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Abstract

Over the last decade, research into 'addictive technological behaviors' has substantially increased. Research has also demonstrated strong associations between addictive use of technology and comorbid psychiatric disorders. In the present study, 23,533 adults (mean age 35.8 years, ranging from 16 to 88 years) participated in an online cross-sectional survey examining whether demographic variables, symptoms of Attention Deficit/Hyperactivity Disorder (ADHD), Obsessive-Compulsive Disorder (OCD), anxiety, and depression could explain variance in addictive use (i.e., compulsive and excessive use associated with negative outcomes) of two types of modern online technologies: social media and video games. Correlations between symptoms of addictive technology use and mental disorder symptoms were all positive and significant, including the weak interrelationship between the two addictive technological behaviors. Age appeared to be inversely related to the addictive use of these technologies. Being male was significantly associated with addictive use of video games, whereas being female was significantly associated with addictive use of social media. Being single was positively related to both addictive social networking and video gaming. Hierarchical regression analyses showed that demographic factors explained between 11% and 12% of the variance in addictive technology use. The mental health variables explained between 7% and 15% of the variance. The study significantly adds to our understanding of mental health symptoms and their role in addictive use of modern technology, and suggests that the concept of Internet use disorder (i.e., 'Internet addiction') as a unified construct is not warranted.

Keywords: ADHD; Anxiety; Depression; Internet Gaming Disorder; Online social networking addiction

The use of modern online technology such as social media and video games has become an increasingly studied area over the last decade (Cheng & Li, 2014; Kuss & Griffiths, 2012; Kuss, Griffiths, Karila, & Billieux, 2014; Mazzoni & Iannone, 2014; Ryan, Chester, Reece, & Xenos, 2014; Young, 2015). Although this technology has been associated with many positive attributes such as entertainment, business facilitation, cognitive skill development, social capital and social interaction, concerns have been raised regarding excessive use, in particular, the potential of users becoming 'addicted' to using such technologies (Andreassen, 2015; Kuss et al., 2014). In this context addictive use is characterized by "being overly concerned about online activities, driven by an uncontrollable motivation to perform the behavior, and devoting so much time and effort to it that it impairs other important life areas" (Andreassen & Pallesen, 2014, p. 4054).

The notion that addictive behaviors can only include behaviors that involve the ingestion of a psychoactive substance has been superseded by empirical evidence demonstrating that individuals can become addicted to specific behaviors. The latest edition of the *Diagnostic and Statistical Manual of Mental Disorders* formally recognized *Gambling Disorder* as a behavioral addiction. Moreover, despite limited evidence regarding its etiology and course, Internet Gaming Disorder was listed as another potential behavioral addiction in Section 3 of the DSM-5 (American Psychiatric Association, 2013).

Although the evidence is still limited, a growing number of studies emphasized that addictive use of video games, along with other behavioral addictions, is characterized by addiction criteria, such as *salience* (preoccupation with the behavior), *mood modification* (performing the behavior to relieve/reduce aversive emotional states), *tolerance* (increasing engagement in the behavior over time in order to attain the initial mood modifying effects), *withdrawal* (experiencing psychological and physical discomfort when the behavior is reduced or prohibited), *conflict* (putting off or neglecting social, recreational, work,

educational, household, and/or other activities as well as one's own and others' needs because of the behavior), and *relapse* (unsuccessfully attempting to cut down or control the behavior) (Griffiths, 2005; Kuss et al., 2014; Ko, 2014). However, to date, studies assessing behavioral and neurobiological similarities between substance-related addictions and addictive use of social media are scarce (Andreassen, 2015; Griffiths, Kuss, & Demetrovics, 2014).

A number of studies have reported positive interrelationships between different addictive technological behaviors (Andreassen et al., 2013; Chiu, Hong, & Chiu, 2013; Király et al., 2014; Salehan & Negahban, 2013; Sussman et al., 2014), suggesting some underlying common risk factors (Grant, Potenza, Weinstein, & Gorelick, 2010; Robbins & Clark, 2015). Based on this previous research and evidence of common underlying risk factors (e.g., impulsive personality, comorbid psychopathology), in the present study it is expected there will be a positive association between symptoms of addictive video gaming and social networking (Hypothesis 1).

Although anybody who has access to the Internet (irrespective of age, gender, or social status) can potentially develop an addictive use of technology, there are specific demographic factors that tend to increase the risk (Kuss et al., 2014), such as young age (e.g., Andreassen, 2015; Kuss & Griffiths, 2012; Kuss et al., 2014; Van Deursen, Bolle, Hegner, & Kommers, 2015). A large part of the social culture of the younger generation involves communicating via digital media, whether it is email, social media, or texting (Allen, Ryan, Gray, Mclnerney, & Waters, 2014; Griffiths, 2010).

