Abstract

There is growing concern over excessive and sometimes problematic Internet use. Drawing upon the framework of the components model of addiction (Griffiths, 2005), Internet addiction appears as behavioural addiction characterised by the following symptoms: salience, withdrawal, tolerance, mood modification, relapse and conflict. A number of factors have been associated with an increased risk for Internet addiction, including personality traits. The overall aim of this study was to establish the association between personality traits and the Internet addiction components model in order to develop a theoretical framework via a nomological network. Internet addiction and personality traits were assessed in two independent samples of 3,105 adolescents in the Netherlands and 2,257 university students in England. The results indicate that low agreeableness and high neuroticism/low emotional stability are associated the Internet addiction components factor in both samples. However, low conscientiousness and low resourcefulness predicted it in the adolescent sample only. The implications include the usage of the Internet addiction components model as parsimonious tool for the initial screening of potential clients in mental health institutes, and identifying populations at risk through their personality traits which may prove advantageous for the initiation of targeted preventions efforts.

1. Introduction

The increased ubiquity and mobile nature of new digital media has arguably come at a price. Excessive and sometimes problematic Internet use is highlighted by a steadily growing research base (Byun et al., 2009; Kuss, Griffiths, Karila, & Billieux, 2014). Treatment approaches such as specialised cognitive-behavioural therapy (CBT) (King, Delfabbro, Griffiths, & Gradisar, 2012) and more controversial methods such as boot camps (Koo, Wati, Lee, & Oh, 2011) are being developed in order to provide professional support for those in need of help from problematic Internet use. Similar to substance-related addictions, Internet addiction is characterised by clinical symptoms leading to significant impairment and distress, which have led the American Psychiatric Association (APA) to include it in Section 3 of the current (fifth) version of the *Diagnostic and Statistical Manual for Mental Disorders* (DSM-5) as *Internet Gaming Disorder* (American Psychiatric Association, 2013), a diagnosis that requires further research to be included as formal disorder (Herold, Connors, & Moore, 2012).

A number of factors have been associated with an increased risk of Internet addiction. These include the presence of comorbid psychiatric symptoms, such as obsessive-compulsive and depressive symptoms (Jang, Hwang, & Choi, 2008), the use of specific Internet applications, such as shopping, social networking, online chatting, blogging, gambling, and playing online games (van Rooij, Schoenmakers, van de Eijnden, & van de Mheen, 2010), and demographic determinants, such as being an adolescent (Leung, 2007), and/or being a university student (Widyanto & Griffiths, 2006).

In addition to this, certain personality traits have been reported as risk factors for Internet addiction. Personality traits appear particularly important given the theory that addiction shapes personality, leading to an addictive personality (Nakken, 2013). Individuals who exhibit certain personality traits

2

and/or do not show other personality traits may be more likely to develop an addiction to different forms of technology, such as mobile phones (Takao, Takahashi, & Kitamura, 2009). Additional research supports the theoretical link between Internet addiction and personality traits. A study of Dutch adolescents found that emotional stability, agreeableness, and conscientiousness as measured via the Quick Big Five Scale (QBF; Vermulst & Gerris, 2009) decreased the risk of Internet addiction operationalized with the Compulsive Internet Use Scale (CIUS; Meerkerk, Van Den Eijnden, Vermulst, & Garretsen, 2009), whereas resourcefulness increased it (Kuss, van Rooij, Shorter, Griffiths, & van de Mheen, 2013). It has also been found that neuroticism as measured via the NEO-Five Factor Inventory (NEO-FFI) (Costa & McCrae, 1992) increased the risk of Internet addiction as measured with the Assessment for Internet and Computer Game Addiction Scale (AICA-S; Wölfling, Müller, & Beutel, 2010), whereas agreeableness was negatively associated with decreased it in an English university student sample (Kuss, Griffiths, & Binder, 2013). Furthermore, in a sample of 204 individuals diagnosed with Internet addiction disorder and 100 control subjects from universities and high schools in Beijing, it was found that Internet addicts had lower extraversion and higher psychoticism scores (Xiuqin et al., 2010) as measured via Eysenck's Personality Questionnaire Revised (EPQ-R) (Eysenck & Eysenck, 1975). Of 7,888 adolescents sampled in the Netherlands it was found that the likelihood of developing Internet addiction as assessed via the CIUS (Meerkerk et al., 2009) was associated increased with low agreeableness and emotional stability, and high introversion (van der Aa et al., 2009). Additionally, in a sample of 868 university students in China, Internet addicts as classified via Young's Internet Addiction Test (Young, 1998) scored more highly on the EPQ's neuroticism and psychoticism subscales than non-addicts (Dong, Wang, Yang, & Zhou, 2012). Finally, in a sample of 1,360 university freshmen in China tested via the Chinese Internet Addiction Scale-Revision (CIAS-R; Chen, Weng, Su, Wu, & Yang, 2003) and the EPQ (Eysenck & Eysenck, 1975), Internet addiction was associated with neuroticism (Tsai et al., 2009).

From the framework of the components model of addiction (Griffiths, 2005), Internet addiction develops as a consequence of biopsychosocial processes along with situational and structural factors.

Similar to any other substance-related addiction, Internet addiction is characterised by the following symptoms: salience, withdrawal, tolerance, mood modification, relapse and conflict. A recent study (Kuss, Shorter, van Rooij, Griffiths, & Schoenmakers, 2013) indicated the addiction components model conceptualises Internet addiction in a parsimonious and comprehensive way as indicated by good fit with data obtained from two independent samples (3,105 adolescents in the Netherlands and 2,257 university students in the UK) using two separate Internet addiction measures.

