den Eijnden et al., 2021). The concept of problematic social media use differs from general or high social media use. While general social media use merely refers to the duration (i.e., hours per day) or frequency (i.e., number of times per day) of social media use, problematic social media use is characterized by symptoms of social media addiction, difficulties in controlling usage and a constant fixation on social media (Boer, 2022; Griffiths et al., 2014).

The connection between problematic social media use and sleep may be explained by the compensatory internet use theory (Kardefelt-Winther, 2014), which suggests that people use the internet, including social media, to escape real-life problems or feel better when they are feeling down, even if this behavior can result in negative consequences in one's life. Framing this in relation to sleep, individuals who engage in compulsive social media use may be using this as a coping strategy to avoid dealing with underlying issues or to distract themselves from negative feelings. Constantly using social media might keep one's mind overly active, making it more difficult to fall asleep which affects sleep quality. Alternatively, the effects of inadequate sleep quality, such as mood disturbances and heightened stress levels (Shen et al., 2018; Zhang et al., 2017), could amplify the underlying motivations for using social media, thereby contributing to more problematic social media use. Moreover, three underlying mechanisms could explain the impact of problematic social media use on sleep. Firstly, adolescents who use social media might spend less time sleeping, as social media use directly displaces sleep time (Exelmans & Van Den Bulck, 2017). Secondly, adolescents may find it more difficult to fall asleep because of social

media's ability to increase mental, emotional and psychological arousal (Cain & Gradisar, 2010). Lastly, exposure to social media devices' bright screens can delay the onset of sleep and lower the quality of sleep due to circadian clock misalignment (Touitou et al., 2016).

Several studies have found that high social media usage impacts sleep (Christensen et al., 2016; Hjetland et al., 2021), but empirical evidence for this relation between problematic social media use and sleep quality is scarce, as problematic social media use is still a relatively new phenomenon. While empirical evidence relating the compensatory internet use theory to sleep is limited, studies did discover links between problematic social media use and emotional dysregulation (Gioia et al., 2021) and anxiety (Malaeb et al., 2020). These studies mention that individuals may use social media as a coping method to manage negative emotions or relieve anxiety, which might alter sleep patterns negatively. As a result, while not directly investigated, the association between problematic social media use, emotional dysregulation, anxiety and sleep disturbances implicitly supports the theory's usefulness in understanding problematic social media use and the effect on sleep. Additionally, empirical research has clarified several ways in which problematic social media use interferes with sleep. Teenagers who use social media more regularly tend to have shorter sleep durations (Gamble et al., 2014), indicating that social media use directly interferes with sleep. Furthermore, Mauri et al. (2011) found that social media's capacity to elicit high levels of mental and emotional arousal may make it more difficult to fall asleep. Together, these studies offer valuable insights into the relevance of the compensatory internet use theory and the underlying mechanisms involved in the connection between problematic social media use and sleep.

The Moderating Role of Gender

Little is known about what demographic groups may be more susceptible to potential negative effects of problematic social media use on sleep quality, with gender potentially playing

a role. One theory that can explain this is the social role theory (Eagly & Wood, 2012), which posits that societal expectations and norms regarding gender roles can affect behavior in individuals. In terms of problematic social media use and sleep, girls are frequently expected to build relationships in social situations and to maintain contacts (Kimbrough et al., 2013), which may result in increased emotional arousal, disrupting their sleep. Boys, on the other hand, may be more encouraged to use social media for entertainment or information searching (Kimbrough et al., 2013), which may cause less emotional arousal and could therefore have a different effect on their sleep. Thus, these gender-specific social responsibilities and expectations might influence how problematic social media use affects sleep.

Another perspective to consider is the developmental perspective (Bornstein et al., 2017), wherein boys and girls experience different physical and psychological changes during puberty (Marceau et al., 2011), which may affect how susceptible they are to the negative sleep-related effects of problematic social media use. Girls usually reach puberty earlier than boys do and with it comes changes in hormones (Susman & Rogol, 2004). These hormonal changes may make girls more sensitive to social influences and more sensitive to emotions (Goddings et al., 2012), which may exacerbate the negative effects of problematic social media use on sleep. In conclusion, gender-specific social expectations and puberty-related developmental changes could influence how problematic social media use affects sleep differently in boys and girls, potentially indicating that girls are more vulnerable to the adverse effects of problematic social media use on sleep.

There is little research on the association between problematic social media use and sleep, with gender acting as a moderator. According to a study conducted by Yang et al. (2018) among Chinese adolescents aged 14 to 18 years old, the association between problematic internet use and sleep appears to be stronger for girls than for boys. Other research on the relation between

social media use and sleep has yielded varied results, where the Dutch study of Van Der Schuur et al. (2018) among adolescents aged 11 to 15 years old supports that this relation is stronger for girls than for boys, but some studies mention that gender does not have a moderating effect on the relation between social media use and sleep (Exelmans & Scott, 2019; Rana, 2021). However, the adult population (older than 18 years) in these studies differed from the young adolescent sample in the current study, which is important to consider and might explain some of the inconsistent findings.

The Moderating Role of Perceived Peer Support

Peer support, as outlined in the social support theory, is pivotal in understanding how individuals navigate stressors and maintain well-being through their social connections (Heaney & Israel, 2008). In the context of problematic social media use and sleep among adolescents, the social support theory suggests that having supportive relationships, such as with peers, can help adolescents cope with the stressors associated with problematic social media use, thereby reducing the likelihood of negative effects on sleep. Especially during early adolescence, peers play an important role in influencing adolescents' behavior, offering approval and allowing for social comparison (Fuligni & Eccles, 1993). This developmental stage is marked by increased sensitivity to peer influence and significant social and emotional growth, which provides opportunities to form adolescents' social identities and resilience (Brown et al., 2008). Thus, perceived peer support may mitigate the link between problematic social media usage and sleep, with perceived peer support having the potential to buffer the detrimental effects of excessive social media use on sleep.

The proposition that peer support has a moderating effect on the relation between problematic social media use and sleep has received limited empirical support. Several studies in the association between social media use and sleep have focused on parental support as a

moderator on adolescents' social media use and sleep, but there has been little research on the moderating role of peer support. The studies investigating the moderating role of parental support showed mixed findings; some studies found that parental support has a moderating effect (Orhon et al., 2022) while others found no moderating effect (Mougharbel et al., 2023). However, a recent study by Lahti et al. (2024) with adolescents aged 13 and 15 years old from six European countries found that friend support moderates the association between problematic social media use and health outcomes, including sleep. In other words, higher levels of friend support can reduce the negative effects of excessive social media use on sleep. Another Canadian study by Cooray (2020) explored peer support, socio-emotional well-being and sleep quality in adolescents. Moreover, peer support was found to buffer the adverse effects of socio-emotional problems on sleep, emphasizing its potential protective role against sleep disturbances in adolescents. Given the fact that one of the central issues of problematic social media use in terms of socio-emotional problems is the inability to manage unpleasant feelings and emotions (Saladino et al., 2024), the buffering effect of peer support on sleep disturbances in this study may also extend to the association between problematic social media use and sleep. In conclusion, these studies demonstrate that higher levels of peer support can mitigate the negative impact of excessive social media use on sleep and serve as a protective factor against sleep disturbances in adolescents.