Research has also demonstrated that both men and women can become 'addicted' to technology, but males and females use different online activities (Kuss et al., 2014). Males are more likely to become 'addicted' to online video gaming, cyber-pornography, and online gambling, while females tend to develop addictive use of social media, texting, and online shopping (Andreassen et al., 2013; Chiu et al., 2013; Davenport, Houston, & Griffiths, 2012;

Durkee et al., 2012; Ferguson, Coulson, & Barnett, 2011; Kuss et al., 2014; Van Deursen et al., 2015; Maraz et al., 2015). Studies have also suggested that individuals not in relationships are more at risk for developing addictive technological behaviors (Kuss et al., 2014). Given these previous findings, in the present study it is expected that younger and single females will score higher on screens assessing symptoms of addictive online social networking, whereas younger and single males will show elevated scores on screens assessing symptoms of addictive video gaming (Hypothesis 2).

Previous research has consistently demonstrated that Attention Deficit/Hyperactivity Disorder (ADHD) is a risk factor for substance and behavioral addictions (Ginsberg, Quintero, Anand, Casillas, & Upadlya, 2014; Kooji et al., 2010). Individuals with ADHD may become addicted to substances or behaviors in an attempt to calm their restless thoughts and behaviors (e.g., to self-medicate) (Ginsberg et al., 2014) and/or because they have impaired impulse control (Lopez, Dauvilliers, Jaussent, Billieux, & Bayard, 2015).

There is a growing body of empirical research suggesting that ADHD and problematic video gaming as well as addictive use of the Internet often co-occur (Carli et al., 2013; Finlay & Furnell, 2014; Ho et al., 2014; Kuss et al., 2014; Sariyska, Reuter, Lachmann, & Montag, 2015; Yen, Ko, Yen, Wu, & Yang, 2007; Yen, Yen, Chen, Tang, & Ko, 2009). However, to date, no study has investigated the relationships between ADHD and addictive online social networking. Such technologies provide an ideal outlet for constant fidgeting and touching, and frequent shifts between activities when bored or feeling inattentive – all typical ADHD behaviors (American Psychiatric Association, 2013). Taken together, it is expected that ADHD symptoms will be positively related to the addictive technological behaviors examined in the present study (Hypothesis 3).

Obsessive-Compulsive Disorder (OCD) is another psychiatric disorder that may increase the likelihood of developing an addictive behavior (Kessler, Chiu, Demler, &

Walters, 2005; Weinstein, Feder, Rosenberg, & Dannon, 2014). A significant number of individuals with OCD also meet the criteria for a substance addiction (Kessler, Berglund et al., 2005). In specific cases, the addictive behaviors displayed in people presenting OCD proneness can be either conceptualized as a coping/escape mechanism for OCD symptoms, or as an OCD-related behavior that eventually becomes addictive (Lieb, 2015).

Previous studies have empirically investigated the relationship between OCD and excessive technology use (Carli et al., 2013; Lee, Cheng, Lin, & Cheng, 2014; Lee, Kim, Lee, & Yook, 2014; Dong, Lu, Zhou, & Zhao, 2011; Santos, Nardi, & King, 2015), showing common factors involved in both OCD and Internet-related disorders. In particular, both disorders are characterized by high impulsivity and poor inhibitory control (e.g., Littel et al., 2012; Zermatten & Van der Linden, 2008). Of note, these factors are also central in the etiology of ADHD (Groman, James, & Jentsch, 2009). OCD is also often associated with a strong need for control (Lee, Cheng et al., 2014). The sheer amount of information that can be accessed via modern technological devices may cause some individuals to develop a fear of missing out, which may facilitate and enhance excessive checking and obsessing over the use of such devices (Lee, Cheng et al., 2014; Lee, Kim et al., 2014; Przybylski, Murayama, DeHaan, & Gladwell, 2013). Given these findings, it is expected that OCD symptoms relate to addictive use of social media, and may play a lesser role in addictive use of video games in the present study (Hypothesis 4).

Further psychiatric disorders, and in particular emotional disorders, such as anxiety and depression, also increase the risk of developing an addiction (Kessler, Chiu et al., 2005). Excessively engaging in certain behaviors may help ease the feelings of anxiety or depression, but may also cause or exacerbate symptoms of anxiety and depression due to their negative consequences (Lieb, 2015). Accordingly, a number of empirical studies have highlighted the relationship between anxiety, depression, and symptoms of addictive technological behaviors

(e.g., Brunborg, Mentzoni, & Frøyland, 2014; Carli et al., 2013; Cho, Sung, Shin, Lim, & Shin, 2012; Ho et al., 2014; Király et al., 2015; Kuss et al., 2014; Lee, Cheng et al., 2014; Lee, Kim et al., 2014; Lepp, Barkley, & Karpinski, 2014; Wei, Chen, Huang, & Bai, 2012; Weinstein, Dorani, Elhadif, Bukovza, & Yarmulnin, 2015). Moreover, longitudinal and clinical data also evidenced that pathological video game use can be promoted by pre-existent emotional disorders and thus can be considered a secondary disorder in some individuals (Gentile et al., 2011; Kuss & Griffiths, 2015). It is expected that there will be a positive association between anxiety, depression, and symptoms of the two addictive technological behaviors examined in the present study (Hypothesis 5).