As Internet addiction is a relatively recent phenomenon, research on this mental health problem is still in its infancy (Young, 2010). It is of crucial theoretical and practical importance to develop a conceptual basis for this type of addiction, and a valid and reliable psychometric assessment tool to measure it. From a theoretical perspective, Cronbach and Meehl (1955) argue that it is necessary to understand the nature of a construct by comprehending the statistical or deterministic laws that underlie its appearance, namely its *nomological network*. The laws underlying this network can either link (i) observations to each other, (ii) constructs to observations, or (iii) constructs to each other (Cronbach & Meehl, 1955). In line with the principles of the nomological network that are a manifestation of a construct's validity, in this study the Internet addiction components model and an addictive personality are operationalised as theoretical constructs that have been observed in two distinct populations via psychometric self-reports. As the Internet addiction components model has recently been established (Kuss, Shorter, et al., 2013), its theoretical understanding requires the development of a statistical model that is able to explain its associations with related constructs, such as an addictive personality (Nakken, 2013). Antisocial and depressive behaviours have been linked to an addictive personality (Nathan, 1988), suggesting that neuroticism and lack of agreeableness are predictors of Internet addiction. Other research suggests that although there are commonalities regarding an addictive personality across different addictions, there are also differences (Kagan, 1987), furthermore strengthening the need to assess the predictive power of personality characteristics on Internet addiction specifically. The potential importance of this research is to establish a nomological network of theoretical knowledge about the concepts of the

Internet addiction components model and an addictive personality, their observed manifestations, as well as their associations.

Based on previous findings (Kuss, Griffiths, et al., 2013; Kuss, van Rooij, et al., 2013), in the present study it was hypothesised that (i) in a Dutch adolescent sample low emotional stability, low agreeableness, low conscientiousness, and resourcefulness predict the Internet addiction components factor, and (ii) in an English university student sample, it was predicted that (ii) neuroticism and low agreeableness predict the Internet addiction components factor. The overall aim of this study was to establish a nomological network for the Internet addiction components model by testing the predictive accuracy of personality traits on the Internet addiction components factor.

2. Method

2.1 Participants

Two separate samples were used. Sample 1 (S1) contained a total of 3,105 adolescents aged 11 to 19 years (M = 14.2, SD = 1.1 years) sampled from high schools in the Netherlands. Sample 2 (S2) contained a total of 2,257 university students aged between 18 and 64 years (M = 22.7, SD = 6.34 years) from a university in the East Midlands of England. Detailed sample information has been published elsewhere (Kuss, Griffiths, et al., 2013; Kuss, van Rooij, et al., 2013).

2.2 Measures

2.2.1.1   S1 Personality traits

Personality traits in S1 were measured using the 30-item Quick Big Five Scale (QBF) (Vermulst & Gerris, 2009), based on Goldberg's personality markers (Goldberg, 1992). It assesses the Big Five

personality traits extraversion, agreeableness, conscientiousness, emotional stability and resourcefulness. Extraversion is the extent to which the following characteristics are present or absent: talkative, introverted, quiet, reserved, withdrawn, and bashful. Agreeableness is the extent to which the participant indicates the following characteristics: kind, cooperative, sympathetic, pleasant, agreeable, and helpful. Conscientiousness consists of being organised, systematic, thorough, neat, careful, and or not sloppy. Emotional stability is indicated by the degree of being anxious, irritable, touchy, nervous, fearful, and high-strung, all negatively scored. Finally, resourcefulness consists of being creative, complex, imaginative, artistic, deep and innovative. The QBF uses a 7-point Likert scale ranging from 1 ("is not completely correct") to 7 ("is exactly correct"), and total scores for the respective scales were derived by summing up the scores for the applicable items. The factor structure, validity and reliability of the scale have been evidenced in large adolescent samples in the Netherlands (e.g., Gerris et al., 1998; Harakeh, Scholte, DeVries, & Engels, 2006; Otten, Engels, & Van den Eijnden, 2008). The internal consistency of the personality trait scales in the present sample was good, with a *Cronbach's alpha* of .86 for extraversion, .84 for conscientiousness, .81 for agreeableness, .82 for emotional stability, and .75 for resourcefulness.

2.2.1.2 S1 Internet addiction components

The 14-item self-report Compulsive Internet Use Scale (CIUS) (Meerkerk et al., 2009) was used to measure the Internet addiction components. It enquires into the extent of compulsive Internet use on a 5-point Likert scale ranging from 0 ("never") to 4 ("very often"). From the original scale, five items (Items 6, 14, 13, 9 and 11 representing withdrawal, mood modification relapse, and conflict respectively) were extracted on the basis of Griffiths' addiction components model (2005). They represent the best match between the respective CIUS items and the five of the six core components of addiction as indicated by content and cross-check with the author. There is no item measuring tolerance on the CIUS scale. In a previous study, it has been shown that the Internet addiction components model showed a good fit to the data of S1 (Kuss, Shorter, et al., 2013). The internal

consistency in the current sample was furthermore established to be acceptable with a *Cronbach's alpha* of .67.

2.2.2.1   S2 Personality traits

Personality traits in S2 were assessed using the 60-item NEO-Five Factor Inventory (NEO-FFI) (Costa & McCrae, 1992). This assesses extraversion, agreeableness, conscientiousness, neuroticism, and openness to experience. Extraversion comprises warmth, gregariousness, assertiveness, activity, excitement-seeking, and positive emotions. Conscientiousness denotes the degree of competence, order, dutifulness, achievement striving, self-discipline, and deliberation. Neuroticism is characterised by anxiety, angry hostility, depression, self-consciousness, impulsiveness, and vulnerability. Finally, openness to experience is characterised by fantasy, aesthetics, feelings, actions, ideas, and values. The NEO-FFI uses a 5-point Likert scale ranging from 1 ("strongly disagree") to 5 ("strongly agree"), and total scores for the respective subscales were derived by summing the scores of the relevant items. A consistent factor structure, good validity and reliability of the scale have been verified in a range of university student samples (e.g., Anthonya, Clarke, & Anderson, 2000; Chamorro-Premuzic, Furnham, Dissou, & Heaven, 2005; Heinström, 2005). The internal consistency of the personality trait scales was good, with a *Cronbach's alpha* of .79 for extraversion, .76 for agreeableness, .84 for conscientiousness, .86 for neuroticism, and .69 for openness to experience.

