FULL-LENGTH REPORT

Journal of Behavioral Addictions 5(3), pp. 465–473 (2016)
DOI: 10.1556/2006.5.2016.056
First published online August 06, 2016

Smartphone addiction proneness in relation to sleep and morningness–eveningness in German adolescents

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(Received: September 14, 2015; revised manuscript received: February 3, 2016; second revised manuscript received: April 1, 2016; third revised manuscript received: June 8, 2016; accepted: June 26, 2016)

Background: Mobile phones are an important part of adolescents' life. In this study, the relationships among smartphone addiction, age, gender, and chronotype of German adolescents were examined. *Materials and methods:* Two studies focused on two different measures of smartphone addiction. The *Smartphone Addiction Proneness Scale* (*SAPS*) was applied to 342 younger adolescents (13.39 ± 1.77; 176 boys, 165 girls, and 1 not indicated) in Study 1 and the *Smartphone Addiction Scale* was applied to 208 older adolescents (17.07 ± 4.28; 146 girls and 62 boys) in Study 2, both samples in southwest Germany. In addition, a *demographic questionnaire* and the *Composite Scale of Morningness* (*CSM*) and sleep measures were implemented. *Results:* The most remarkable result of this study was that morningness–eveningness (as measured by CSM scores) is an important predictor for smartphone addiction; even stronger than sleep duration. Evening oriented adolescents scored higher on both smartphone addiction scales. In addition, gender is an important predictor for smartphone addiction and girls are more prone to become addicted. In addition, while sleep duration on weekdays negatively predicted SAPS, age, sleep duration on weekends, and midpoint of sleep on weekdays and weekends did not predicted smartphone addiction in both scales. The analysis of covariance revealed statistically significant effects of the covariates gender and age in both studies, as well as the main effect of chronotype. According to the *t*-test results, girls had higher scores than boys in smartphone addiction. *Conclusion:* Evening types and girls are more prone to become smartphone addicted.

Keywords: adolescents, circadian preference, morningness–eveningness, smartphone addiction proneness

INTRODUCTION

Smartphone usage as a problem

Mobile phones are part of our everyday life, and in 1997 the new term "Smartphone" was implemented in our daily lives, with a brand of Ericsson that described its GS 88 "Penelope" concept as a smartphone to distinguish this term from other mobile phones because of their advanced features (Stockholm Smartphone, 2010). They rank as new class of mobile technology that provides voice communication, personal information management applications, and wireless communication capability (Sarwar & Soomro, 2013). Emanuel et al. (2015) indicated that smartphones enable us to stay informed, entertained, and connected at any time with a portable device. The current smartphones are like laptops because of including web browsing, WiFi, third-party apps, etc. (Katz & Aakhus, 2002), and in the twenty-first century, they are more portable and attractive, especially for adolescents. A great number of adolescents enjoy using their smartphones and its applications. Using different kinds of music, wallpaper, etc., offers a way to express themselves. In Germany, 25% of the 12–19-year-old adolescents owned a smartphone in 2011 while this number has increased to 72% in 2013 (Medienpädagogischer Forschungsverbund Südwest, 2013). Although mobile phones have positive outcomes, such as sending e-mails, playing video games, or utilizing many applications (Lepp, Barkley, & Karpinski, 2014), their overuse can cause a wide range of problems. There may be medical problems, such as damaging fingers and forearms (Ming, Pietikainen, & Hanninen, 2006), injuries of the vertebrae of the neck and spine (Binning, 2010), as well as psychological and physiological disorders including depression (Takao, Takahashi, & Kitamura, 2009; Turel & Serenko, 2010; Walsh, White, Hyde, & Watson, 2008; Yen et al., 2009). Turel and Serenko (2010) claimed that smartphone addiction might be a type of

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non-substance addiction. Kim (2013) noted that smartphone overuse can be a sign of smartphone addiction. Lin et al. (2014) revealed the components of smartphone addiction, such as tolerance, withdrawal, compulsive symptoms, and functional impairment. However, Billieux, Maurage, Lopez-Fernandez, Kuss, and Griffiths (2015) summarized that the term "addiction" may not be appropriate because studies are lacking that show behavioral and neurobiological similarities between mobile phone addiction and other types of legitimate addictive behaviors. Therefore, these authors suggested the term "problematic usage," and Kim, Lee, Lee, Nam, and Chung (2014) labeled this behavior as "addiction proneness."