The Current Study

This study will examine the association between problematic social media use and sleep quality among Dutch adolescents and whether this association is moderated by gender and perceived peer support (Figure 1). Based on the information presented in the introduction, the following hypotheses have been developed:

H1: Problematic social media use has a negative association with sleep quality.

H2: Gender moderates the association between problematic social media use and sleep quality:

The negative association is stronger for girls than for boys.

H3: Perceived peer support moderates the association between problematic social media use and

sleep quality: The negative association is less strong for adolescents who perceive more peer

support.

Figure 1

Conceptual Model
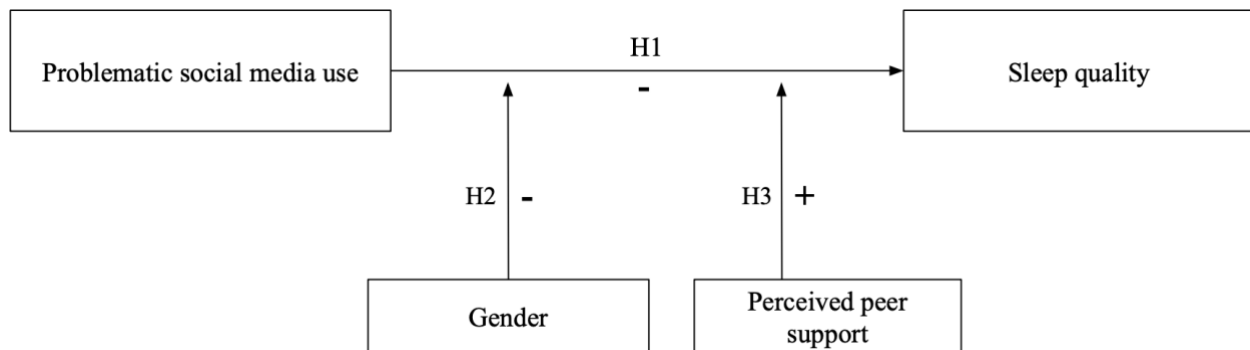
Methods

Participants and Design

       Data is used from the Dutch Health Behaviour in School-aged Children (HBSC) study.

The HBSC study is a collaborative international research project conducted every four years,

focusing on adolescents' health behaviors, lifestyles and well-being based on self-report measures

(Health Behaviour in School-aged Children [HBSC], 2014). For the present study, the data of

Dutch adolescents collected in 2021 is used (Boer et al., 2022), which included adolescents from

8th grade in primary schools and from all grades of secondary education across the Netherlands, except for special education.

The sample of this study contains 7,258 participants. Respondents with missing data on the social media disorder scale ($n =226$), the peer support scale ($n = 39$) and the sleep quality question ($n = 79$) were removed listwise, as well as respondents younger than 11 years and older than 18 years ($n = 212$). The final sample consisted of 6,820 participants with an equal distribution of boys (51.2%) and girls (48.8%) and a mean age of 13.9 years ($SD = 1.8$). Most of the participants (76.9%) did not have a migration background. In secondary school, 22.6% of the adolescents followed pre-university level education, 22.9% followed higher general secondary education, 22.6% went to higher vocational level education and 12.4% to lower vocational level education.

Procedure

The data collection took place in the schools in autumn 2021, where the research assistants explained the study before the respondents were asked to fill out the questionnaire. During the introduction of the study, it was emphasized that participation was voluntary and adolescents could choose not to answer a question if they preferred to. Respondents answered the questionnaire on paper in primary school and a digital questionnaire in secondary education.

This study used a two-step sampling approach. Initially, schools were selected from Dienst Uitvoering Onderwijs (DUO) databases, with stratification by Gemeentelijke Gezondheidsdienst (GGD) region to ensure a balanced representation of both urban and rural areas. Subsequently, school classes were chosen: one 8th grade class for primary education was randomly chosen if there were multiple 8th grade groups and a random selection of school classes for secondary education based on the size of the school, whereby classes with less than ten pupils were excluded.

Prior to participation, informed consent was obtained from parents. They were informed about the goals and methods of the study, the anonymity of data and the voluntary nature of participation through an information letter. Additionally, parents could indicate that they did not want their child to participate. Adolescents were actively asked for consent to participate in the study by checking a box before completing the questionnaire. In total, 76 pupils did not participate, whereby 42 parents did not give consent and 34 pupils refused to participate themselves.

Ethical Considerations

The Ethical Review Board of the Trimbos Institute approved the execution of the HBSC research in the Netherlands (TET-202109). The current study involved a vulnerable target group and sensitive topics. Despite this, it has been approved by the Ethical Review Board of the Faculty of Social and Behavioral Sciences of Utrecht University.

The research ensured anonymity by using sealed envelopes for primary school questionnaires. In secondary schools, cards with digital access codes to the questionnaire were given, which participants could either take with them or discard afterward. Participants received the assurance that their responses would not be distributed to third parties.

Measurements

Demographics

Several demographics were measured. Gender functioned as a moderator, where participants identified themselves as either boy (0) or girl (1). Additionally, age was measured in years and served as a control variable.

Problematic Social Media Use

The independent variable problematic social media use was measured with the 9-item Social Media Disorder Scale (Van Den Eijnden et al., 2016), where respondents indicated

whether they, in the past year, regularly could not think of anything else but social media (preoccupation), often felt dissatisfied when they could not use social media (tolerance), frequently felt bad when they could not use social media (withdrawal), failed to spend less time on social media (persistence), neglected other activities due to social media (displacement), lied to parents or friends about how much time they spent on social media (deception), frequently used social media as an escape from unpleasant feelings (escape) and caused serious conflicts with parents or siblings (conflict). There was a dichotomous yes (1) or no (0) response option. The cut-off value for the problematic user group was six or more yes responses and all others were classified as nonproblematic users (Boer, Van Den Eijnden, et al., 2021). This scale showed good psychometric properties in earlier research (Boer, Stevens, et al., 2021). In this study, the Social Media Disorder Scale showed acceptable reliability ($\alpha = .69$).

Sleep Quality

The dependent variable sleep quality was assessed using a single question, where adolescents had to indicate how often they experienced difficulty falling asleep in the last six months. Respondents could choose from answer options on a 5-point Likert scale, which were almost every day (0), more than once a week (1), almost every week (2), almost every month (3), or almost never or never (4). This single-item question has been used in other studies and has proven good reliability (Thorsteinsson et al., 2019). The answer options constitute a scale showing the frequency of difficulty falling asleep, with higher scores representing less sleep difficulties and therefore better sleep quality.