2.2.2.2   S2 Internet addiction components

In order to measure the Internet addiction components in S2, the 16-item self-report Assessment for Internet and Computer Game Addiction Scale (AICA-S; Wölfling et al., 2010) was used. This is a diagnostic tool used in clinical settings and uses a 5-point Likert scale ranging from 0 ("not at all" or "never") to 4 ("very strongly" or "very often") for the first 15 questions, whereas the presence of problems as a consequence of excessive or addictive Internet use is scored from 0.5 (one problem is present) to 3 (six problems are present) for the last question. From the original scales, six items were

most representative of the six addiction components as specified by Griffiths (2005), namely salience (AICA-S item 5), withdrawal (item 7), tolerance (item 8), mood modification (item 11), relapse (item 12), and conflict (item 15). In a previous study, it was shown that the Internet addiction components model shows a good fit to the data in S2 (Kuss, Shorter, et al., 2013). The internal consistency of the Internet addiction components model in S2 was good with *Cronbach's alpha* of .77.

2.3   Statistical analysis

Structural equation modelling (SEM) was performed using *Mplus 6.11* (Muthén & Muthén, 2011). In both samples, analyses aimed to determine which personality traits predicted the Internet addiction components factor in a single multivariate regression model. In both samples, the Internet addiction components factor was treated as latent endogenous variable using the addiction components from each scale (CIUS in S1, and AICA-S in S2) as specified by Griffiths (2005); the respective personality trait factors were used as exogenous latent variables (via the QBF in S1, and NEO-FFI in S2). Maximum likelihood estimation was used as the data were distributed normally (Kline, 2005). Missing data were excluded only if cases were missing on all variables (i.e., in S1, 26 cases were excluded, and in S2, 4 cases were excluded), and otherwise treated as missing at random (MAR). These missing data were handled as pairwise present by being replaced by estimates using information available from pairs of variables and the entire data set to account for relationships in the data (Little & Rubin, 2002). Throughout, a .05 significance level was adopted. Graphical representations of both models are presented in Figure 1 and Figure 2.
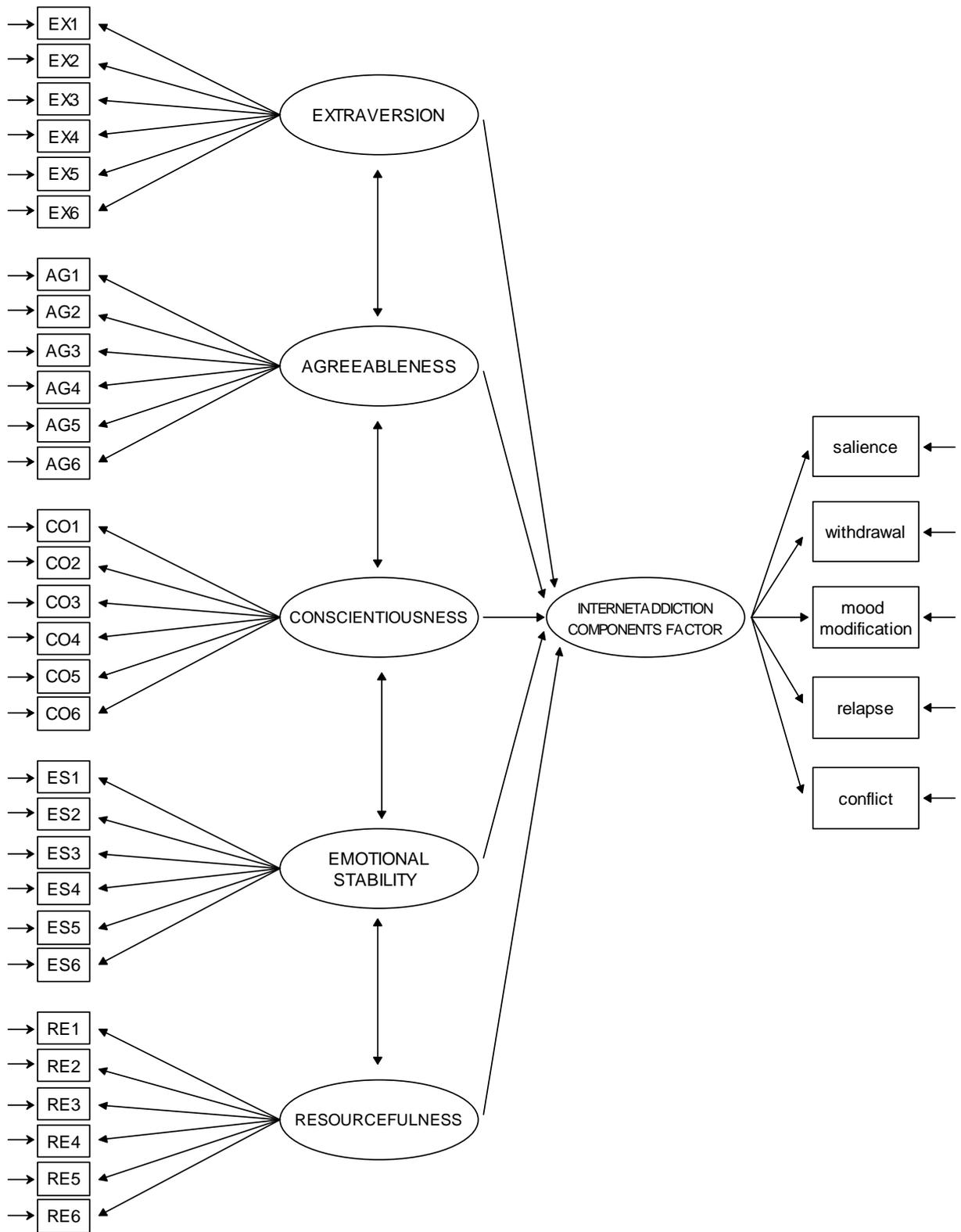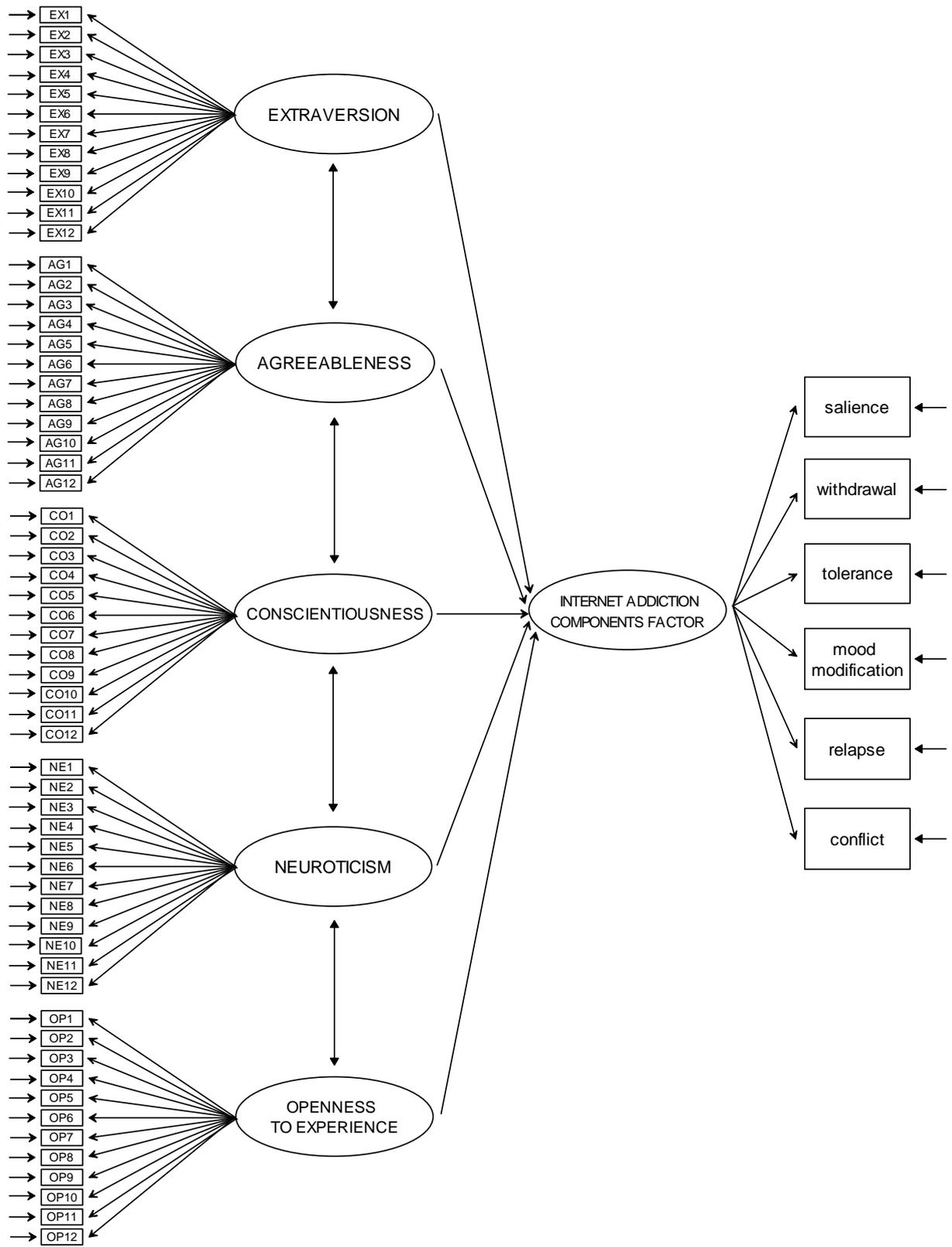
3. Results