Studies about gender differences and problematic smartphone usage/addiction are contradictory. Some studies reported that females are more likely to be addicted to smartphones and more likely to engage in problematic mobile phone use (Augner & Hacker, 2012; Billieux, Van der Linden, & Rochat, 2008; Lee, Chang, Lin, & Cheng, 2014; Mok et al., 2014; Şar, Ayas, & Horzum, 2015; Schifferstein, 2006; Walsh, White, Cox, & Young, 2011). However, some studies showed opposite findings with males showing a higher problematic mobile phone usage compared with females (Morahan-Martin & Schumacher, 2000; Öztunç, 2013; Takao et al., 2009). Finally, some studies found no clear gender effect (Demirci, Orhan, Demirdas, Akpınar, & Sert, 2014). Age is another correlation of smartphone usage. According to the National Information Society Agency Internet Addiction Survey (2011), smartphone addiction is more prevalent among 10–20-year-old individuals than among 20–30-year–old individuals. Likewise Kwon, Lee, et al. (2013) indicated that individuals, who have a low level of education, and students are more likely to become addicted to smartphones and Park and Park (2014) concluded that children could easily be addicted to smartphones because of not having reached the age to make rational decisions.

Chronotype and sleep and its relationship to electronic media usage

Chronotype or circadian preference is related to the endogenous circadian clock that synchronizes to the 24-hr day (Adan et al., 2012). Individuals' circadian preferences can be grouped into three categories as "morning type," "neither type," and "evening type," but they can also be seen as a continuum (Natale & Cicogna, 2002). Morning types wake up early in the morning, feel exhausted in the early evening hours, and quickly fall asleep, usually waking up fresh in the early morning. Evening types go to sleep late at night and wake up late the next day, often with a worse feeling in the morning (Adan et al., 2012). There are several variables that have an impact on ones' chronotype, such as endogenous factors – genetic factors, biological variables, age, and gender, as well as exogenous factors – cultural, social, and environmental ones (Adan et al., 2012). Previous work showed that as communication technologies were becoming widespread, media screens, such as TV, video games, mobile phones, and computers, contribute to insufficient sleep or poor-quality sleep in university students (Carney, Edinger, Meyer, Lindman, & Istre, 2006; Suen, Ellis Hon, & Tam, 2008). Similarly, Crowley, Tarokh, and Carskadon (2014) found that the light emitted from media screens in the evening before bedtime may delay the circadian rhythm. In addition, excessive mobile phone usage may lead to sleep disturbances (Badre, 2008; Kauderer & Randler, 2013; Pea et al., 2012; Van den Bulck, 2003; Vollmer, Michel, & Randler, 2012). Bartel, Gradisar, and Williamson (2014) found that using information and communication technologies such as internet, computer, video gaming, and phone use were all associated with later bedtimes, related to longer sleep onset latency, but were unrelated to sleep duration. Lemola, Perkinson-Gloor, Brand, Dewald-Kaufmann, and Grob (2014) indicated that smartphone ownership was related to higher electronic media use in bed before sleep and later bedtimes. Also, electronic media use was negatively related to sleep duration and positively to sleep difficulties. Mobile phone usage can be seen as an antecedent of a behavioral addiction, and recent studies showed that eveningness preferences is related to internet addiction or problematic internet use (Lin & Gau, 2013; Randler, Horzum, & Vollmer, 2013), as well as to computer game addiction (Vollmer, Randler, Horzum, & Ayas, 2014). Furthermore, Nimrod's (2015) findings indicate that morning persons are inclined toward using traditional media in traditional environments, whereas night persons reported significantly higher preference for and use of new media in more varied locations.