Against this empirical background, data were analyzed from one of the largest surveys ever undertaken in this area. This increases statistical power and thus increases the possibility to identify socio-demographic and psychopathological factors that are associated with addictive use of two specific and widely used technologies: social media and video games (Hypotheses 1-5). Although previous empirical research has demonstrated links between addictive technological behaviors and certain demographic variables and symptoms of psychiatric disorders (see Kuss et al., 2014, for a review), there is a lack of evidence showing associations with regard to specific activities within the same sample. Conducting such a study is necessary as different risk factors may be in play concerning different types of addictive technology use (Kuss et al., 2014; Gentile et al., 2011). In addition, the present study considered the conjoint role of several risk factors (demographics, symptoms of ADHD, OCD, anxiety, and depression) in multivariate analyses in a large sample, making a unique and substantial contribution to this field of research.

Methods

Procedure

An online open-access link to a web-based cross-sectional survey focusing on several addictive behaviors was published in feature articles in the online edition of five different nationwide Norwegian newspapers during March and May 2014. Respondents were asked to click on the link to access the survey. Information about the study was provided on the first page, and respondents were given immediate feedback on their risk of 'addiction' scores at the end of the survey, which was viewed as an incentive to participate by the research team based on previous studies (see Appendix A). Participants' responses were stored on a server administered by a company with special expertise for this purpose (i.e., *SurveyXact*). After one week of study initiation, all collected data were sent to the research team ($N = 41,970$).

In total, 23,533 individuals completed the survey. Respondents that only clicked on the link or provided a limited number of answers were deleted from the data file ($n = 18,437$). All data were collected anonymously, no intervention was conducted, and the study was carried out in accordance with the Helsinki Convention and the Norwegian Health Research Act. No material/monetary incentive, other than the aforementioned feedback, was provided.

Sample

The sample comprised 23,533 respondents, with a mean age of 35.8 years ($SD = 13.3$), ranging from 16 to 88 years of age. In terms of included age groups, 40.7%, 35.0%, 19.8% and 4.5% of the sample were between 16-30 years, 31-45 years, 46-60 years, and 61-88 years old, respectively. The corresponding percentages of the Norwegian population aged 16-88 years in 2014 were 25.0%, 26.3%, 24.5% and 24.2%, respectively. This difference is statistically significant ($\chi^2 = 6974.5$, df = 3, $p < .0001$). The sample comprised 15,299 females (65.0%) and 8,234 males (35.0%), and also significantly differed from the corresponding population percentages (49.7% vs.50.3%; $\chi^2 = 2206.2$, df = 1, $p < .0001$). In terms of marital status, 15,373 (65.3%) were currently in a relationship (married, common law partner, partner, boyfriend or girlfriend) and 8,160 (34.7%) were not (single, divorced, separated,

widow or widower). Regarding educational level, 2,350 had completed compulsory school (10.0%), 5,949 had completed high school (25.3%), 3,989 had completed vocational school (17.0%), 7,630 had a Bachelor's degree (32.4%), 3,343 had a Master's degree (14.2%), and 272 had a PhD (1.2%). Detailed data on marital status and educational level were not available on the population level, thus precluding comparison with the data collected from the present sample.

Instruments

The *Bergen Social Media Addiction Scale (BSMAS)* is an adaptation of the Bergen Facebook Addiction Scale (BFAS) (Andreassen, Torsheim, Brunborg, & Pallesen, 2012), and contains six items reflecting core addiction elements (Griffiths, 2005). Each item is answered on a 5-point Likert scale ranging from *very rarely* (1) to *very often* (5), thus yielding a composite score from 6 to 30, concerning experiences during the past year (e.g., "How often during the last year have you tried to cut down on the use of social media without success?"). A one-factor solution has been found for the BFAS (Andreassen et al., 2012). The BFAS has been translated into several languages and has shown acceptable psychometric properties across studies (e.g., Andreassen et al., 2012; Andreassen et al., 2013; Phanasathit, Manwong, Hanprathet, Khumsri, & Yingyeun, 2015; Wang, Ho, Chan, & Tse, 2015). The adaptation (BSMAS) involves replacing the word *Facebook* with *social media* only, and social media being defined as "*Facebook, Twitter, Instagram* and the like" in the instructions to participants. Internal consistency of the BSMAS was good in the present study (Cronbach's alpha = .88). Appendix B provides a full list of the items in the scale.