Perceived Peer Support

Perceived peer support was measured on a 7-point Likert scale from strongly disagree (1) to strongly agree (7), whereby participants had to rate their agreement on four items; "my friends really try to help me", "I can really count on my friends", "I can share my joys and sorrows with

my friends" and "I can talk about my problems with my friends". The mean score of the four items was computed, whereby higher scores indicated higher perceived support from peers. This scale has been used in earlier research with good reliability (Benzi et al., 2023). The peer support scale in this study showed good internal consistency ($\alpha = .93$).

Analysis

Firstly, descriptive statistics have been executed for age, gender, education level, migration background, sleep quality, problematic social media use and peer support. Also, a reliability analysis was conducted for the social media disorder and peer support scales and later correlations between all variables of interest were examined. Next, independent samples t-tests and chi-squared tests were conducted to test the differences in gender, sleep quality and peer support between adolescents who engage in problematic social media use and non-problematic social media use. Then, a regression analysis was performed to examine the association between problematic social media use and sleep while controlling for age. To investigate whether gender and perceived peer support moderate the association between problematic social media use and sleep, the variables gender and peer support were mean-centered and the interaction effects between problematic social media use and gender and between problematic social media use and perceived peer support were added in the analysis, again controlling for age. The significance of this interaction was assessed using a cutoff of $p < .05$. All statistical analyses were conducted using the statistical software program JASP version 0.18.3 (JASP Team, 2024).

Assumptions

To identify outliers, standardized residuals and Cook's distance were examined, where standardized residuals should not be higher than 3 or Cook's distance higher than 1. Assumptions for linear regression were checked before conducting the analyses. To check for normality, the histograms of standardized residuals were examined to ascertain their normal distribution.

Homoscedasticity was checked by the inspection of the residual plot, to assess if the variance of each predictor remained consistent across its values. Linearity was evaluated using the residual plot by the examination of the linear relation between sleep and problematic social media use. Lastly, multicollinearity was checked, whereby the variance inflation factors (VIF) value had to be lower than 10 to ensure that predictors did not overlap (Vittinghoff et al., 2006).

Results

Descriptive Statistics

Table 1 shows the descriptive statistics of the variables included in this study split by problematic social media use. In this study sample ($n = 6,820$), 4.8% ($n = 328$) were classified as problematic social media users. The percentage of girls was higher among problematic social media users (61%) than among non-problematic social media users (48.2%, $\chi^2(1) = 20.55$, $p < .001$). Problematic social media users exhibited lower sleep quality scores ($M = 1.4$) than non-problematic users ($M = 2.4$, $t(6,764) = 11.77$, $p < .001$). The peer support score was lower for problematic social media users ($M = 5.1$) compared to non-problematic social media users ($M = 5.6$, $t(6,788) = 6.17$, $p < .001$).

Table 2 illustrates the correlations between all variables of interest. Problematic social media use was significantly negatively correlated with sleep quality ($r = -.14$) and peer support ($r = -.08$) and significantly positively correlated with gender ($r = 0.06$). Sleep quality was significantly negatively correlated with gender ($r = -.15$) and significantly positively correlated with peer support ($r = .10$) and age ($r = .04$). Age was not significantly correlated to problematic social media use and therefore age was not included as a control variable in this study.

Table 1

Study Population's Sociodemographic Characteristics, Split by Problematic Social Media Use

	Non-problematic social media use (*n* = 6,492)	Problematic social media use (*n* = 328)	Total sample (*n* = 6,820)
Age, *M* years (*SD*)	13.9 (1.8)	13.8 (1.6)	13.9 (1.8)
Gender (%)			
Boy	51.8	39.0	51.2 (3494)
Girl	48.2	61.0	48.8 (3326)
School type (%)			
Primary school	19.8	14.9	19.5 (1333)
Secondary school	80.2	85.1	80.5 (5487)
School level (%)			
Lower vocational	12.1	18.6	12.4 (847)
Higher vocational	22.3	27.1	22.6 (1538)
Higher general	22.9	24.1	22.9 (1563)
Pre-university	22.9	15.2	22.6 (1539)
Migration background (%)			
Without	77.3	68.3	76.9 (5244)
With	22.6	31.7	23.0 (1572)
Sleep quality score, *M* (*SD*)	2.4 (1.5)	1.4 (1.5)	2.4 (1.6)
Peer support score, *M* (*SD*)	5.6 (1.4)	5.1 (1.7)	5.6 (1.4)

Table 2

Correlation Matrix With Variables of Interest

	1.	2.	3.	4.	5.
1. PSMU	-				
2. Sleep quality	-.14 ***	-			
3. Gender[a]	.06 ***	-.15 ***	-		
4. Peer support	-.08 ***	.10 ***	.13 ***	-	
5. Age	-.02	.04 ***	.01	-.04 **	-

Note. PSMU = problematic social media use

[a] 0 = boy, 1 = girl

* $p < .05$. ** $p < .01$. *** $p < .001$.

H1: The Association Between Problematic Social Media Use and Sleep Quality

To test hypothesis 1, a simple linear regression was used to predict sleep quality from problematic social media use. There was a significant negative relation found between problematic social media use and sleep quality ($B = -1.034$, *SE* $(B) = 0.088$, $\beta = -0.142$, $p < .001$), which implies that adolescents with problematic social media use tend to have lower sleep quality scores compared to non-problematic social media users. Problematic social media use was shown to explain a significant amount of the variance in sleep quality ($R^2 = 0.020$, $p < .001$), indicating that problematic social media use explains 2.0% of the variance in sleep quality. These findings align with hypothesis 1.

H2: Gender as Moderator

A regression analysis (Table 3) identified a significant association between gender and sleep quality (B = -0.444), suggesting that being a girl is associated with lower sleep quality. When gender was added to the model, the explained variance in sleep quality increased to 4% (ΔR^2 = .020, p < .001). The interaction effect between problematic social media use and gender was not significant (B = -0.031). This indicates that gender does not moderate the association between problematic social media use and sleep quality, resulting in the rejection of H2.

Table 3

Moderation Analysis With Sleep Quality, Problematic Social Media Use and Gender

Model	B	SE (B)	β	p	LLCI	ULCI
Intercept	2.402	0.019		< .001	2.364	2.439
PSMU	-0.971	0.090	-0.133	< .001	-1.147	-0.795
Gender[a]	-0.444	0.038	-0.143	< .001	-0.519	-0.370
PSMU ✳ Gender	-0.031	0.179	-0.002	.862	-0.381	0.319

Note. PSMU = problematic social media use, B = unstandardized coefficient, SE = standard error, β = standardized coefficient, LLCI = lower level confidence interval, ULCI = upper level confidence interval.