Aims of the study

Despite the considerable number of studies mentioned above, none has analyzed the relationship between chronotype and smartphone addiction. Given the previous work on internet addiction and computer game addiction, we hypothesize that evening-oriented students should also score higher on smartphone addiction and addiction proneness. Furthermore, we investigate which of the variables, morningness–eveningness or habitual sleep duration, is the better statistical predictor to add incremental validity. We carried out two studies, focusing on two different measures of smartphone addiction, the *Smartphone Addiction Proneness Scale* (*SAPS*) and the *Smartphone Addiction Scale* (*SAS*). Two studies with two different scales and populations give more strengths and generalizability.

MATERIALS AND METHODS

In this study, a cross-sectional survey method was used based on a convenience sample. Different schools in southwest Germany (see Acknowledgments section) have been approached and the principals were asked to participate. After this agreement, teachers, parents, and pupils were approached.

Participants and data collection

Study 1 was conducted with 342 younger adolescents (176 boys, 165 girls, and 1 not indicated). The SAPS, Composite Scale of Morningness (CSM), and habitual sleep–wake variables were collected from January to March 2015 in three secondary schools in southwest Germany. Study 2 was conducted with 208 older adolescents (146 girls and 62

boys). The SAS, CSM, and habitual sleep–wake variables were collected at seven different schools with older students from January to March 2015 mainly in southwest Germany. We used two different questionnaires for measuring smartphone addiction/proneness because we wanted to check if the results are similar, adding some validity to our results. Participation was voluntarily, anonymous, and unpaid in both Study 1 and Study 2. Descriptive statistics of the study groups are given in Table 1.

Smartphone Addiction Proneness Scale (SAPS)

The 15-item scale from Kim et al. (2014) measures smartphone addiction proneness in young adolescents (Appendix 1). The scale was translated by independent researchers using the parallel translation method and one of the authors was used as adjunctor, the person who decides which one is used, if there were different translations. The scale is coded from 1 = "fully disagree" to 5 = "fully agree." Three items were reverse coded in the original Korean version and two items are reverse coded in the German version. This was done because the third reverse coded item did not sound German, and it was easier to understand in a positive than a negative wording. Example items are "I try cutting my smartphone usage time, but I fail," and "Family or friends complain that I use my smartphone too much." Cronbach's α was 0.87 in the present sample and 0.88 in the original version (Kim et al., 2014). Mean inter-item correlation was 0.32.

Table 1. Descriptive statistics of the sample (Mean ± *SD*). Problematic smartphone usage was measured with the Smartphone Addiction Proneness Scale (SAPS) and the Smartphone Addiction Scale (SAS)

	Study 1		Study 2	
	N	SAPS	*N*	SAS
Total	342	2.04 ± 0.71	208	2.28 ± 0.75
Gender				
Girl	165	2.13 ± 0.73	146	2.38 ± 0.78
Boy	176	1.95 ± 0.69	62	2.03 ± 0.63
Chronotype (20th/80th percentiles)				
Morning type	68	1.73 ± 0.58	41	1.86 ± 0.66
Neither type	212	2.01 ± 0.69	129	2.29 ± 0.67
Evening type	62	2.42 ± 0.74	38	2.69 ± 0.89
CSM score	342	33.62 ± 6.92	208	32.08 ± 7.47
Wake-up time at weekday	341	6:12 ± 0:24	208	6:15 ± 0:39
Wake-up time at weekend	339	9:43 ± 1:35	208	10:07 ± 1:40
Bedtime at weekday	342	21:46 ± 1:01	208	22:31 ± 1:09
Bedtime at weekend	328	23:48 ± 1:35	205	24:32 ± 1:43
SDR at weekday	341	8:26 ± 1:05	208	7:43 ± 1:12
SDR at weekend	327	9:53 ± 1:32	205	9:34 ± 1:32
MS at weekday	341	25:59 ± 0:33	208	26:23 ± 0:43
MS at weekend	327	28:45 ± 1:22	205	29:19 ± 1:31

Note. SD: standard deviation; SDR: sleep duration; MS: midpoint of sleep; CSM: Composite Scale of Morningness.