The *Game Addiction Scale (GAS)* comprises seven items assessing symptoms of addictive video gaming (Lemmens, Valkenburg, & Peter, 2009). The GAS was originally developed and tested in two independent Dutch adolescent samples, where evidence for a one-factor solution was found. Although the GAS was initially designed to assess symptoms

of gaming addiction among adolescents, it is also suitable for – and has been administered across – individuals across a wide age span (14-90 years) (Festl, Scharkow, & Quandt, 2013). All items are answered on a 5-point scale ranging from *never* (1) to *very often* (5), yielding an overall score from 7 to 35. Items concern experiences during the past six months (e.g., "How often during the last 6 months did you play games to forget about real life?"). The scale was originally validated against measures of constructs (such as time spent gaming, loneliness, life satisfaction, aggression and social competence) that gaming was expected to correlate with (Lemmens et al., 2009). Based on the pattern of correlations in the original and later studies, a review of scales developed to assess addictive video gaming suggests that the validity of the GAS is good (King, Haagsma, Delfabbro, Gradisar, & Griffiths, 2013). In the present study, the internal consistency of the GAS was good (Cronbach's alpha = .89). See Appendix C for a list of items and instructions used in the present study.

The *Adult ADHD Self-Report Scale (ASRS-Version 1.1)* comprises 18 questions reflecting symptoms of ADHD in adults (Kessler, Adler et al., 2005), and is based on the DSM-IV criteria for ADHD (American Psychiatric Association, 1994). All items are answered on a 5-point Likert scale ranging from *never* (1) to *very often* (5), yielding an overall score ranging from 18 to 90 (e.g., "How often do you feel overly active and compelled to do things, like you were driven by a motor?" or "How often are you distracted by activity or noise around you?"). The ASRS-1.1 has shown good psychometric properties across studies (e.g., Glind et al., 2013; Hines, King, & Curry, 2012). Internal consistency for the ASRS-v1.1 was good in the present study (Cronbach's alpha = .87).

The *Obsession-Compulsive Inventory-Revised (OCI-R)* comprises 18 items assessing six common OCD symptoms (Foa et al., 2002). These include *checking* (e.g., "I check things more often than necessary"), *ordering* (e.g., "I get upset if objects are not arranged properly"), *neutralizing* (e.g., "I feel compelled to count while I am doing things"), *washing* (e.g., "I find

it difficult to touch an object when I know it has been touched by strangers or certain people"), *obsessing* (e.g., "I find it difficult to control my own thoughts"), and *hoarding* (e.g., "I have saved up so many things that they get in the way"). All items are answered on a 5-point Likert scale from *not at all* (1) to *extremely* (5). High scores indicate the individual is bothered by their OCD symptoms. Contemporary psychometric evaluations of the OCI-R suggest it to be a reliable and valid measure (e.g., Wooton et al., 2015). A composite score was calculated based on all items and Cronbach's alpha for OCI-R in the present study was .87, indicating good internal consistency.

Finally, the *Hospital Anxiety and Depression Scale (HADS)* is a 14-item two-factor scale that measures non-vegetative symptoms of anxiety and depression (Bjelland, Dahl, Haug, & Neckelmann, 2002; Zigmond & Snaith, 1983). Seven items assess anxiety symptoms (e.g., "I feel tense or wound up"), and seven items assess symptoms of depression (e.g., "I feel as if I am slowed down"). All items are answered along a 4-point frequency scale ranging from 0 to 3. The HADS has shown good validity in clinical populations as well as in the general population (e.g., Bjelland et al., 2002). Cronbach's alphas for HADS-Anxiety and HADS-Depression in the present study were .82 and .75, suggesting good and acceptable consistency, respectively.

Data analytic strategy

Descriptive statistics in terms of internal consistencies, means, and standard deviations were calculated. Pearson product-moment correlation coefficients were calculated in order to assess the interrelationships between each pair of the study's variables. Two linear hierarchical regression analyses were then performed with the respective addictive technological behaviors (social networking, video game playing) as the dependent variables. Basic demographic variables (age [entered as a continuous variable], gender, education level, relationship status) were entered in the first step of the regression analyses. Educational level

was dummy coded and the largest group (Bachelor's degree) comprised the reference category. In the second step, symptoms of ADHD, OCD, anxiety, and depression were entered. Preliminary analyses ensured that there was no violation of the assumptions of normality, linearity, multicollinerarity (tolerance for all predictors was over .10 and VIF under 5) and homoscedasticity.