Mean scores on each of the Internet addiction components comprising the factor ranged between 0.4 and 0.6 in S1, and 0.6 and 1.4 in S2. Means and standard deviations for the Internet addiction components and personality trait total scores for S1 and S2 are presented in Tables 1 and 2.

T 1: *Means, Standard Deviations and Ranges for Internet Addiction Components and Personality Trait Total Scores for S1*

	M	SD	Range
Internet addiction components total	2.43	2.78	0 – 20
Salience	0.37	0.72	0 – 4
Withdrawal	0.57	0.90	0 – 4
Mood modification	0.53	0.91	0 – 4
Relapse	0.46	0.81	0 – 4
Conflict	0.52	0.88	0 – 4
Extraversion	31.53	6.91	8 – 42
Agreeableness	33.02	4.87	6 – 42
Conscientiousness	25.81	7.02	6 – 42
Emotional stability	29.30	6.67	6 – 42
Resourcefulness	28.35	6.09	6 – 42

T 2: *Means, Standard Deviations and Ranges for Internet Addiction Components and Personality Trait Total Scores for S2*

	M	SD	Range
Internet addiction components total	6.30	4.01	0 – 20
Salience	1.32	0.98	0 – 4
Withdrawal	1.13	1.04	0 – 4
Tolerance	0.99	0.99	0 – 4
Mood modification	1.41	1.11	0 – 4
Relapse	0.90	1.05	0 – 4
Conflict	0.59	0.71	0 – 3
Extraversion	40.33	6.31	15 – 57
Agreeableness	42.78	5.93	22 – 60
Conscientiousness	42.41	6.80	16 – 60
Neuroticism	35.50	8.40	12 – 58
Openness to experience	40.02	6.04	18 – 57

Mean scores on the personality trait totals ranged from 25.8 to 33.0 in S1, and 35.5 to 42.8 in S2. Overall, participants in both samples scored highest on agreeableness (*M* = 33.0 in S1 and *M* = 42.8 in S2) relative to any other personality trait. The samples differed in the scoring on all other personality

traits. Notably, conscientiousness received the lowest mean score of all personality traits in S1 ($M =$ 25.8). In S2, it was the second most highly scored personality trait ($M = 42.4$).