Smartphone Addiction Scale – Short Version (SAS-SV)

The SAS was originally developed by Kwon, Lee, et al. (2013) and revised to a short form for adolescents containing 10 items (Kwon, Kim, Cho, & Yang, 2013). The scale was translated by independent researchers using the parallel translation method and one of the authors was used as adjunctor if there were different translations (see above, Appendix 2). The scale is coded from 1 = "fully disagree" to 6 = "fully agree." Example items are "Constantly checking my smartphone so as not to miss conversations between other people on Twitter or Facebook," and "Having a hard time concentrating in class, while doing assignments, or while working due to smartphone use." Cronbach's α was 0.83 in this study and 0.91 in the original study. Mean inter-item correlation was 0.31.

Composite Scale of Morningness (CSM)

The CSM was developed by Smith, Reily, and Midkiff (1989) and adapted to German by Randler (2008b). The scale is composed of 13 Likert-type items (10 items are coded on a 4-point Likert-type scale and 3 items are coded on a 5-point scale). The total score varies from a minimum of 13 to a maximum of 55 with high scores reflecting high morningness. The scale has been used in many different countries and shows good psychometric properties and convergent validity (Di Milia, Adan, Natale, & Randler, 2013; Horzum et al., 2015). Cronbach's α coefficient of the CSM scale was 0.84 in the SAPS study and 0.88 in the SAS. To classify evening, neither, and morning types, the 20th/80th percentiles are taken as cut-offs in this study (lower than 20% = evening types; 80% and higher than 80% = morning types; 21–79% = neither types). This was done by following the procedures of many other researchers because the cut-off scores were not fully defined for the CSM (Di Milia et al., 2013).

Habitual sleep–wake variables

We asked for bed times and rise times for both weekdays and weekends. From these data, we calculated sleep length for weekdays and weekends and the midpoint of sleep, which is another marker for the circadian phase. The midpoint of sleep is just the clock time (midtime) between falling asleep and waking up (Roenneberg et al., 2004).

Statistical analysis

We used SPSS Statistics for Windows 22.0 (IBM Corp., Armonk, NY), and the analysis based on correlations to assess bivariate relationships and on a linear multiple regression to assess the influence of all predictors simultaneously. A one-way analysis of covariance (ANCOVA) was used to assess whether the smartphone addiction proneness scores differ by chronotype (morning, neither, and evening types) both in Study 1 and Study 2. Age and gender were included as covariates in this analysis. In the ANCOVA, we

used Bonferroni adjustment for multiple post-hoc comparisons, when we compare the three different chronotypes to avoid type I errors. In addition, independent sample *t*-tests were conducted to identify the impact of gender differences in smartphone addiction.

Ethics

The study procedures were carried out in accordance with the Declaration of Helsinki. The study followed the guidelines of the Institutional Review Board of the University of Education Heidelberg. All subjects were informed about the study and all provided informed consent. Parental consent was obtained for those younger than 18 years of age. The principals of all schools gave informed consent.

RESULTS

Descriptive data are presented in Table 1. There were significant moderate and negative correlations between the SAPS and the SAS with CSM scores, indicating that the proclivity toward eveningness is related to a higher problematic smartphone usage (Table 2). Similarly, midpoint of sleep was positively related to smartphone usage, with adolescents that go to bed and sleep later having higher scores on the SAPS and SAS.

Table 2. Correlations between sleep duration, midpoint of sleep, CSM scores and SAPS and SAS controlling for age and gender

	Study 1 (SAPS)	Study 2 (SAS)
CSM score	−.347**	−.349**
SDR at weekday	−.192**	−.294**
SDR at weekend	.032	−.041
MS at weekday	.137*	.265**
MS at weekend	.219**	.329**

Note. SAPS: Smartphone Addiction Proneness Scale; SAS: Smartphone Addiction Scale; CSM: Composite Scale of Morningness; SDR: sleep duration; MS: midpoint of sleep.
*Correlation is significant at the 0.05 level.
**Correlation is significant at the 0.01 level.

Sleep duration during the week was negatively correlated with smartphone addiction. Short sleepers showed higher problematic usage. However, weekend sleep duration was unrelated to problematic smartphone usage. Multiple regressions (Table 3) showed a significant influence of CSM scores on mobile phone usage. The β-value showed that this was the most important predictor variable in SAPS scores, and then gender effects emerged (SAPS; total model: $F_{7,306} = 8.712$, $p < .001$, $R^2 = .17$). Girls showed a higher proneness (2.13 ± 0.74) than boys (1.96 ± 0.70). Similarly, concerning the SAS, the influence of CSM scores was important, but gender had the strongest influence (SAS; $F_{7,201} = 8.107$, $p < .001$, $R^2 = .22$).