Results

Table 1 presents mean scores and standard deviations for each of the study's variables and their correlation coefficients. The two addictive technological behaviors were significantly and positively correlated ($r = .13$), and showed significant and positive zero-order correlations with all of the other variables in the present study. It is worth noting that addictive social networking showed moderately high correlations with measures of ADHD ($r = .41$), anxiety ($r = .34$), and OCD ($r = .33$), respectively. Addictive video gaming overall showed the same correlational pattern with the different symptom scales, although the coefficients, except for depression, were somewhat lower for addictive use of video games (ranging from .17 to .27) compared to addictive use of social media (ranging from .19 to .41).

The results of the regression analysis for addictive use of social media are presented in Table 2. Age, gender, marital status, and educational level were entered in Step 1, explaining 11.6% of the variance in addictive social networking ($F_{8, 23524} = 385.98$, $p < .001$). ADHD, OCD, anxiety, and depression entered in Step 2 explained a further 14.9% of the variance, $\Delta R^2 = .149$, $\Delta F_{4, 23520} = 1192.09$, $p < .001$. The total variance explained by the model as a whole was 26.4%, $F_{12, 23520} = 705.99$, $p < .001$. In the final model, age ($\beta = -.154$), Master's degree ($\beta = -.023$), PhD degree ($\beta = -.016$), and depression ($\beta = -.018$) were negatively associated with addictive social networking, while gender (female) ($\beta = .180$), marital status (being single) ($\beta = .055$), ADHD ($\beta = .268$), OCD ($\beta = .147$), and anxiety ($\beta = .074$) were all positively associated with addictive use of social media.

Table 2 also shows the regression results for addictive use of video games. The analysis revealed that the independent variables in Step 1 explained 11.4% of the variance ($F_{8, 23524} = 376.66$, $p < .001$). ADHD, OCD, anxiety, and depression entered in Step 2 explained an additional 6.6% of the variance ($\Delta R^2 = .066$, $\Delta F_{4, 23520} = 469.76$, $p < .001$). Overall, the independent variables explained 17.9% of the variance ($F_{12, 23520} = 427.71$, $p < .001$). Negative significant independent variables in Step 2 were age ($\beta = -.166$), gender (female) ($\beta = -.171$), Master's degree ($\beta = -.020$), and anxiety ($\beta = -.065$). The results from the final step further showed that marital status (being single) ($\beta = .013$), primary school ($\beta = .072$), high school ($\beta = .051$), ADHD ($\beta = .176$), OCD ($\beta = .071$), and depression ($\beta = .138$) were positively associated with addictive video gaming.

Discussion

Taken together, ADHD, OCD, anxiety, and depression contributed significantly to the variance in addictive use of social media (15%) and video games (7%) – after controlling for age, gender, relationship status, and education level. Demographic variables alone explained between 11% and 12% of the variance in the hierarchical multiple regression models. The findings also suggest that the two investigated addictive uses of technology share a number of characteristics.

Addictive use of technology

The two addictive technological behaviors studied here are characterized on the one hand by common risk factors, such as young age, but also by a degree of uniqueness, reflected by specific non-shared risk factors, such as gender. This view is supported by the significant but rather low correlation between video gaming and social media use assessed in the current study (e.g., Andreassen et al., 2013; Chiu et al., 2013; Khang, Kim, & Kim, 2013; Salehan & Negahban, 2013), and thus provided support for the first hypothesis.

The most likely explanation for the low correlation between the two addictive online behaviors is that social affiliation-related motives are a key aspect of social networking behavior, whereas online gaming is likely driven by different motives, such as personal achievement, immersion, and escapism (Billieux et al., 2013, 2015; Király et al., 2015; Kuss, Louws, & Wiers, 2012) – although it should be noted that many people now play games via social networking sites (Griffiths, 2014).

Demographic factors

The inverse relationship between age and the two addictive technological behaviors is also in line with the second hypothesis (H2). This may reflect a cohort effect given that younger generations have been exposed to more of these technologies during their formative years than older generations. An alternative interpretation is that people use less of these technologies as they age, in line with a progressive shift from using selection developmental tasks (i.e., developing personal goals, which is typical of adolescence) to using optimization tasks (i.e., to achieve already set goals, which is typical of adult age) (Freund & Baltes, 1998).

As expected, being female was positively associated with addictive social networking, whereas being male was associated with addictive video gaming. This may reflect a female proneness towards activities that involve social interaction and co-operation, and a male orientation towards (often solitary) activities that feature "aggressive" and competitive content (e.g., fighting and winning against other players) (Andreassen et al., 2013; Kuss et al., 2014; Kuss & Griffiths, 2015).

Not being in a relationship was positively associated with both addictive behaviors, thus supporting Hypothesis 2. For single people, social networking may represent a more important social function and an arena for meeting potential partners relative to individuals who are in a relationship (Andreassen, Torsheim, & Pallesen, 2014). Loneliness has been

found to predict (and also to be a consequence of) addictive video game use (Lemmens, Valkenburg, & Peter, 2011).

