IS INTERNET ADDICTION REAL? A NOVEL VALIDATION STUDY OF 3 DIAGNOSTIC QUESTIONNAIRES

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ABSTRACT

Since the 1990s, increasing rates of Internet use and Internet-related problems have led to the Internet Addiction Debate, which has yet to establish a firm consensus on the existence of Internet addiction. Proponents who believe Internet addiction exists are fighting for its official recognition as a mental disorder (Young and Case, 2004). However, sceptics posit that individuals are not addicted to the Internet itself; rather, the Internet serves as a platform to access various sources of addiction such as social media or online gambling (Griffiths, 2000). Previous research has focused on evaluating the validity of Internet addiction diagnostic questionnaires by investigating the measured characteristics of addiction without any comparisons between the questionnaires (Moon et al., 2018). This method is unable to sufficiently address the question of the existence of Internet addiction. In the first of its kind, this study aims to address the Internet Addiction Debate by comparing three commonly utilized diagnostic questionnaires. Statistical analyses found that these questionnaires measure a common construct identified as addiction, but not Internet addiction specifically. Despite determining good predictive abilities of each questionnaire, further analysis found inappropriate designs and inconsistent thresholds for identifying Internet 'addicts', casting doubt on these questionnaires as valid diagnostic tools. It was concluded that Internet addiction does not exist and should thus not be listed as a mental health disorder. A new model of various cyber addictions to guide the development of relevant diagnostic tools and prevention/treatment interventions is proposed.

INTRODUCTION

Addiction traditionally describes an uncontrollable urge to engage in certain behaviours, including consuming mind-altering substances, a preoccupation by thoughts of the addictive behaviour or substance, and continued use or engagement despite negative consequences like impairment and distress (Shaw and Black, 2008; Young, 2004). Internet addiction is similar to behavioural addictions and shares some core characteristics of traditional addiction such as salience, mood alteration, tolerance, withdrawal and relapse (Griffiths, 1996). Sceptics who doubt the addictive nature of the Internet refer to this phenomenon as 'problematic Internet use' and describe it as extreme Internet usage resulting from accessing online activities (Griffiths, 2000). Problematic Internet use has been an increasingly growing concern for the 4.9 billion active users worldwide (ITU, 2021). Previous studies have reported problematic Internet use prevalence rates ranging from 0.8% to 26.7%, with suspected increases annually (Cheng and Li, 2014; Kuss et al., 2014).

In the long term, individuals affected by problematic Internet use may suffer from negative physiological effects due to a sedentary lifestyle, loss of social skills, increased social anxiety and shunning responsibilities in their personal and professional lives (Machimbarrena et al., 2019). There is a consequent need to accurately identify individuals who are suffering due to their problematic Internet behaviours to improve their quality of life without over- or misdiagnosing patients (Musetti et al., 2016). Recent studies have found that Internet addiction often co-occurs with other psychiatric disorders such as anxiety and depression, further complicating the diagnostic process (Kuss et al., 2017; Brown et al., 2021). As the first of its kind, the current study aimed to investigate the convergent and face validity of three of the most used diagnostic scales, and to use this to address the question of the existence of Internet addiction. The study culminated in the suggestion of a new model explaining cyber addictions for a more accurate account of the involvement of the Internet in addiction.

A key consideration in understanding whether the Internet can be addictive is discerning whether someone is addicted to the Internet itself or uses the Internet as a means to access another addiction. The psychological literature has repeatedly emphasised the addictive nature of the Internet (Young, 1996; Young, 1999; Young, 2004; Shaw and Black, 2008; Chou et al., 2005), and has eventually led to the development of diagnostic questionnaires such as the Internet Addiction Test (IAT; Young, 1998), despite Internet addiction not being formally recognized (APA, 2013; Petry et al., 2014). Sceptics believe that the Internet is not addictive and is simply a medium that people are using to fuel other addictive behaviours such as gaming addiction, cybersexual addiction, forming cyber-relationships and compulsive online shopping or gambling (Griffiths, 2000; Shaffer et al., 2000; Yellowlees and Marks, 2007).