Girls and women had a higher addiction value (2.39 ± 0.78) than boys (2.04 ± 0.63). Sleep duration at weekends, midpoint of sleep at weekdays and weekends, and age variables were not significant predictors in SAPS and SAS. Sleep duration at weekdays was significant predictor in SAPS but not in SAS scores. Lower sleep duration was found in young adolescents, scoring higher on the SAPS.

The ANCOVA revealed a statistically significant effect for all covariates in both Study 1 [gender: $F_{1,324} = 6.011$, $p < .05$, $\eta^2 = 0.018$; age: $F_{1,324} = 6.140$, $p < .05$, $\eta^2 = 0.019$] and Study 2 [gender: $F_{1,203} = 12.311$, $p < .001$, $\eta^2 = 0.057$; age: $F_{1,203} = 3.695$, $p < .05$, $\eta^2 = 0.018$] and also the independent variable of chronotype showed a significant effect on problematic mobile phone usage [Study 1: $F_{2,324} = 15.355$, $p < .001$, $\eta^2 = 0.087$; Study 2: $F_{2,203} = 610.391$, $p < .001$, $\eta^2 = 0.093$].

In Study 1, Bonferroni-corrected, multiple comparison tests indicated that evening type students (2.42 ± 0.74) had higher SAPS scores than both neither type students (2.01 ± 0.69) and morning type students (1.73 ± 0.58). Similarly in Study 2, evening type students (2.69 ± 0.89) had higher SAS scores than both neither type students (2.29 ± 0.67) and morning type students (1.86 ± 0.66) and also neither type students had higher scores than morning type students ($p < .0167$ for all post-hoc comparisons).

Finally, independent sample *t*-tests revealed a statistically significant effect of gender on smartphone addiction in both Study 1 [$t_{(328)} = -2.272$, $p < .05$] and Study 2 [$t_{(206)} = -3.183$, $p < .05$]. Girls had higher SAPS scores (2.38 ± 0.78) than boys (2.03 ± 0.63) and similar results were found in SAS scores [girls: 2.13 ± 0.73; boys: 1.95 ± 0.69].

Table 3. Multiple regression results of independent variables on Study 1 and Study 2

	Study 1 (SAPS)			Study 2 (SAS)		
	β	*t*	*p*	β	*t*	*p*
Gender	0.118*	2.188	.029	0.237**	3.645	≤.001
Age	0.051	0.791	.429	−0.113	−1.689	.093
SDR at weekday	−0.171*	–2.042	.042	−0.101	−1.297	.196
SDR at weekend	0.025	0.436	.663	−0.029	−0.442	.659
MS at weekday	−0.086	–1.030	.304	0.055	0.657	.512
MS at weekend	−0.038	–0.482	.630	0.098	1.044	.298
CSM score	−0.349**	−4.967	≤.001	−0.217*	−2.451	.015

Note. SAPS: Smartphone Addiction Proneness Scale; SAS: Smartphone Addiction Scale; SDR: sleep duration; MS: midpoint of sleep; CSM: Composite Scale of Morningness.
*Correlation is significant at the 0.05 level.
**Correlation is significant at the 0.01 level.

DISCUSSION

The most remarkable and unique result of this study was that morningness–eveningness (as measured by CSM scores) is an important predictor for smartphone addiction even when taking sleep duration into account. Moreover, while in Study 1 CSM score was the best predictor of smartphone addiction proneness, in Study 2 gender was the best predictor followed by CSM score.

The correlation coefficients between smartphone addiction proneness and midpoint of sleep were higher when using the midpoint of sleep on weekends than on weekdays. This may result because the midpoint of sleep on weekends more truly reflects the internal biological rhythm. The midpoint of sleep on weekdays is restricted by the school schedule. Weekend sleep duration was not related to smartphone addiction proneness because this may reflect the recovery sleep, when adolescents sleep longer on the weekends to "sleep in" their sleep debt which is accumulated during the school week.