Attention-Deficit/Hyperactivity Disorder

As hypothesized, ADHD was positively associated with the addictive technological behaviors. These findings are in line with established empirical findings relating to the co-occurrence of ADHD and addictions more generally (Ginsberg et al., 2014; Kooji et al., 2010). The association between ADHD and addictive social networking has not been tested explicitly in previous research, and is thus reported for the first time in the present study. Moreover, ADHD explained more of the variance in addictive social networking ($\beta = .268$) compared to video gaming ($\beta = .176$). An explanation for the relationship between ADHD and addictive social networking in particular (as the activity is often accessed via mobile phones) may be that beeping or vibrating phones, constant updates from hundreds of people, and the inherent attributes of these platforms drive vulnerable individuals (i.e., those that are easily distracted and/or impulsive) to use social networks excessively/compulsively (Finlay & Furnell, 2014; Zajdel et al., 2012; Zheng et al., 2014) as they may function as self-medication.

Obsessive-Compulsive Disorder

OCD was positively related to addictive use of both video games ($\beta = .071$) and social media ($\beta = .147$). It was expected that OCD symptoms would be more associated with addictive social networking (Hypothesis 4). The hypothesis was based on the assumption that individuals overusing social media may experience a constant urge to check their social networks for new information and updates – due to the fear of missing out (Andreassen, 2015; Lee, Chang et al., 2014; Lee, Kim et al., 2014; Przybylski et al., 2013; Weinstein et al., 2014). The findings of the present study supported this assumption.

Anxiety and depression

Both anxiety and depression were positively related to a proneness to addictive technology use in the correlation analysis. After controlling for demographic factors, ADHD, and OCD in the regression analyses, the associations changed both in magnitude and direction. Anxiety contributed positively to addictive social networking, but negatively to addictive video game playing. For depression, the associations were reversed. However, the variance explained by depression in addictive social networking ($\beta = -.018$) was small, compared to addictive video gaming ($\beta = .138$). These findings may indicate that addictive social networkers are more anxious than depressed, while addictive gamers may be more depressed than anxious. This is partly in line with previous research and the hypotheses (Kuss et al., 2014; Lee, Kim et al., 2014; Weinstein et al., 2015) as anxiety, depression, and addictions usually co-vary (Grant et al., 2010; Kessler, Chiu et al., 2005; Lieb, 2015).

The present findings may suggest that anxious people (e.g., social phobia) may have difficulties communicating face-to-face, and therefore may prefer online over real life communication (Andreassen et al., 2013; Cho et al., 2012; Kuss et al., 2014; Lee, Chang et al., 2014; Lee, Kim et al., 2014; Wei et al., 2012; Weinstein et al., 2014, 2015). The fact that depression often entails social withdrawal (American Psychiatric Association, 2013) may explain why symptoms of depression were slightly negatively associated with addictive social networking in the regression analysis.

The association between addictive video game playing and depression was expected (Brunborg et al., 2014; Furgerson et al., 2011). Gaming may be an escape strategy to alleviate depression (Billieux et al., 2015; Kuss & Griffiths, 2012; Kuss et al., 2014; Weinstein et al., 2014). This may also reflect that addictive video gamers find it difficult to engage socially (e.g., experiencing autistic traits), thus escaping into online gaming worlds with virtual people rather than real people (Carli et al., 2013; Cho et al., 2012; Kuss et al., 2014; Wei et al., 2012; Weinstein et al., 2014). Consequently, they may become socially withdrawn. Being socially

withdrawn and operating in a predictive world of games may explain why anxiety was inversely related to addictive video gaming in the regression analysis (Kuss et al., 2014).

Strengths and limitations

Due to the very large sample size and statistical power of the analyses, some trivial relationships may have turned out to be significant. Another limitation concerns the cross-sectional design that prevented any conclusions concerning causality in the significant associations. Consequently, the identified relationships may very well be the other way around or go in both directions (Kuss et al., 2014; Lieb, 2015). This should be further investigated using longitudinal study designs.

One specific limitation of the present study involved the web-based convenience sampling methodology (Kuss et al., 2014). Compared to the general population, a relatively high number of young people and females participated in the present study. Also, potential participants were informed of receiving immediate feedback on their 'addiction' risk test score after survey completion, and this might have led to an oversampling of individuals worried about their technology habits. In general, self-selection in online surveys has been found to negatively affect representativeness (e.g., Khazaal et al., 2014). Overall, this puts restrictions on the generalizability of the findings to other populations – hence making it inappropriate to estimate specific population parameters both in and outside of Norway. Also, no controls for multiple entries were made in this survey. However, the length of the survey (over 225 items) would have conceivably limited the willingness and motivation to complete the survey more than once. The dataset was also analyzed for duplicate responses and none were identified. Despite these limitations, the data in the present study are considered suitable for estimations of relationships between characteristics and variables under investigation (Cozby, 2005). Both dependent variables were analyzed as continuous variables. Still, according to suggested cut-offs, a dichotomized approach could have been used, which in the

present sample would have classified 13.5% as problematic social media users (Andreassen et al., 2012) and 7.0% as problematic video gamers (Lemmens et al., 2009), respectively.