[a] 0 = boy, 1 = girl

H3: Perceived Peer Support as Moderator

A regression analysis (Table 4) identified a significant association between peer support and sleep quality (B = 0.108), indicating that higher levels of peer support are associated with

better sleep quality. As previously stated, the model that included only problematic social media use explained 2.0% of the variance in sleep quality. When peer support was added, the explained variance in sleep quality increased to 2.9% ($\Delta R^2 = .009$, $p < .001$). The interaction effect between problematic social media use and peer support was not significant ($B = 0.015$). This suggests that peer support does not moderate the relation between problematic social media use and sleep quality, leading to the rejection of H3.

Table 4

Moderation Analysis With Sleep Quality, Problematic Social Media Use and Peer Support

Model	B	SE (B)	β	p	LLCI	ULCI
Intercept	2.398	0.019		$< .001$	2.360	2.436
PSMU	-0.974	0.091	-0.133	$< .001$	-1.152	-0.796
Peer support	0.108	0.014	0.096	$< .001$	0.080	0.135
PSMU ✶ Peer support	0.015	0.054	0.004	.784	-0.091	0.121

Note. PSMU = problematic social media use, B = unstandardized coefficient, SE = standard error, β = standardized coefficient, LLCI = lower level confidence interval, ULCI = upper level confidence interval.

Discussion

This study aimed to examine the association between problematic social media use and sleep quality in adolescents aged 11 to 17 years old in the Netherlands. Additionally, this study aims to examine whether this association is influenced by gender and perceived peer support. Results showed that adolescents with problematic social media use experience lower sleep

quality. However, the analysis showed that adolescents who engage in problematic social media use do not experience differences in sleep quality based on gender or peer support, indicating these factors do not influence the relation.

In line with hypothesis 1, the findings showed that adolescents who engage in problematic social media use were more vulnerable to experience lower sleep quality. This finding is consistent with previous research (Khan et al., 2024; Wong et al., 2020) and the compensatory internet use theory (Kardefelt-Winther, 2014). The findings in these studies support the compensatory internet use theory, suggesting that individuals with problematic social media habits may turn to social media as a coping mechanism, which in turn disrupts their sleep patterns. This can be attributed to factors such as the direct displacement of sleeping time (Exelmans & Van Den Bulck, 2017), increased mental arousal (Cain & Gradisar, 2010) and exposure to blue-enriched light (Touitou et al., 2016).

Contrary to hypothesis 2, the results indicated there was no evidence found that gender influences the association between problematic social media use and sleep quality among adolescents. This finding contradicts expectations from the social role theory and developmental perspectives (Eagly & Wood, 2012; Marceau et al., 2011) and with findings from previous studies, such as Van Der Schuur et al. (2018) and Yang et al. (2018), which reported a stronger association between problematic internet use and sleep disturbances in girls compared to boys. This discrepancy may be attributed to differences in the methods used to measure problematic social media use and sleep quality in these studies compared to the current study. Another study by Turel et al. (2018) on problematic social networking site use highlights how neuroticism intensifies the negative impact of social media addiction symptoms on well-being (whereas sleep is considered a component of overall well-being), particularly in women. The adult population in Turel's study was different from the young adolescent sample in the current study, which is

essential to note and may account for some of the inconsistent results. An alternative explanation for the contradictory finding that gender does not moderate the association between problematic social media use and sleep quality could possibly lie in the gender similarity hypothesis provided by Hyde (2005). This hypothesis is a psychology theory that says that men and women are more similar than different in most psychological variables. This idea may help explain why this study found no gender influence on the association between adolescents who engage in problematic social media use and their sleep quality.

In contrast to hypothesis 3, the results of this study demonstrated that there was no evidence found that peer support influences the association between problematic social media use and sleep quality among adolescents. This finding contradicts social support theory and related empirical work, such as studies by Lahti et al. (2024), which examined the effect of problematic social media use on sleep and Cooray (2020) which investigated the impact of socio-emotional problems on sleep, both suggesting that peer support can buffer the negative effects. The contradictory finding of the current study is not in line with the idea of social support theory, which suggests that having supportive social networks, like those with peers, can reduce the negative effects of problematic social media use and potentially mitigate against negative impacts on sleep quality. One possible explanation for the conflicting result may lie in the intricate interplay between family, peer and school experiences in early adolescence. While peer support is one component of social support, this study may not have fully accounted for the broader social connections that influence adolescents' perceptions of support. Young adolescents are particularly sensitive to these interconnections Roberts et al. (2000). Therefore, future research should delve deeper into the multifaceted nature of adolescents' social dynamics, considering the roles of family and school environments alongside peer relationships.

Strengths and Limitations

One strength of this study can be considered the large, representative sample of young adolescents in the Netherlands due to the cluster sampling strategy. Additionally, the use of reliable measurement instruments to measure problematic social media use and peer support strengthens the study's credibility. Nevertheless, despite these strengths, several limitations need to be considered when interpreting the results of this study.

Firstly, due to a cross-sectional study design, the causality of the observed associations cannot be determined. Moreover, this cross-sectional design does not allow to investigate whether poor sleep quality may also lead to vulnerability to problematic social media use. It could be possible that adolescents with poor sleep might use social media to cope with their sleep problems or to pass time when they are unable to fall asleep. Additionally, adolescents with poor sleep quality over a longer period could have impaired cognitive functions and emotional regulation (Krause et al., 2017), which may increase the risk of engaging in compulsive social media use. Therefore, a longitudinal approach in future research would be valuable to understand how sleep quality and problematic social media use affect each other over time.

Secondly, another limitation is the measurement of sleep quality, which relies on a single item. This measurement possibly creates problems with reliability, validity and measurement error (Allen et al., 2022). Furthermore, sleep quality includes more than only sleep latency, such as sleep continuity, sleep frequency, sleep depth and sleep efficiency, which are all not measured and taken into account in this study. This may ignore critical information regarding sleep as a whole, potentially undermining a thorough understanding of its relation with problematic social media use. Future research should use comprehensive measures of sleep quality, including different aspects of both sleep quality and sleep quantity to better understand the relation with problematic social media use on the different components of sleep in adolescents.

Thirdly, the use of self-report questionnaires to identify problematic social media use and sleep quality may create recall bias, as respondents are asked to recall their behaviors from the previous year and the last six months. Furthermore, there may be social desirability bias, due to a reluctance to provide honest responses to sensitive questions about their social media usage and negative consequences in life. Altogether, this may result in an underrepresentation of problematic social media use and sleep difficulties. Future research could explore alternative research methods, such as behavioral observations to directly observe participants' social media behavior in a real-time context. Furthermore, it is recommended that future studies use polysomnography (sleep study) to directly measure sleep by monitoring brain activity, eye movements, muscle activity and other factors, providing more precise information about sleep patterns and quality (Rundo & Downey, 2019).