Using the mobile phone after going to sleep leads to increasing sleep problems (Van den Bulck, 2007). Furthermore, high mobile phone usage was found to be related to later bedtimes (Lemola et al., 2014). Roenneberg (2004) suggested that the prevalence of light-emitting electronic devices such as computers, tablets, and mobile phones late in the biological night is shifting people to a later chronotype. This is supported by studies about the effect of light-emitting electronic devices (Cajochen et al., 2011; Fossum, Nordnes, Storemark, Bjorvatn, & Pallesen, 2014). Similarly, Vollmer et al. (2012) found that evening types have a longer screen time, and Kauderer and Randler (2013) found that evening type adolescents generally spend more time in front of the computer. Moreover, Demirci, Akgönül, and Akpinar (2015) found significantly positive correlations between sleep quality, sleep disturbance, and daytime dysfunction on one side and smartphone overuse on the other. These studies support the finding that especially the light of screens (blue light) shifts people to eveningness.

However, apart from the biological explanation, a further hypothesis could be explicated. This hypothesis suggests that eveningness per se is associated with a higher potential for addictive behaviors. Previous work established a relationship between substance addiction and eveningness with higher smoking prevalence in evening types (Randler, 2008a), and a higher number of current smokers (Gau et al., 2007; Urbán, Magyaródi, & Rigó, 2011). Also, behavioral addictions are related to eveningness (Gau et al., 2007; Nakade, Takeuchi, Taniwaki, Noji, & Harada, 2009; Prat & Adan, 2011). Adan (2013) summed up that evening circadian typology is being considered as a risk factor. Similarly, Prat and Adan (2013) found that eveningness could be related to developing psychological distress, which may turn into drug consumption. Thus, it may be the evening personality itself that leads to addiction proneness.

We found a clear gender effect in this study with both younger and older adolescent girls scoring higher in smartphone addiction. There are similar results in other studies (Augner & Hacker, 2012; Billieux et al., 2008; Lee et al., 2014; Mok et al., 2014; Şar et al., 2015; Walsh et al., 2011).

In comparison with SAPS and SAS results, we can infer that younger people are more addicted to their smartphones on weekdays because of the negative β-value in SAPS scores. Maybe this is because of their lacking of self-control mechanism when compared with older ones (SAS scores). In line with our results, Barnes and Meldrum (2015) indicated that participants who reported sleeping fewer hours at night displayed lower levels of self-control. At the weekends, individuals (children or adolescents) are able to regulate their sleep duration times on their own (in comparison to school days). This may be the reason of the non-significant β values at the weekends.

Our results are more generalized, because we used two different scales to measure smartphone addiction (proneness), and chronotype by two measures (CSM scores, midpoint of sleep), as well as sleep duration and two different populations.

LIMITATIONS

This study has several limitations. It was conducted with adolescents. To obtain a more generalizable result, similar studies are needed from children and older adults. Furthermore, we showed the relationships between smartphone addiction and chronotypes by a self-report scale, and also in this study two different scales were used for measuring the smartphone addiction. To overcome these effects, future researches may add some physiological measures, such as actigraphy for sleep measurements, blood pressure, and pulse rate, when using the smartphone to increase the validity of the data. Also, the smartphone addiction scales should be validated by real behavior or experimental tests (e.g., playbacks of smartphone ringing tones and observation of participants, e.g., how they react), as well as by prospective studies.

CONCLUSION

In conclusion, this study presented the relationships between smartphone addiction and chronotype in adolescents. As a main result, chronotype was the best predictor of smartphone addiction proneness for younger adolescents and the second important predictor of smartphone addiction for older adolescents. Therefore, this variable is more important than age, sleep duration, and midpoint of sleep. Evening types are more prone to smartphone addiction. The second result is that gender is an important predictor for smartphone addiction. Girls are more prone to become smartphone addicted. When sleep duration on weekdays was longer, the behavior of smartphone addiction was lower, setting an impact on education. Probably, sleep education programs might focus on the aspect of smartphone usage.