There are various questionnaires used to identify problematic Internet use. Pan et al. (2020) conducted a systematic review and meta-analysis of 113 epidemiological studies (N = 693,306) and found that the prevalence of generalized Internet addiction was increasing with time. This pattern varied with the different assessment tools used to diagnose problematic users, which brings into question the validity of the diagnostic tools being used to identify problematic Internet use. These questionnaires are designed using existing criteria for substance use disorder and gambling disorder (Moon et al., 2018). Good convergent validity between diagnostic questionnaires would indicate that they are measuring the same construct, thus confirming the existence of Internet 'addiction', or rather, an Internet 'addiction'-like construct (Cunningham et al., 2001). However, there is a lack of studies comparing and investigating the convergent validity of problematic Internet use questionnaires.

Face validity (which describes whether a test measures what it claims to test) is often used to assess the validity of questionnaires as this assesses the extent to which a test, like a questionnaire, measures the construct that it is supposed to (Bolarinwa, 2015). This assessment speaks to the construct validity of a questionnaire. As a diagnostic tool, a questionnaire

must have good construct validity, which can be reflected by cut-off scores that can be used to accurately classify respondents into various categories (Lortie and Guitton, 2013). The lack of this impairs the efficacy of diagnostic tools, especially in the case of subjective behaviours like problematic Internet use. One study investigated the IAT in a clinical population of self-proclaimed Internet addiction patients (N = 52) who attended an Internet 'addiction' clinic housed in Konkuk University Hospital in Seoul. Participants were screened for comorbid psychiatric disorders. The IAT was only able to classify 42% of patients as Internet addicts, leading the researchers to suggest a highly cautionary approach when interpreting IAT scores (Kim et al., 2013). It is evident that such questionnaires require further validation and investigation to guide improvements that would prepare these tools for reliable, clinical use.

Face validity has previously been investigated using psychometric factor analysis to show the various characteristics of addiction that are measured by such questionnaires. A review of studies utilizing this method yielded inconsistencies in the number of facets of addiction that these questionnaires measure, rendering their conclusions about the existence of Internet addiction inaccurate (Moon et al., 2018).

A review of Internet addiction scales identified 45 diagnostic questionnaires that had their psychometric factor structures investigated in at least two studies (Laconi et al., 2014). However, their accuracy in classifying populations into 'addicts' and 'non-addicts' was not studied, and investigations into their convergent validity are lacking. Among the most common diagnostic tools include: the Internet Addiction Test, Compulsive Internet-Use Scale, Chen's Internet Addiction Scale, Problematic Internet Use Questionnaire, and the Internet-Related Problems Scale (Laconi et al., 2014). In the current study, Chen's Internet Addiction Scale was excluded as this was developed specifically for the Chinese population and had weak generalizability (Chen et al., 2003). The Problematic Internet Use Questionnaire was also excluded because this was derived from the IAT (Demetrovics et al., 2008).

Mak and Young (2020) introduced the Internet Addiction Test – Revised (IAT-R) which is the revised version of the original IAT (Young, 1998), and was designed using the DSM-IV criteria for pathological gambling. This updated version of the questionnaire was selected for this study due to its increased relevance as opposed to the original IAT. IAT-R research is scarce due to its recent introduction, and there are no validity studies examining the correlation between IAT-R scores and other questionnaires. Many academics refer to IAT literature for information, but the IAT does not have measurement equivalence and the high variance in factor models seen in versions such as the Lebanese (Samaha et al., 2018), Japanese (Tateno et al., 2018) and Indian (Spoorthy et al., 2021) versions, have been attributed to cultural differences. It is thus necessary to begin studying the IAT-R in greater depth instead of relying on information of an outdated test. The Compulsive Internet Use Scale (CIUS; Meerkerk et al., 2009) was selected for this study because it is the second most used questionnaire and was designed using a combination of DSM-IV diagnostic criteria for pathological gambling and substance abuse. The third most used questionnaire, the Internet-Related Problems Scale (IRPS; Armstrong et al., 2000), was developed using the DSM-IV criteria for substance abuse. The psychological literature is currently lacking any investigation of this critical combination of questionnaires which could potentially shed new light on the existence of Internet addiction and its official recognition as a mental disorder.

The current study aims to investigate the convergent and face validity of the three most common diagnostic questionnaires, the IAT-R, IRPS and CIUS. This was achieved by evaluating the correlations between the final scores of each questionnaire and a self-diagnosis question (SDQ). A Principal Components Analysis (PCA) was then used to identify the common components across all three questionnaires to inform upon their convergent validity. PCA does so by reducing large data with many dimensions to lower-dimensional data while limiting the loss of information. Lower-dimensional data consist of the most common dimensions identified throughout the dataset (Abdi and Williams, 2010). A logistic regression analysis was used to identify which questionnaires are valid diagnostic tools by investigating the ability of each questionnaire to predict participants' answers to the SDQ. The regression models were then used to determine the cut-off scores for each questionnaire based on predictions in a new sample. The convergent and construct validity information was used to inform upon the over-arching question: does Internet 'addiction' truly exist?