Implications

The current study helps to better understand the relation between problematic social media use and sleep quality among Dutch adolescents and the factors that influence this relation. Future research should explore additional influencing factors in this relation, such as family experiences and school environment. By gaining more knowledge about these possible influencing factors, practitioners can offer more tailored support to adolescents.

The study's findings present an opportunity to complement existing guidelines, such as the Public Health Youth Care (JGZ) guidelines for Healthy Sleep and Sleep Problems in Children, by addressing problematic social media habits and their effect on sleep quality among adolescents. These recommendations may help parents and other caregivers manage young adolescents who exhibit addictive-like behavior with social media, especially during the hours before bedtime, to improve their sleep quality.

Also, policymakers might incorporate these findings into school programs by educating adolescents about the effects of problematic social media use on sleep and to provide resources or tools for better digital habits. For example, health education classes may include modules explaining how using social media before bedtime disrupts sleep patterns and overall sleep quality. Furthermore, schools might offer practical workshops in which students are taught to recognize indicators of problematic social media use and practice tactics for limiting screen time in the evening.

Conclusion

This research aimed to investigate the relation between problematic social media use and sleep quality among Dutch adolescents and whether this relation is moderated by gender and perceived peer support. The main finding reveals that adolescents who engage in problematic social media use report worse sleep quality outcomes than adolescents who do not. Additionally, gender and peer support did not moderate the association between problematic social media use and sleep quality. These findings underscore the importance to consider more contextual factors to understand the relation between problematic social media use and sleep quality better. Overall, the current study emphasizes the importance of addressing and minimizing the negative consequences of problematic social media use on sleep quality, as well as investigating additional factors that may influence this relation, in order to improve adolescents' well-being within today's digital landscape.

References

Abrams, Z. (2023, August 3). Why young brains are especially vulnerable to social media. *American Psychological Association*. Retrieved from https://www.apa.org/news/apa/2022/social-media-children-teens

Allen, M. S., Iliescu, D., & Greiff, S. (2022). Single item measures in psychological science. *European Journal of Psychological Assessment*, *38*(1), 1–5. https://doi.org/10.1027/1015-5759/a000699

Azhari, A., Toms, Z., Pavlopoulou, G., Esposito, G., & Dimitriou, D. (2022). Social media use in female adolescents: Associations with anxiety, loneliness, and sleep disturbances. *Acta Psychologica*, *229*, 103706. https://doi.org/10.1016/j.actpsy.2022.103706

Benzi, I. M. A., Gallus, S., Santoro, E., Barone, L., Cavallo, F., Coppola, L., Celata, C., Fave, A. D., Nigris, E., Vecchio, L., Terraneo, M., Tognetti, M., Barone, L., Salvatore, S., Capolongo, S., Marta, E., Lozza, E., Torbica, A., Russo, V., . . . Casalini, M. L. (2023). Psychosocial determinants of sleep difficulties in adolescence: the role of perceived support from family, peers, and school in an Italian HBSC sample. *European Journal of Pediatrics*, *182*(6), 2625–2634. https://doi.org/10.1007/s00431-023-04934-0

Boer, M. (2022). *#ConnectedTeens: Social media use and adolescent wellbeing*. https://doi.org/10.33540/1272

Boer, M., Stevens, G. W. J. M., Finkenauer, C., Koning, I. M., & Van Den Eijnden, R. J. J. M. (2021). Validation of the Social Media Disorder Scale in Adolescents: Findings from a Large-Scale Nationally Representative sample. *Assessment*, *29*(8), 1658–1675. https://doi.org/10.1177/10731911211027232

Boer, M., Van Den Eijnden, R., Finkenauer, C., Boniel-Nissim, M., Marino, C., Inchley, J., Cosma, A., Paakkari, L., & Stevens, G. W. J. M. (2021). Cross-national validation of the social media

disorder scale: findings from adolescents from 44 countries. *Addiction*, *117*(3), 784–795. https://doi.org/10.1111/add.15709

Boer, M., Van Dorsselaer, S. A. F. M., de Looze, M., De Roos, S. A., Brons, H., van den Eijnden, R., ... & Stevens, G. (2022). HBSC 2021. Gezondheid en welzijn van jongeren in Nederland.

Bornstein, M. H., Putnick, D. L., & Esposito, G. (2017). Continuity and stability in development. *Child Development Perspectives*, *11*(2), 113–119. https://doi.org/10.1111/cdep.12221

Brown, B. B., Bakken, J. P., Ameringer, S. W., & Mahon, S. D. (2008). A comprehensive conceptualization of the peer influence process in adolescence. Understanding peer influence in children and adolescents, 13, 17-44.

Buysse, D. J. (2014). Sleep health: Can we define it? Does it matter? *SLEEP*, *37*(1), 9–17. https://doi.org/10.5665/sleep.3298

Cain, N., & Gradisar, M. (2010). Electronic media use and sleep in school-aged children and adolescents: A review. *Sleep Medicine*, *11*(8), 735–742. https://doi.org/10.1016/j.sleep.2010.02.006

CBS. (2020, December 18). *Wat voeren jongeren online uit? - Nederland in cijfers 2020*. Retrieved from https://longreads.cbs.nl/nederland-in-cijfers-2020/wat-voeren-jongeren-online-uit/

CBS. (2023, November 8). *Meer slaapproblemen en psychische klachten onder jongeren*. Retrieved from https://www.cbs.nl/nl-nl/nieuws/2023/45/meer-slaapproblemen-en-psychische-klachten-onder-jongeren

Christensen, M. J., Bettencourt, L., Kaye, L., Moturu, S. T., Nguyen, K. T., Olgin, J. E., Pletcher, M. J., & Marcus, G. M. (2016). Direct Measurements of Smartphone Screen-Time: Relationships with Demographics and Sleep. *PLOS ONE*, *11*(11), e0165331. https://doi.org/10.1371/journal.pone.0165331

Clement-Carbonell, V., Portilla-Tamarit, I., Rubio-Aparicio, M., & Madrid-Valero, J. J. (2021). Sleep

quality, mental and physical health: a differential relationship. *International Journal of*

Environmental Research and Public Health, *18*(2), 460. https://doi.org/10.3390/ijerph18020460

Colley, R. C., Lo Fo Wong, S., Garriguet, D., Janssen, I., Gorber, S. C., & Tremblay, M. S. (2012).

Physical activity, sedentary behaviour and sleep in Canadian children: parent-report versus direct

measures and relative associations with health risk. *PubMed*, *23*(2), 45–52.

https://doi.org/10.3389/fpubh.2021.794307

Cooray, M. (2020). *Screen time, sleep and social relationships: a population-level study examining*

emotional wellbeing during early adolescence. https://doi.org/10.14288/1.0392376

Eagly, A. H., & Wood, W. (2012). Social role theory. Handbook of theories of social psychology, 2,

458-476.