Most empirical studies into addictive technological behaviors rely on small and/or non-representative samples, often surveying college and university students (Andreassen, 2015; Ryan et al., 2014), with few exceptions (e.g., Koronczai et al., 2011). The present study enhances previous research given its broad and large sample size, providing a high level of statistical power. Another asset of this study is that the survey was administered in nationwide newspapers (not local ones). The five utilized newspapers are also known for having very diverse reader groups. Hence, the sample probably represents a wide range of Norwegian people. It should also be noted that compared to citizens in other countries, Norwegians are heavy newspaper readers (World Association of Newspapers and News Publishers, 2011) and have high Internet access rates (about 95% of the Norwegian population have access to the Internet) (International Telecommunications Union, 2013).

The present study is the first, as far as the present authors are aware, that empirically investigates the association between ADHD and addictive social networking. The present combination of dependent and independent variables also represents a novelty in the field. Furthermore, this study used a generic measure of addictive use of social media, as opposed to focusing on addictive *Facebook* use only, which has recently been called for by scholars in this field (Griffiths et al., 2014).

Conclusions

The present study suggests that symptoms of underlying psychiatric disorders are associated with addictive social networking and video gaming. Addictive use of social media was positively related with being female and single, lower age, ADHD, OCD, anxiety, and lower levels of depression. Addictive use of video games was positively associated with being male and single, lower age, ADHD, OCD, depression, and inversely related with symptoms of

anxiety. This implies that adolescents and young adults with some of these characteristics could be targeted regarding preventing the development of addictive online participation.

Given the finding that the addictive online behaviors had a low intercorrelation and were partly associated with different variables, suggests that the concept of Internet use disorder (i.e., 'Internet addiction') as a unified construct is not warranted. This is also supported by the findings of a recent large nationally representative survey demonstrating that problematic Internet use and problematic gaming are not the same (i.e., Király et al., 2014). However, further studies are required to better identify the commonalities among and dissimilarities between addictive technology use, along with their course (e.g., fluctuation, stability, natural recovery) and function. These studies will have to be conducted using representative samples and longitudinal designs in this under-studied field.

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Table 1

Descriptive data and correlation coefficients between study variables (N = 23,533)

Variables	1	2	3	4	5	6
1 Addictive Social Networking	--					
2 Addictive Video Gaming	.13**	--				
3 ADHD	.41**	.27**	--			
4 OCD	.33**	.22**	.46**	--		
5 Anxiety	.34**	.17**	.55**	.49**	--	
6 Depression	.19**	.24**	.39**	.37**	.55**	--
M	10.30	9.48	43.96	29.23	6.64	4.10
SD	4.77	4.21	9.71	9.17	3.92	3.20
Range	6-30	7-35	18-90	18-90	0-21	0-21
Alpha	.88	.89	.87	.87	.82	.75
Items	6	7	18	18	7	7

Note. M = mean, SD = standard deviation, ADHD = Attention Deficit/Hyperactivity Disorder, OCD = Obsessive-Compulsive Disorder.

** $p < .01$.

Table 2

Results from the hierarchical regression analyses where age, gender, marital status, educational level, ADHD, OCD, anxiety, and depression

were regressed upon the addictive technological behavior scores (N = 23,533)

	Addictive Social Networking					Addictive Video Gaming				
	B	**SE**	**β**	**t**	**ΔR²**	**B**	**SE**	**β**	**t**	**ΔR²**
Step 1					.116***					.114***
Age	- 0.087	.002	- .243	- 37.022***		- 0.065	.002	- .206	- 31.247***	
Gender[a]	1.972	.062	.197	31.792***		- 1.652	.055	- .187	- 30.080***	
Marital status[b]	0.608	.064	.061	9.553***		0.228	.056	.026	4.038***	
Education[c]										
Primary school	0.742	.109	.047	6.782***		1.417	.097	.101	14.630***	
High school	0.081	.079	.007	1.026		0.630	.070	.065	8.973***	
Vocational school	- 0.034	.089	- .003	- 0.379		0.219	.078	.019	2.793**	
Master's degree	- 0.404	.093	- .030	- 4.346***		- 0.339	.082	- .028	- 4.109***	
PhD degree	- 0.715	.277	- .016	- 2.580**		- 0.160	.245	- .004	- 0.654	
Step 2					.149***					.066***