In S1, all correlations between the exogenous latent variables were significant except for the correlation between emotional stability and resourcefulness ($R = .03$, *ns*). The other correlations were weak (i.e., for conscientiousness and extraversion $R = -.06$, $p < .01$) to strong (i.e., for emotional stability and extraversion, $R = .78$, $p < .001$). In S2, all correlations between the exogenous latent variables were significant except for the correlation between neuroticism and openness to experience ($R = .03$, *ns*) and agreeableness with openness to experience ($R = .05$, *ns*). The other correlations ranged from being weak (i.e., extraversion with openness to experience, $R = .07$, $p < .01$) to being moderate (i.e., extraversion with neuroticism, $R = -.51$, $p < .001$). The correlations between the exogenous latent variables for S1 and S2 are presented in Tables 3 and 4.

Table 3: *Correlations between Exogenous Latent Variables in S1*

	Agreeableness	Conscientiousness	Emotional stability	Resourcefulness
Extraversion	.32**	-.06*	.78**	.15**
Agreeableness		.45**	.17**	.62**
Conscientiousness			-.07*	.34**
Emotional stability				.03

** p < .001, *p < .01.

Table 4: *Correlations between Exogenous Latent Variables in S2*

	Agreeableness	Conscientiousness	Neuroticism	Openness to experience
Extraversion	.44**	.32**	-.51**	.07*
Agreeableness		.22**	-.26**	.05
Conscientiousness			-.35**	.09*
Neuroticism				.03

** p < .001, *p < .01.

Overall, model fit indices for both Model 1 and Model 2 were equivocal. However, RMSEA values and SRMR indicated good fit. In both samples, RMSEA and corresponding confidence intervals were lower than .06 (Hu & Bentler, 1999) and the SRMR values were ≤ .08 (Schreiber, Stage, King, Nora, & Barlow, 2006). The advantages of the RMSEA relative to other fit indices include (i) sensitivity to

misspecification of the developed model, (ii) current guidelines for interpretation lead to informed conclusions, and (iii) standard statistical programmes provide confidence intervals for the RMSEA value (MacCallum & Austin, 2000).

In S1, the personality trait items loaded onto the respective personality trait factors as expected, with standardised loadings ranging from .42 to .84. The standardised loadings of the Internet addiction components were similarly high, ranging from .50 to .64. The structural analysis revealed that agreeableness (β = -.13), conscientiousness (β = -.05), emotional stability (β = -.17), and resourcefulness (β = .06) significantly predicted the Internet addiction components factor (all p values < .001). Overall, these personality trait factors explained 14.0% of the variance in the Internet addiction components factor (R^2 = .14), indicating a small to medium effect (Cohen, 1992). A detailed account of unstandardized and standardised loadings for the full structural equation model in S1 is provided in Table 5.

Table 5: *Unstandardized Loadings (Standard Errors) and Standardized Loadings for Structural Equation Model of the Internet Addiction Components Factor on Personality in S1*

Latent construct and indicator for measurement model	Unstandardised loading (SE)	Standardised loading (SE)	p
Internet addiction components factor			
Salience: Do you think about the Internet, even when not online?	1.00 (.00)	.54 (.02)	.000
Withdrawal: Do you feel restless, frustrated, or irritated when you cannot use the Internet?	1.49 (.07)	.64 (.02)	.000
Mood modification: Do you use the Internet to escape from your sorrows or get relief from negative feelings?	1.27 (07)	.54 (.02)	.000
Relapse: Have you unsuccessfully tried to spend less time on the Internet?	1.06 (.06)	.50 (.02)	.000
Conflict: Do you neglect your daily obligations (school or family life) because you prefer to be on the Internet?	1.15 (.06)	.50 (.02)	.000
Extraversion			
reserved	1.00 (.00)	.71 (.01)	.000
quiet	1.06 (.03)	.69 (.01)	.000
introverted	1.03 (.03)	.76 (.01)	.000
talkative	0.68 (.03)	.53 (.01)	.000
bashful	1.10 (.03)	.74 (.01)	.000
withdrawn	1.09 (.03)	.84 (.01)	.000
Agreeableness			
agreeable	1.00 (.00)	.58 (.01)	.000
helpful	1.32 (.05)	.70 (.01)	.000
kind	1.08 (.04)	.70 (.01)	.000
cooperative	1.37 (.05)	.75 (.01)	.000
pleasant	1.27 (.05)	.67 (.01)	.000
sympathetic	1.16 (.05)	.52 (.02)	.000
Conscientiousness			
sloppy	1.00 (.00)	.59 (.01)	.000
careful	1.08 (.04)	.72 (.01)	.000
organised	1.27 (.04)	.78 (.01)	.000
thorough	1.16 (.04)	.75 (.01)	.000
neat	1.25 (.04)	.80 (.01)	.000
systematic	0.76 (.04)	.48 (.02)	.000
Emotional stability			
irritable	1.00 (.00)	.42 (.02)	.000
nervous	1.76 (.08)	.74 (.01)	.000
touchy	1.56 (.08)	.59 (.01)	.000
anxious	1.56 (.08)	.63 (.01)	.000
fearful	1.53 (.07)	.73 (.01)	.000
high-strung	1.82 (.08)	.82 (.01)	.000
Resourcefulness			
imaginative	1.00 (.00)	.60 (.01)	.000
deep	0.73 (.04)	.42 (.02)	.000
complex	0.73 (.04)	.45 (.02)	.000
innovative	0.87 (.04)	.60 (.02)	.000
artistic	1.22 (.05)	.66 (.01)	.000
creative	1.25 (.05)	.72 (.01)	.000

Parameter estimates for the structural model	B	β	p
Internet addiction components factor ON			
Extraversion	.01 (.02)	.02 (.05)	.685
Agreeableness	-.13 (.03)	-.21 (.04)	.000
Conscientiousness	-.05 (.01)	-.13 (.03)	.000
Emotional stability	-.17 (.03)	-.29 (.04)	.000
Resourcefulness	.06 (.02)	.14 (.03)	.000

Model fit indices: X^2 (545) = 7417.35, p < .001; CFI = .83, TLI = .82; RMSEA (90% CI) = .06 (.06-.07); SRMR = .07.