Funding sources: No financial support was received for this study.

Authors' contribution: All authors designed the study; KM and LW carried out the data collection and data input; CR

and ED carried out the statistical calculation; all authors discussed the results; CR, ED, and MBH wrote this manuscript.

Conflict of interest: The authors declare no conflict of interest.

Acknowledgements: We would like to thank the principals, teachers, parents, and adolescents for their participation in this study. Especially, the Konrad-von-Dürn-Realschule Walldürrn (Odenwald), Realschule Weingarten (Bodensee-Oberschwaben), Gutenbergschule Karlsruhe (Haupt- und Werkrealschule), Albert-Schweitzer-Schule in Villingen-Schwenningen, and Hauptschule Maßbruch in Nordrhein-Westfalen.

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APPENDIX

Appendix 1. German translation of the SAPS (Kim et al., 2014)

Gib bitte an, inwieweit die folgenden Aussagen auf dich zutreffen.
Bitte mache in jeder Zeile nur ein Kreuz.

1. Meine Schulnoten verschlechtern sich aufgrund von exzessivem Smartphonegebrauch.
2. Ich tue mich schwer damit, das zu tun, was ich geplant habe (lernen, Hausaufgaben machen, zur Nachhilfe gehen), weil ich mein Smartphone benutze.
3. Andere Leute äußern sich häufig über meinen übermäßigen Smartphonegebrauch.
4. Meine Familie oder Freunde beschweren sich, dass ich mein Smartphone zu viel benutze.
5. Mein Smartphone lenkt mich vom Lernen ab.[a]
6. Mein Smartphone zu benutzen, macht mir mehr Spaß als meine Zeit mit Familie oder Freunden zu verbringen.
7. Wenn ich mein Smartphone nicht benutzen kann, fühle ich mich von der kompletten Welt abgeschottet.
8. Es würde mich ärgern, wenn man mir nicht erlauben würde, mein Smartphone zu benutzen.
9. Ich werde unruhig und nervös, wenn ich ohne mein Smartphone bin.
10. Ich bin nicht unruhig, wenn ich ohne Smartphone bin.[b]
11. Ich kriege Panik, wenn ich mein Smartphone nicht benutzen kann.
12. Ich habe versucht mein Smartphone weniger zu benutzen, aber es gelingt mir nicht.
13. Ich habe die Zeit, in der ich mein Smartphone benutze, im Griff.[b]
14. Sogar wenn ich denke ich sollte aufhören, benutze ich mein Smartphone trotzdem zu viel.
15. Viel Zeit mit meinem Smartphone zu verbringen ist für mich zur Gewohnheit geworden.

[a]Item in the original version negatively worded.
[b]Reverse coded.

Appendix 2. German translation of the SAS (Kwon, Kim, et al., 2013)

Bitte gib an, wie oft die folgenden Aussagen zutreffen, bezogen auf deine Selbsteinschätzung!
Bitte mache in jeder Zeile nur ein Kreuz.

1. Meine geplante Arbeit wird aufgrund der Benutzung des Smartphones nicht erledigt.
2. Während ich in der Klasse Aufgaben erledige oder arbeite, fällt es mir schwer mich zu konzentrieren, da ich mein Smartphone benutze.
3. Ich fühle Schmerzen in den Handgelenken oder im Genick, wenn ich mein Smartphone benutze.
4. Ich könnte mir ein Leben ohne Smartphone nicht vorstellen.
5. Wenn ich mein Smartphone nicht bei mir trage, werde ich ungeduldig und fühle mich unruhig.
6. Ich denke ständig an mein Smartphone, selbst wenn ich es nicht benutze.
7. Selbst wenn mein Alltag schon sehr durch meinen Smartphone-Gebrauch beeinflusst ist, werde ich nicht aufhören es zu benutzen.
8. Ich schaue ständig auf mein Smartphone, damit ich z.B. keine Gespräche zwischen anderen Leuten auf Twitter oder Facebook verpasse.
9. Ich benutze mein Smartphone länger als beabsichtigt.
10. Die Leute um mich herum teilen mir mit, dass ich mein Smartphone zu oft benutze.