METHODS

Participants

101 participants took part in this study. Eight participants provided incomplete or duplicate data and were excluded from the analysis. Participants were actively recruited from the University of Glasgow's School of Psychology subject pool comprising Psychology students and users of Facebook, Instagram, WhatsApp, and LinkedIn.

Data collection

Data was collected using the online research platform Experimentum, developed by Psychology researchers at the University of Glasgow (DeBruine et al., 2020). The survey consisted of demographic questions, three diagnostic questionnaires and a SDQ. The questionnaires were presented in random order. The survey was active online from December 2021 to February 2022.

Internet Addiction Test – Revised. The IAT-R (Mak and Young, 2020) is a 20-item questionnaire (Refer to Table 1; Appendix II) that is the recently revised version of Young's original IAT (Young, 1998). Each question carries equal weight. A higher final score reflected by the total sum of the ratings indicates higher levels of IA. This was created while keeping in mind the evolution of technology and the way we use the Internet today. For example, the amount of time spent on the Internet is no longer relevant without differentiating the reason for Internet use due to the integration of the Internet into our daily functioning (Mak and Young, 2020). As a result, questions judging the amount of time spent online were replaced by more specific and relevant ones. Mak and Young (2020) also introduced some instructional changes, reminding respondents that Internet use extends to other smart devices like smartphones and tablets.

Compulsive Internet Use Scale. The CIUS (Meerkerk et al., 2009) is a 14-item questionnaire (Refer to Table 1; Appendix III). A higher final score reflected by the total sum of the ratings indicates higher levels of problematic Internet use. Assessors are advised to moderate this at their own discretion for different cultural contexts.

Internet-Related Problems Scale. The IRPS (Armstrong et al., 2000) is a 20-item questionnaire (Refer to Table 1; Appendix IV). Respondents are reminded to answer in accordance with their non-business-related Internet activities. Each question is classified into one of nine categories: withdrawal (five questions), tolerance (two questions), reduced activities (two questions), related activities (one question), craving (one question), introversion (one question), negative effects (four questions) and escape from other problems (three questions). The sum of the mean rating for each category reflects the

Table 1: Specifications of the IAT-R, CIUS and IRPS investigated in this study.

Questionnaire	Number of Questions	Likert Scale Ratings	Range	Cut-Off Scores (Suggested)	Modelled After
IAT-R	20	0 = Never 1 = Rarely 2 = Occasionally 3 = Sometimes 4 = Often 5 = Always	0 - 100	Normal users: 0 – 39 Problematic users: 40 – 69 Addicted users: 70 – 100	Pathological Gambling (DSM-IV)
CIUS	14	0 = Never 1 = Seldom 2 = Sometimes 3 = Often 4 = Very often	0 - 56	Normal users: 0 – 28 Problematic Users: 29 – 56	Pathological Gambling and Substance Use Disorder (DSM-IV)
IRPS	20	1 = not true at all 10 = extremely true (no descriptors for ratings 2 – 9)	9 - 90	N/A Problematic users are identified based on the assessors' discretion	Substance Use Disorder (DSM-IV)

respondent's final score. A higher final score is indicative of more severe problematic Internet use behaviours. Respondent classification of the severity of problematic Internet use is up to the discretion of the assessor. (PCA of the IRPS can be found in Appendix I). Five factors were found that do not map onto the categories well. This was beyond the scope of this study so no further analysis was conducted.

Self-Diagnosis Question. The SDQ is a yes-no question asking respondents if they believe they are addicted to the Internet. Individuals answering 'Yes' are classified as self-defined addicts (SDAs). Individuals answering 'No' are grouped as non-SDAs.

Ethics

Ethical approval was obtained from University of Glasgow's Institute of Psychology and Neuroscience. Informed consent was sought from participants prior to inclusion in the study.

Exclusion criteria consisted of a minimum age of 18 years. Participants were not screened for any underlying mental health conditions. No rewards or monetary compensation was offered upon completion of the study. Participation was voluntary.