In S2, all the personality trait items for the personality trait factors extraversion, agreeableness, conscientiousness, and neuroticism loaded highly onto their related factors. However, for openness to experience, there was evidence of low factor loadings including item OP8 which did not load significantly onto the openness to experience factor (β = -.03, *ns*), indicating that the openness to experience factor did not explain a sufficient amount of variance in this item (R^2 < .01). Items OP1, OP4, OP6, and OP7 were also low, with standardised factor loadings of .13, .26, .28, and .25, respectively. Other than that, the standardised loadings for the respective personality trait factors ranged from .06 to .78. The standardised loadings for the Internet addiction components were good, ranging from .44 to .79. The structural analysis revealed that extraversion (β = .15), agreeableness (β = -.31), conscientiousness (β = -.13), and neuroticism (β = .47) significantly predicted the Internet addiction components factor (all *p* values < .001). Overall, these personality trait factors explained 19.1% of the variance in the Internet addiction components factor (R^2 = .19), indicating a small to medium sized effect (Cohen, 1992). A detailed account of unstandardized and standardised loadings for the full measurement and structural equation model in S2 is presented in Table 6.

Table 6: *Unstandardized Loadings (Standard Errors) and Standardized Loadings for Structural Equation Model of the Internet Addiction Components Factor on Personality in S2*

Latent construct and indicator for the measurement model	Unstandardised loading (SE)	Standardised loading (SE)	p
Internet addiction components factor			
Salience: How strongly are you mentally preoccupied with the Internet during a day?	1.00 (.00)	.55 (.02)	.000
Withdrawal: Do you feel moody if you cannot be online?	1.43 (.06)	.73 (.01)	.000
Tolerance: Did you recognise having to be online more often or for a longer time to feel good or relaxed again?	1.47 (.06)	.79 (.01)	.000
Mood modification: How frequently do you avoid negative temper or feelings by surfing the Internet?	1.31 (.06)	.63 (.02)	.000
Relapse: How often have you tried to quit or restrict surfing the Internet?	0.86 (.68)	.44 (.02)	.000
Conflict: Did you face problems or negative consequences because of your Internet usage?	0.68 (.04)	.51 (.02)	.000
Extraversion factor			
I like to have a lot of people around me.	1.00 (.00)	.52 (.02)	.000
I laugh easily.	0.79 (.05)	.47 (.02)	.000
I don't consider myself especially "light-hearted".	0.65 (.05)	.33 (.02)	.000
I really enjoy talking to people.	0.98 (.05)	.59 (.02)	.000
I like to be where the action is.	0.78 (.05)	.44 (.02)	.000
I usually prefer to do things alone.	0.83 (.05)	.43 (.02)	.000
I often feel as if I'm bursting with energy.	0.93 (.06)	.49 (.02)	.000
I am a cheerful, high-spirited person.	1.29 (.06)	.76 (.01)	.000
I am not a cheerful optimist.	1.38 (.07)	.68 (.02)	.000
My life is fast-paced.	0.58 (.05)	.31 (.02)	.000
I am a very active person.	0.87 (.06)	.45 (.02)	.000
I would rather go my own way than be the leader of others.	0.72 (.05)	.36 (.02)	.000
Agreeableness			