Engel, G. L. (1977). The need for a new medical model: a challenge for biomedicine. *Science*,

196(4286), 129–136. https://doi.org/10.1126/science.847460

Exelmans, L., & Scott, H. (2019). *Social Media Use and Sleep Quality among Adults: The Role of*

Gender, Age and Social Media Checking Habit. https://doi.org/10.31234/osf.io/eqxdh

Exelmans, L., & Van Den Bulck, J. (2017). Bedtime, shuteye time and electronic media: sleep

displacement is a two-step process. *Journal of Sleep Research*, *26*(3), 364–370.

https://doi.org/10.1111/jsr.12510

Ferranti, R., Marventano, S., Castellano, S., Giogianni, G., Nolfo, F., Rametta, S., Matalone, M., &

Mistretta, A. (2016). Sleep quality and duration is related with diet and obesity in young

adolescent living in Sicily, Southern Italy. *Sleep Science*, *9*(2), 117–122.

https://doi.org/10.1016/j.slsci.2016.04.003

Foster, R. G. (2020). Sleep, circadian rhythms and health. *Interface Focus*, *10*(3), 20190098.

https://doi.org/10.1098/rsfs.2019.0098

Fuligni, A. J., & Eccles, J. S. (1993). Perceived parent-child relationships and early adolescents'

  orientation toward peers. *Developmental Psychology*, *29*(4), 622–632.

  https://doi.org/10.1037/0012-1649.29.4.622

Gamble, A., D'Rozario, A. L., Bartlett, D. J., Williams, S. C., Bin, Y. S., Grunstein, R. R., & Marshall,

  N. S. (2014). Adolescent Sleep Patterns and Night-Time Technology use: Results of the

  Australian Broadcasting Corporation's BiG Sleep Survey. *PLOS ONE*, *9*(11), e111700.

  https://doi.org/10.1371/journal.pone.0111700

Gioia, F., Rega, V., & Boursier, V. (2021). Problematic internet use and emotional dysregulation among

  young people: A literature review. *PubMed*, *18*(1), 41–54.

  https://doi.org/10.36131/cnfioritieditore20210104

Goddings, A., Heyes, S. B., Bird, G., Viner, R., & Blakemore, S. (2012). The relationship between

  puberty and social emotion processing. *Developmental Science*, *15*(6), 801–811.

  https://doi.org/10.1111/j.1467-7687.2012.01174.x

Griffiths, M. D., Kuss, D. J., & Demetrovics, Z. (2014). Social networking addiction. In *Elsevier eBooks*

  (pp. 119–141). https://doi.org/10.1016/b978-0-12-407724-9.00006-9

Health Behaviour in School-aged Children (HBSC). (2014). *Terms of reference*. HBSC International

  Coordinating Centre. Retrieved from https://hbsc.org/about/

Heaney, C. A., & Israel, B. A. (2008). Social networks and social support. Health behavior and health

  education: Theory, research, and practice, 4(1), 189-210.

Hershner, S. (2020). Sleep and academic performance: measuring the impact of sleep. *Current Opinion

  in Behavioral Sciences*, *33*, 51–56. https://doi.org/10.1016/j.cobeha.2019.11.009

Hjetland, G. J., Skogen, J. C., Hysing, M., & Sivertsen, B. (2021). The association between Self-

  Reported Screen Time, Social media addiction, and sleep among Norwegian University students.

  Frontiers in Public Health, *9*. https://doi.org/10.3389/fpubh.2021.794307

Hyde, J. S. (2005). The gender similarities hypothesis. *American Psychologist/the American Psychologist*, *60*(6), 581–592. https://doi.org/10.1037/0003-066x.60.6.581

JASP Team. (2024). JASP (Version 0.18.3) [Computer software].

Kardefelt-Winther, D. (2014). A conceptual and methodological critique of internet addiction research: Towards a model of compensatory internet use. *Computers in Human Behavior*, *31*, 351–354. https://doi.org/10.1016/j.chb.2013.10.059

Khan, A., Thomas, G., Karatela, S., Morawska, A., & Werner-Seidler, A. (2024). Intense and problematic social media use and sleep difficulties of adolescents in 40 countries. *Journal of Adolescence*. https://doi.org/10.1002/jad.12321

Kimbrough, A. M., Guadagno, R. E., Muscanell, N. L., & Dill, J. (2013). Gender differences in mediated communication: Women connect more than do men. *Computers in Human Behavior*, *29*(3), 896–900. https://doi.org/10.1016/j.chb.2012.12.005

Klinzing, J. G., Niethard, N., & Born, J. (2019). Mechanisms of systems memory consolidation during sleep. *Nature Neuroscience*, *22*(10), 1598–1610. https://doi.org/10.1038/s41593-019-0467-3

Krause, A. J., Simon, E. B., Mander, B. A., Greer, S. M., Saletin, J. M., Goldstein-Piekarski, A. N., & Walker, M. P. (2017). The sleep-deprived human brain. *Nature Reviews. Neuroscience*, *18*(7), 404–418. https://doi.org/10.1038/nrn.2017.55

Kryger, M. H., Roth, T., & Dement, W. C. (2011). Principles and practice of sleep Medicine. In *Elsevier eBooks*. https://doi.org/10.1016/c2009-0-59875-3

Kushida, C. A. (2013). Encyclopedia of Sleep. In *Elsevier eBooks*. https://doi.org/10.1016/c2011-1-69820-0

Lahti, H., Kulmala, M., Hietajärvi, L., Lyyra, N., Kleszczewska, D., Boniel-Nissim, M., Fürstová, J., Van Den Eijnden, R., Sudeck, G., & Paakkari, L. (2024). What counteracts problematic social

media use in adolescence? a Cross-National observational study. *Journal of Adolescent Health*, *74*(1), 98–112. https://doi.org/10.1016/j.jadohealth.2023.07.026

Laursen, B., & Veenstra, R. (2021). Toward understanding the functions of peer influence: A summary and synthesis of recent empirical research. *Journal of Research on Adolescence*, *31*(4), 889–907. https://doi.org/10.1111/jora.12606

Malaeb, D., Salameh, P., Barbar, S., Awad, E., Haddad, C., Hallit, R., Sacre, H., Akel, M., Obeïd, S., & Hallit, S. (2020). Problematic social media use and mental health (depression, anxiety, and insomnia) among Lebanese adults: Any mediating effect of stress? *Perspectives in Psychiatric Care*, *57*(2), 539–549. https://doi.org/10.1111/ppc.12576