Data Analysis and Visualization

All statistical analysis was conducted using R (V4.0.3) (R Core Team, 2021) and R Studio (V 1.4.1103).

Questionnaire scores for each unique participant were calculated according to the methods provided by the questionnaires' authors (see Table 1). Descriptive statistics were calculated. A correlation analysis along with the sensitivity analysis was conducted on the final scores. A PCA on the final scores was conducted to determine the number of factors measured by all three questionnaires, and to what extent. PCA does so by reducing large data with many dimensions to lower-dimensional data while limiting the loss of information. Lower-dimensional data consist of the most common dimensions identified throughout the dataset (Abdi and Williams, 2010). Both tests were used to investigate convergent validity.

The diagnostic validity of the questionnaires was assessed using binary logistic regression models for the SDQ. An initial model contained all three questionnaires' scores as predictors. Separate models were created with each of the questionnaire scores as the sole predictors. Results were used to determine the rate of correct classifications of each questionnaire. The regression models were used to determine the cut-off score for each questionnaire in a predicted sample. Model residuals were checked for normality using a quantile-quantile plot.

RESULTS

Descriptive Statistics

The final statistical analysis was performed on 93 participants aged between 19 and 42 years (M = 23.0, SD = 3.93). There were 46 males (49.4%), 42 females (45.2%) and 5 individuals who preferred not to disclose their gender (5.4%). Participants were from the following regions: two from Africa (2.2%), 50 from Asia (55.0%), 38 from Europe (41.8%), one from North America (1.0%), and none from Oceania, South America, The Caribbean and Central America. 31 (33%) participants answered 'Yes' to the SDQ and 62 (66%) answered 'No'.

Correlation Analysis

All three questionnaires shared strong positive correlations with one another, and weak positive correlations with the SDQ. The IAT-R and IRPS had a strong positive correlation ($r = 0.77$, $p < .001$). The CIUS was also strongly positively correlated with the IAT-R ($r = 0.72$, $p < .001$) and the IRPS ($r = 0.72$, $p < .001$). All three questionnaires were moderately correlated with the SDQ ($.32 \leq r \leq .41$; see Figure 1). The sensitivity analysis found that the minimum correlation able to be detected at 80% power of N = 93 was r = .25.

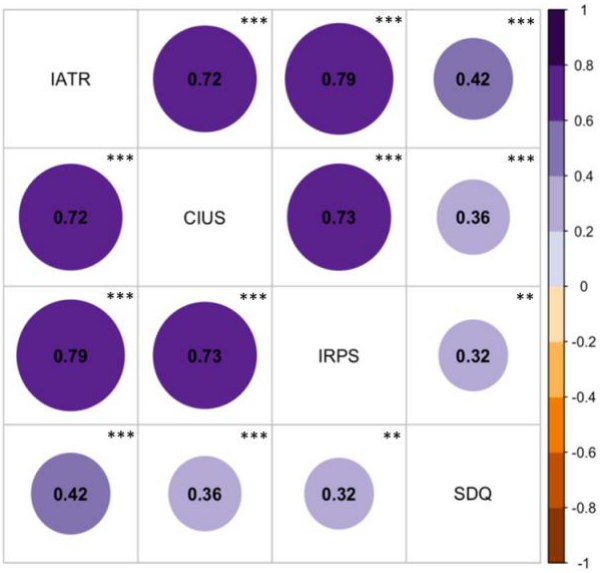

Figure 1: Correlation coefficients for the IAT-R, IRPS, CIUS and SDQ.

'*' indicates a significant result with a p-value < 0.05.

'' indicates a significant result with a p-value < 0.01.**

'*' indicates a significant result with a p-value < 0.001.**

Principal Components Analysis

PCA was conducted using the criterion in the SPSS-default method of eigenvalues > 1 for selecting which components were significant for semantic interpretation. The analysis was based on a correlation matrix of the final sum scores for the three questionnaire and the SDQ. A single factor loading accounting for 68.2% of variance was found, suggesting that all three questionnaires measured this factor well. The IAT-R, CIUS and IRPS were strongly associated with the factor and the IAT-R was the most associated (see Table 2). The SDQ was moderately associated with the factor. The factor was identified as "addiction", but not "Internet addiction" because the CIUS and IRPS address this concept as problematic Internet use. The CIUS and IRPS are, however, created using existing addiction criteria and hence measure addiction.