I try to be courteous to everyone I meet.	1.00 (.00)	.43 (.02)	.000
I often get into arguments with my family and co-workers.	1.46 (.10)	.48 (.02)	.000
Some people think I'm selfish and egotistical.	1.95 (.12)	.63 (.02)	.000
I would rather cooperate with others than compete with them.	0.85 (.08)	.30 (.02)	.000
I tend to be cynical and sceptical of others' intentions.	1.54 (.11)	.49 (.02)	.000
I believe that most people will take advantage of you if you let them.	1.27 (.10)	.38 (.02)	.000
Most people I know like me.	0.87 (.07)	.39 (.02)	.000
Some people think of me as cold and calculating.	2.03 (.13)	.65 (.02)	.000
I'm hard-headed and tough-minded in my attitudes.	1.12 (.09)	.37 (.02)	.000
I generally try to be thoughtful and considerate.	0.85 (.06)	.44 (.02)	.000
If I don't like people, I let them know it.	1.26 (.10)	.39 (.02)	.000
If necessary, I am willing to manipulate people to get what I want.	1.65 (.12)	.48 (.02)	.000
Conscientiousness			
I keep my belongings neat and clean.	1.00 (.00)	.45 (.02)	.000
I'm pretty good about pacing myself so as to get things done on time.	1.51 (.08)	.65 (.01)	.000
I am not a very methodical person.	0.71 (.06)	.34 (.02)	.000
I try to perform all the tasks assigned to me conscientiously.	0.79 (.05)	.52 (.02)	.000
I have a clear set of goals and work toward them in an orderly fashion.	1.44 (.08)	.68 (.01)	.000
I waste a lot of time before settling down to work.	1.18 (.07)	.51 (.02)	.000
I work hard to accomplish my goals.	1.23 (.07)	.71 (.01)	.000
When I make a commitment, I can always be counted on to follow through.	0.90 (.06)	.52 (.02)	.000
Sometimes I'm not as dependable or reliable as I should be.	1.07 (.07)	.46 (.02)	.000
I am a productive person who always gets the job done.	1.22 (.06)	.73 (.01)	.000
I never seem to be able to get organised.	1.48 (.08)	.63 (.02)	.000
I strive for excellence in everything I do.	1.16 (.07)	.60 (.02)	.000
Neuroticism			
I am not a worrier.	1.00 (.00)	.36 (.02)	.000
I often feel inferior to others.	1.51 (.10)	.58 (.02)	.000
When I'm under a great deal of stress, sometimes I feel like I'm going to pieces.	1.66 (.11)	.59 (.02)	.000
I rarely feel lonely or blue.	1.62 (.11)	.61 (.02)	.000
I often feel tense and jittery.	1.61 (.11)	.63 (.02)	.000
Sometimes I feel completely worthless.	2.35 (.15)	.77 (.01)	.000
I rarely feel fearful or anxious.	1.61 (.11)	.61 (.02)	.000
I often get angry at the way people treat me.	1.27 (.09)	.50 (.02)	.000
Too often, when things go wrong, I get discouraged and feel like giving up.	1.72 (.12)	.65 (.01)	.000
I am seldom sad or depressed.	1.06 (.09)	.39 (.02)	.000
I often feel helpless and want someone else to solve my problems.	1.59 (.11)	.63 (.02)	.000
At times I have been so ashamed I just wanted to hide.	1.73 (.12)	.60 (.02)	.000
Openness to experience			
I don't like to waste my time daydreaming.	1.00 (.00)	.13 (.02)	.000
Once I find the right way to do something, I stick to it.	0.35 (.15)	.06 (.02)	.008
I am intrigued by the patterns I find in art and nature.	5.20 (1.01)	.60 (.02)	.000
I believe letting students hear controversial speakers can only confuse and mislead them.	1.79 (.38)	.26 (.02)	.000
Poetry has little or no effect on me.	6.03 (1.17)	.67 (.02)	.000
I often try new and foreign foods.	2.50 (.53)	.28 (.02)	.000
I seldom notice the moods or feelings that different environments produce.	1.87 (.40)	.25 (.02)	.000
I believe we should look to our religious authorities for decisions on moral issues.	-0.29 (.22)	-.03 (.03)	.179
Sometimes when I am reading poetry or looking at a work of art, I feel a chill or wave of excitement.	7.13 (1.38)	.78 (.02)	.000
I have little interest in speculating on the nature of the universe or the human condition.	3.87 (.76)	.47 (.02)	.000
I have a lot of intellectual curiosity.	2.94 (.58)	.49 (.02)	.000
I often enjoy playing with theories or abstract ideas.	4.19 (.82)	.55 (.02)	.000

Parameter estimates for the structural model	B	β	*p*
Internet addiction components factor ON			
Extraversion	.15 (.04)	.15 (.03)	.000
Agreeableness	-.31 (.05)	-.19 (.03)	.000
Conscientiousness	-.13 (.03)	-.11 (.03)	.000
Neuroticism	.47 (.05)	.37 (.03)	.000
Openness to Experience	.19 (.11)	.05 (.03)	.059

Model fit indices: X^2 (2064) = 13964, *p* < .001; CFI = .70, TLI = .69; RMSEA (90% CI) = .05 (.05-.05); SRMR = .07.

4. Discussion

The aim of this study was to establish a nomological network for the Internet addiction components model by testing the association of personality traits with the Internet addiction components factor. The results support the first hypothesis that low agreeableness, low conscientiousness, low emotional stability, and resourcefulness significantly predict the Internet addiction components factor in S1. The association between low agreeableness, low emotional stability and Internet addiction can be explained by characteristics associated with these personality traits, namely anxiety, tension, lack of stability, antagonism, lack of kindness, and dishonesty (Goldberg, 1992). These may lead to a difficulty in establishing peer networks in real life for the adolescents, which may make them turn to the Internet instead (Caplan, 2003). Conscientiousness has been implicated as a predictor of health behaviours (Hagger-Johnson & Whiteman, 2007). This suggests that high scores on the conscientiousness subscale have served as a protective factor for Internet addiction in this study, whereas low scores had the opposite effect for the adolescents. Resourcefulness has been associated with openness to experience (Matthews, Deary, & Whiteman, 2009), and its subcomponent novelty seeking has been associated with Internet addiction in previous research (Ko et al., 2010), providing support for the present results.

The results also support the second hypothesis that neuroticism and low agreeableness predict the Internet addiction components factor in S2. In addition to the hypothesised predictions in S2, low conscientiousness and extraversion predicted the Internet addiction components factor. In comparison to the other personality trait factors, the coefficients for neuroticism and agreeableness were low, indicating that they are weaker predictors of the Internet addiction components factor. In Kuss et al.'s original study (2013), Internet addiction was assessed as a binary categorical variable using a cut-off score for a potentially pathological level of Internet addiction using the complete AICA-S. In the present study, a more parsimonious theoretical approach was adopted using the Internet addiction components model as based on Griffiths' (2005) framework. From a comparative point of view, the finding that low conscientiousness predicts the Internet addiction components

factor in S2 mirrors a similar result in S1, indicating that low conscientiousness is associated with the Internet addiction components factor more generally.

To the authors' knowledge, extraversion has not been associated with increased risk for Internet addiction in previous research. On the contrary, low extraversion (i.e., introversion) has been found to be a correlated with greater problematic Internet use in an undergraduate Australian university student sample (Mottram & Fleming, 2009). Nevertheless, it has previously been reported that "socially rich" individuals who score highly on extraversion use social applications such as *Facebook* frequently (Zywica & Danowski, 2008). This suggests that the English university students in S2 may have lived out their high sociability online, which may have led them to score more highly on the Internet addiction components factor relative to their more introverted peers. This conjecture requires testing in future research studies.