Marceau, K., Ram, N., Houts, R., Grimm, K. J., & Susman, E. J. (2011). Individual differences in boys' and girls' timing and tempo of puberty: Modeling development with nonlinear growth models. *Developmental Psychology*, *47*(5), 1389–1409. https://doi.org/10.1037/a0023838

Mauri, M., Cipresso, P., Balgera, A., Villamira, M., & Riva, G. (2011). Why is Facebook so successful? Psychophysiological measures describe a core flow state while using Facebook. *Cyberpsychology, Behavior, and Social Networking*, *14*(12), 723–731. https://doi.org/10.1089/cyber.2010.0377

Mougharbel, F., Chaput, J., Sampasa-Kanyinga, H., Hamilton, H., Colman, I., Leatherdale, S. T., & Goldfield, G. S. (2023). Heavy social media use and psychological distress among adolescents: the moderating role of sex, age, and parental support. *Frontiers in Public Health*, *11*. https://doi.org/10.3389/fpubh.2023.1190390

Moyer, M. W. (2022, March 24). Kids are using social media more than ever, study finds. *The New York Times*. Retrieved from https://www.nytimes.com/2022/03/24/well/family/child-social-media-use.html

Nelson, K. L., Davis, J. E., & Corbett, C. F. (2021). Sleep quality: An evolutionary concept analysis. *Nursing Forum*, *57*(1), 144–151. https://doi.org/10.1111/nuf.12659

Ohayon, M. M., Wickwire, E. M., Hirshkowitz, M., Albert, S. M., Avidan, A. Y., Daly, F. J., Dauvilliers, Y., Ferri, R., Fung, C. H., Gozal, D., Hazen, N., Krystal, A. D., Lichstein, K. L., Mallampalli, M. P., Plazzi, G., Rawding, R., Scheer, F. A., Somers, V. K., & Vitiello, M. V. (2017). National Sleep Foundation's sleep quality recommendations: first report. *Sleep Health (Print)*, *3*(1), 6–19. https://doi.org/10.1016/j.sleh.2016.11.006

Oosterveer, D. (2021, January 23). *Social media in Nederland 2021: TikTok-gebruik door jongeren stijgt explosief en passeert Facebook - Marketingfacts*. Marketingfacts. Retrieved from https://www.marketingfacts.nl/berichten/social-media-in-nederland-2021/

Orhon, F. Ş., Ergin, A., Topçu, S., Çolak, B., Almış, H., Durmaz, N., Aygün, B., Boran, P., Bağ, Ö., Ayçiçek, T., Altun, D., & Başkan, S. (2022). The role of social support on the relationships between internet use and sleep problems in adolescents during COVID-19 pandemic: a multicentre study. *Child and Adolescent Mental Health*, *28*(1), 117–123. https://doi.org/10.1111/camh.12626

Pea, R., Nass, C., Meheula, L., Rance, M., Kumar, A., Bamford, H., & Nass, M. (2012). Media use, face-to-face communication, media multitasking, and social well-being among 8- to 12-year-old girls. *Developmental Psychology 48*(2), 327–36. https://doi.org/10.1037/a0027030

Rana, N. (2021). A study of social media impact on self esteem and sleep hygiene on young adults. *International Journal of Indian Psychology*, *9*(1). https://doi.org/10.25215/0901.094

Roberts, A., Seidman, E., Pedersen, S., Chesir-Teran, D., Allen, L., Aber, J. L., Duran, V., & Hsueh, J. (2000). Perceived Family and Peer Transactions and Self-Esteem among Urban Early Adolescents. *Journal of Early Adolescence/the Journal of Early Adolescence*, *20*(1), 68–92. https://doi.org/10.1177/0272431600020001004

Rodrigues, G. D., Fiorelli, E. M., Furlan, L., Montano, N., & Tobaldini, E. (2021). Obesity and sleep disturbances: The "chicken or the egg" question. *European Journal of Internal Medicine*, *92*, 11–16. https://doi.org/10.1016/j.ejim.2021.04.017

Rundo, J. V., & Downey, R. (2019). Polysomnography. In *Handbook of clinical neurology* (pp. 381–392). https://doi.org/10.1016/b978-0-444-64032-1.00025-4

Saladino, V., Verrastro, V., Cannavò, M., Calaresi, D., & Barberis, N. (2024). Emotion dysregulation and problematic social media use: the role of need fulfillment and fear of missing out. *Current Psychology*. https://doi.org/10.1007/s12144-024-06005-5

Shen, L., Van Schie, J., Ditchburn, G., Brook, L., & Bei, B. (2018). Positive and Negative Emotions: Differential Associations with Sleep Duration and Quality in Adolescents. *Journal of Youth and Adolescence*, *47*(12), 2584–2595. https://doi.org/10.1007/s10964-018-0899-1

Shochat, T., Flint-Bretler, O., & Tzischinsky, O. (2010). Sleep patterns, electronic media exposure and daytime sleep-related behaviours among Israeli adolescents. *Acta Paediatrica 99*(9), 1396–1400. https://doi.org/10.1111/j.1651-2227.2010.01821.x

Steinberg, L., & Morris, A. S. (2001). Adolescent Development. *Annual Review of Psychology*, *52*(1), 83–110. https://doi.org/10.1146/annurev.psych.52.1.83

Susman, E. J., & Rogol, A. (2004). Puberty and psychological development. Handbook of adolescent psychology, 15-44.

Thorsteinsson, E. B., Potrebny, T., Arnarsson, Á. M., Tynjälä, J., Välimaa, R., & Eriksson, C. (2019). Trends in sleeping difficulty among adolescentsin five Nordic countries 2002–2014. *Nordisk Välfärdsforskning*, *4*(2), 77–87. https://doi.org/10.18261/issn.2464-4161-2019-02-05

Touitou, Y., Touitou, D., & Reinberg, A. (2016). Disruption of adolescents' circadian clock: The vicious circle of media use, exposure to light at night, sleep loss and risk behaviors. *Journal of Physiology-paris*, *110*(4), 467–479. https://doi.org/10.1016/j.jphysparis.2017.05.001

Turel, O., Poppa, N. ".", & Gil-Or, O. (2018). Neuroticism Magnifies the Detrimental Association between Social Media Addiction Symptoms and Wellbeing in Women, but Not in Men: a three-Way Moderation Model. *Psychiatric Quarterly*, *89*(3), 605–619. https://doi.org/10.1007/s11126-018-9563-x

Van Den Eijnden, R., Geurts, S. M., Ter Bogt, T., Van Der Rijst, V. G., & Koning, I. M. (2021). Social Media Use and Adolescents' Sleep: A Longitudinal Study on the Protective Role of Parental Rules Regarding Internet Use before Sleep. *International Journal of Environmental Research and Public Health*, *18*(3), 1346. https://doi.org/10.3390/ijerph18031346