	B	SE	β	t		B	SE	β	t
Age	- 0.055	.002	- .154	- 25.011***		- 0.053	.002	- .166	- 25.507***
Gender[a]	1.802	.058	.181	30.970***		- 1.514	.054	- .171	- 27.844***
Marital status[b]	0.553	.058	.055	9.497***		0.118	.054	.013	2.172*
Education[c]									
Primary school	0.189	.101	.012	1.881		1.013	.094	.072	10.772***
High school	- 0.091	.073	- .008	- 1.259		0.492	.068	.051	7.251***
Vocational school	- 0.124	.081	- .010	- 1.536		0.122	.076	.011	1.614
Master's degree	- 0.311	.085	- .023	- 3.664***		- 0.240	.079	- 0.20	- 3.020**
PhD degree	- 0.693	.253	- .016	- 2.742**		- 0.115	.236	- .003	- 0.489
ADHD	0.131	.003	.268	37.950***		0.076	.003	.176	23.600***
OCD	0.077	.004	.147	21.841***		0.033	.003	.071	9.939***
Anxiety	0.090	.010	.074	9.372***		- 0.070	.009	- .065	- 7.821***
Depression	- 0.027	.010	- .018	- 2.643**		0.182	.010	.138	18.799***

Note. B = unstandardized regression coefficient, SE = standard error, β = standardized regression coefficient, t = t-test statistic, ΔR^2 = change in variance,

ADHD = Attention Deficit/Hyperactivity Disorder, OCD = Obsessive-Compulsive Disorder.

[a] 1 = male, 2 = female. [b] 1 = in a relationship, 2 = not in a relationship. [c] Bachelor's degree comprises the reference category.

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

Appendix A

Introductory text to the online study survey

This survey is conducted by researchers at the University of Bergen. The purpose of the survey is to assess excessive behaviors and factors that may be related to excessive behaviors. Questions related to symptoms of impaired health are also asked. The collected data will be used for research purposes only. All your answers are strictly anonymous and confidential, thus they cannot be traced back to any specific individual. You must be 16 years or older in order to participate. You will get feedback on your own test result regarding your risk of being addicted to work, computer game playing, online social networking, exercise, mobile phone, and shopping at the end of the survey.

Appendix B

Bergen Social Media Addiction Scale (BSMAS) (Andreassen et al., 2012)

Instruction: Below you find some questions about your relationship to and use of social media (*Facebook, Twitter, Instagram* and the like). Choose the response alternative for each question that best describes you.

How often during the last year have you...

	Very rarely	**Rarely**	**Sometimes**	**Often**	**Very often**
..spent a lot of time thinking about social media or planned use of social media?[1]	❑	❑	❑	❑	❑
..felt an urge to use social media more and more?[2]	❑	❑	❑	❑	❑
..used social media in order to forget about personal problems?[3]	❑	❑	❑	❑	❑
..tried to cut down on the use of social media without success?[4]	❑	❑	❑	❑	❑
..become restless or troubled if you have been prohibited from using social media?[5]	❑	❑	❑	❑	❑
..used social media so much that it has had a negative impact on your job/studies?[6]	❑	❑	❑	❑	❑

Note. Addiction component: [1]salience, [2]craving/tolerance, [3]mood modification, [4]relapse/loss of control, [5]withdrawal, [6]conflict/functional impairment. All items are scored on the following scale: 1 (Very rarely), 2 (Rarely), 3 (Sometimes), 4 (Often), 5 (Very often).

Appendix C

Game Addiction Scale (GAS) (Lemmens et al., 2009)

Instruction: The following questions are about your experiences with video games during the last six months (NB! By video games means here different electronic games that are played on a computer, mobile phone, tablet or on different game consoles such as *Playstation, PSP, Nintendo, Gameboy, Xbox* and the like. Gambling, online poker and the like do not count as video games in this regard).

How often during the last six months...

	Never	Rarely	Sometimes	Often	Very often
Did you think about playing a game all day long?	❑	❑	❑	❑	❑
Did you spend increasing amounts of time on games?	❑	❑	❑	❑	❑
Did you play games to forget about real life?	❑	❑	❑	❑	❑
Have others unsuccessfully tried to reduce your game use?	❑	❑	❑	❑	❑
Have you felt bad when you were unable to play?	❑	❑	❑	❑	❑
Did you have fights with others (e.g., family, friends) over your time spent on games?	❑	❑	❑	❑	❑
Have you neglected other important activities (e.g., school, work, sports) to play games?	❑	❑	❑	❑	❑

Note. Response options were: (1) Never, (2) Rarely, (3) Sometimes, (4) Often, (5) Very often.