The respective personality trait factors explained 14% to 19% of the variance in the Internet addiction components factor. This indicates a small to medium sized effect (Cohen, 1992). Overall, it appears that a number of other factors which have not been included in the present analyses may have contributed to explaining the variance in the Internet addiction components factor. Possible factors are the respective Internet applications users engage with as it has been shown that the excessive usage of applications such as online games and social applications increases the risk for Internet addiction (Kuss, Griffiths, et al., 2013; Kuss, van Rooij, et al., 2013). Future research is strongly encouraged to assess the predictive power of Internet application usage on explaining the Internet addiction components factor as based on the CIUS and the AICA-S, respectively.

With regards to the validation of the respective measurement models in the current study, scores on the respective QBF personality trait scales in S1 were comparable to scores found in previous samples containing Dutch adolescents aged between 13 and 17 years (Harakeh et al., 2006). In addition to this, overall, the scores on the respective NEO-FFI personality scales in S2 closely resemble norm scores for British populations (Egan, Deary, & Austin, 2000). With a four-point

difference, the current sample only scored slightly higher on neuroticism, suggesting that English students are marginally more neurotic than the general British population as measured via the NEO-FFI. Furthermore, the low factor loadings of a number of items onto the openness to experience factor suggest that the respective items do not measure the theoretical construct of openness to experience adequately. Previous research on the NEO-FFI in three independent British samples has shown that openness to experience and extraversion are less reliable subscales than neuroticism, agreeableness and conscientiousness (Egan et al., 2000). Openness to experience specifically appears to be defined somewhat imprecisely when viewed from the point of lexical systems, where it initially originated from. Synonyms such as intellect, culture, or imagination are frequently used (Digman & Takemoto-Chock, 1981), which indicates a discrepancy in meaning as openness is associated with different constructs, potentially leading to validity problems. The present research adds to the conundrum that surrounds the factor of openness to experience and suggests that a revision of the factor and specifically the items by which it is measured is necessary.

Notwithstanding the favourable model results, it should be noted that there exists a discrepancy between the theoretical model and its real-life counterpart (i.e., the ways in which the theoretical constructs appear in the real world). The question is one of the degree of "model-reality consistency" (Bollen, 1989). The QBF and NEO-FFI are separate scales that measure similar phenomena in separate ways. For instance, the number of NEO-FFI items per factor was larger than for the QBF. This would possibly suggest a better solution, more accurate parameter estimates, and greater variability in participants' scores on the NEO-FFI (Marsh, Hau, Balla, & Grayson, 1998). However, rather than providing a direct comparison between two samples with regards to observed personality traits, the present study confirms the applicability of theoretical models to the data obtained from two independent samples. The present analysis must be understood and evaluated as an indicator of the observable relationship between personality traits and the Internet addiction components model. An account has been made of the nomological network of the Internet addiction components model. The inclusion of personality trait factors as predictors of the Internet addiction

components factor in the established model serves as a first step towards the development of a more comprehensive and elaborate theoretical framework for Internet addiction.

Despite the many strengths of the study (e.g., large independent datasets, use of validated questionnaires), the study is not without its limitations. First of all, a self-report measure will never be sufficient to assess clinically relevant levels of psychopathology. The Internet addiction components model therefore must be understood as an indicator of risk for pathological Internet use, not as a behavioural addiction *per se*. Second, the lack of a measure of tolerance in S1 may have consequences for the actual construct of the Internet addiction components model because tolerance has been implicated as important distinguishing feature between pathological and non-pathological gamblers (Griffiths, 1993). Future studies should assess the validity and reliability of the Internet addiction components model via the CIUS including an item assessing tolerance to facilitate comparability across measurement instruments and the DSM-5 Internet Gaming Disorder criteria, and investigate the potential importance of tolerance as a criterion for a behavioural addiction.

5. Conclusion

In sum, the main contribution of this research is the establishment of a nomological network for the Internet addiction components model which is primarily of conceptual and research relevance. It has been shown that in two independent samples using two measures of Internet addiction and personality traits, low agreeableness and high neuroticism/low emotional stability predicted the Internet addiction components factor, suggesting an addictive personality may increase the risk for Internet addiction via the presence/absence of particular personality traits. In addition to this, low conscientiousness and low resourcefulness predicted it in the adolescent sample only. Taken together, important elements of a theoretical framework have been established that allow researchers to utilise and expand upon the recently developed Internet addiction components model. The association between Internet addiction and certain personality traits suggests some

populations appear at higher risk for developing Internet addiction than others. In order to confirm and expand on this finding, future research is necessary. More specifically, assessing different Internet application usages and their relationships with personality traits may prove advantageous as previous research has indicated an interaction between certain personality traits and Internet application usages in increasing the risk for Internet addiction (Kuss, Griffiths, et al., 2013; Kuss, van Rooij, et al., 2013).

In terms of clinical applications, the Internet addiction components model as such is a parsimonious construct which can potentially be used for initial screening of potential clients in mental health institutions in order to discern problematic Internet usage. This screening can take place in risk-groups with specific personality traits (selective prevention). Moreover, assessing factors associated with Internet addiction (i.e., certain personality traits), may prove beneficial in comprehending the degree to which individuals suffer from Internet addiction symptoms. Certain personality traits have been found to be predictive of Internet addiction and they can potentially exacerbate the phenomenological symptom experience. Prevention could be tailored with the enhanced understanding of the personality traits of those who might develop problems. Identifying children and adolescents at risk for developing Internet addiction will enable and facilitate prevention endeavours as these groups can be specifically targeted before the actual psychopathology manifests itself. Finally, a cross-validation and replication of the study's results are necessary in order to verify the reliability of the findings. Moreover, a qualitative study may shed additional light upon the ways in which an addictive personality may increase the individual's vulnerability for developing Internet addiction.

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