Van Den Eijnden, R., Koning, I. M., Doornwaard, S. M., Van Gurp, F., & Ter Bogt, T. (2018). The impact of heavy and disordered use of games and social media on adolescents' psychological, social, and school functioning. *Journal of Behavioral Addictions*, *7*(3), 697–706. https://doi.org/10.1556/2006.7.2018.65

Van Den Eijnden, R., Lemmens, J. S., & Valkenburg, P. M. (2016). The social media disorder scale. *Computers in Human Behavior*, *61*, 478–487. https://doi.org/10.1016/j.chb.2016.03.038

Van Der Schuur, W. A., Baumgartner, S. E., & Sumter, S. R. (2018). Social Media Use, social media stress, and Sleep: Examining Cross-Sectional and Longitudinal Relationships in Adolescents. *Health Communication*, *34*(5), 552–559. https://doi.org/10.1080/10410236.2017.1422101

Van Der Velden, P. G., Setti, I., Van Der Meulen, E., & Das, M. (2019). Does social networking sites use predict mental health and sleep problems when prior problems and loneliness are taken into account? A population-based prospective study. *Computers in Human Behavior*, *93*, 200–209. https://doi.org/10.1016/j.chb.2018.11.047

Verhulst, S., Schrauwen, N., Haentjens, D., Rooman, R., Van Gaal, L., De Backer, W. A., & Desager, K. N. (2008). Sleep duration and metabolic dysregulation in overweight children and adolescents. *Archives of Disease in Childhood*, *93*(1), 89–90. https://doi.org/10.1136/adc.2007.124768

Vittinghoff, E., Glidden, D. V., Shiboski, S., & McCulloch, C. E. (2006). *Regression methods in biostatistics: linear, logistic, survival, and repeated measures models*. https://doi.org/10.1007/978-1-4614-1353-0

Vlasblom, E., Van Sleuwen, B., L'Hoir, M., & Beltman, M. (2016). *JGZ richtlijn Gezonde slaap en slaapproblemen*. TNO. Retrieved from https://www.ncj.nl/wp-content/uploads/media-import/docs/57848d02-2590-4e7c-b22e-dba76db0e209.pdf

Wong, H. Y., Mo, H. Y., Potenza, M. N., Chan, M. N. M., Lau, W. M., Chui, T. K., Pakpour, A. H., & Lin, C. Y. (2020). Relationships between Severity of Internet Gaming Disorder, Severity of Problematic Social Media Use, Sleep Quality and Psychological Distress. *International Journal of Environmental Research and Public Health/International Journal of Environmental Research and Public Health*, *17*(6), 1879. https://doi.org/10.3390/ijerph17061879

Woods, H., & Scott, H. (2016). #Sleepyteens: Social media use in adolescence is associated with poor sleep quality, anxiety, depression and low self-esteem. *Journal of Adolescence*, *51*(1), 41–49. https://doi.org/10.1016/j.adolescence.2016.05.008

Yang, J., Guo, Y., Du, X., Jiang, Y., Wang, W., Di, X., Wang, T., Lu, C., & Guo, L. (2018). Association between Problematic Internet Use and Sleep Disturbance among Adolescents: The Role of the Child's Sex. *International Journal of Environmental Research and Public Health*, *15*(12), 2682. https://doi.org/10.3390/ijerph15122682

Zhang, J., He, Y., Zheng, S., & Wan, C. (2024). The relationship between mobile phone addiction and sleep quality in college students: the role of rumination and fear of missing out. *Research Square (Research Square)*. https://doi.org/10.21203/rs.3.rs-4015790/v1

Zhang, J., Xu, Z., Zhao, K., Chen, T., Ye, X., Shen, Z., Wu, Z., Zhang, J., Shen, X., & Li, S. (2017). Sleep habits, sleep problems, sleep hygiene, and their associations with mental health problems

among adolescents. *Journal of the American Psychiatric Nurses Association*, *24*(3), 223–234.

https://doi.org/10.1177/1078390317715315

Appendix: Reflection on Interdisciplinarity

This thesis provides an enhanced understanding of the complex relation between problematic social media use and sleep quality in adolescents and whether this association is influenced by gender and perceived peer support, due to the integration of insights from different disciplines such as psychology, sociology and biology. By employing the biopsychosocial model (Engel, 1977), this thesis combines psychological theories to explain individual behaviors and motivations connected to problematic social media use, such as the compensatory internet use theory, whereas sociological approaches give insight into the larger social framework that influences these behaviors, including the social support theory. Additionally, biological perspectives contribute to the understanding of how physiological processes play a role in the explanation of the association and factors that influence this, such as the impact of screen exposure on circadian rhythms and hormonal changes during adolescence.

It is important to gain insights from stakeholders outside academia, such as policymakers, educators and healthcare professionals. These stakeholders can offer invaluable insights into the practical implications of research findings, helping to bridge the gap between scientific knowledge and practical application. In the current study, it is particularly important to consider the perspectives of policymakers, educators and healthcare professionals when trying to apply scientific knowledge in practical ways. Policymakers can enact policies to address the negative effects of problematic social media use, educators can implement interventions in educational settings and healthcare professionals can provide support and resources for adolescents struggling with sleep issues.

Although an interdisciplinary approach is necessary to tackle the complexity of the research problem, there are situations where a single disciplinary approach may be appropriate. For instance, a psychological study that concentrates only on individual behaviors concerning

social media use can offer valuable insights into cognitive processes and motivations without necessarily considering broader social or public health implications. Nevertheless, to gain a comprehensive understanding of the multifaceted nature of the problem, an interdisciplinary approach is preferable.

This thesis uses quantitative methods to study the link between problematic social media use and sleep quality in adolescents. Future research could benefit from employing alternative research methods. For instance, behavioural observations could provide a more detailed account of participants' problematic social media usage in real-time contexts, offering a more nuanced understanding of their digital habits. Furthermore, the use of polysomnography (sleep studies) to monitor brain activity, eye movements, muscle activity and other factors would provide precise and comprehensive insights into sleep patterns and quality. The integration of these methods will enable future studies to gain more detailed and accurate information, thereby facilitating a more comprehensive understanding of the impact of problematic social media use on adolescent sleep.

The use of multiple analytical levels can significantly enhance the understanding of the association between problematic social media use and sleep quality in adolescents. In this study, the analysis focused on individual behavior and characteristics such as gender and perceived peer support. However, the inclusion of additional analytical levels could provide a more comprehensive perspective. For example, a systems approach could explore the interaction between family dynamics, school environments, broader societal influences and individual behaviors. Analyzing data at both the micro (individual) and macro (societal) levels would allow for a more detailed understanding of how various factors converge to impact adolescent sleep quality. This multi-level approach could pinpoint specific intervention opportunities, leading to the development of more effective strategies to address the negative effects of problematic social media use on adolescent sleep.