Table 2: Factor loadings—IAT-R, CIUS, IRPS and SDQ

Measure	Factor 1
	Addiction
PCA loadings	
IAT-R	.914
CIUS	.876
IRPS	.894
SDQ	.571
Proportion of Variance	.682

Logistic Regression Analysis

A logistic regression analysis was conducted to determine the predictive power of each questionnaire and the cut-off scores for the current sample. IAT-R scores was the only predictor variable that was found to significantly contribute to the model with all three questionnaires as predictors. The unstandardized Beta weight for IAT-R scores; B = 0.0761, SE = 0.04, Wald = 2.141, p = 0.032. The estimated odds ratio showed that the probability of answering 'Yes' to the SDQ increased as the IAT-R score increased [Exp (B) = 1.079, 95% CI (1.006, 1.157)] (see Table 3). The second model used IAT-R scores as the predictor. The unstandardized Beta weight for IAT-R scores; B = 0.0827, SE = 0.022, Wald = 3.679, p < 0.001. The estimated odds ratio showed that the probability of answering 'Yes' to the SDQ increased as the IAT-R score increased [Exp (B) = 1.086, 95% CI (1.039, 1.135)] (see Table 3). The IAT-R was found to have a correct classification rate of 76%.

The third model used CIUS scores as the predictor. The unstandardized Beta weight for CIUS scores; B = 0.110, SE = 0.034, Wald = 3.25, p = 0.001. The estimated odds ratio showed that the probability of answering 'Yes' to the SDQ increased as the CIUS score increased [Exp (B) = 1.116, 95% CI (1.044, 1.192)] (see Table 3). The CIUS was found to have a correct classification rate of 70%.

The fourth model used IRPS scores as the predictor. The unstandardized Beta weight for IRPS scores; B = 0.076, SE = 0.026, Wald = 2.94, p = 0.003. The estimated odds ratio showed that the probability of answering 'Yes' to the SDQ increased as the IRPS score increased [Exp (B) = 1.079, 95% CI (1.026, 1.135)] (see Table 3). The IRPS was found to have a correct classification rate of 72%.

Normality of model residuals was checked with a quantile-quantile plot (Figure 2). Model residuals were not completely normally distributed.

The Q-Q plot (figure 2) shows the distribution of residuals for the logistic regression model with all three questionnaires as predictors. A normal distribution indicates a well-fitted linear model for predicting questionnaire scores accurately. This plot shows evidence of non-normality of residuals.

Cut-Off Scores

Cut-off scores were compared to those suggested by the questionnaires' authors and inconsistencies were found across all three questionnaires. The cut-off scores are the threshold for each questionnaire where participants are classified into 'addicts' and 'non-addicts'. Density curves were plotted for the IAT-R, CIUS and IRPS, and were differentiated by SDAs and non-SDAs. The calculated cut-off score was superimposed on the figures and compared to those suggested by the questionnaires' authors.

The IAT-R logistic regression model was used to predict responses for the SDQ for possible final scores 0 – 100. A cut-off score of 46 was found to differentiate between 'normal' and 'problematic' users in the predicted sample. This is six points higher than the original suggested cut-off score of 40 (Figure 3).

The CIUS logistic regression model was used to predict responses for the SDQ for possible final scores 0 – 56. A cut-off score of 33 was found to differentiate between 'normal' and 'problematic' users. This is seven points higher than the original suggested cut-off score of 28 used to differentiate between 'normal' and 'problematic' users (Figure 4).

The IRPS logistic regression model was used to predict responses for the SDQ for possible final scores 9 – 90. A cut-off score of 54 was found to differentiate between 'normal' and 'problematic' users (Figure 5).

Table 3: Logistic regression analysis. This table highlights the results of the logistic regression models with independent binary variable SDQ score. Four separate models were created. The first model listed all three questionnaires as predictors. Only the IAT-R was found to be a significant predictor. The remaining three models had the IAT-R, CIUS and IRPS scores as predictors respectively. CI refers to the confidence intervals for each predictor.

Predictor	Estimate (β)	SE	Odds Ratio (e^{β})	Wald	*p*	95% CI [lower, upper]
(Intercept)	-3.81	1.24	0.022	-3.08	< 0.001	[0.002, 0.251]
IAT-R	0.076	0.036	1.08	2.14	0.032	[1.01, 1.16]
CIUS	0.041	0.049	1.04	0.848	0.397	[.947, 1.15]
IRPS	-0.0179	0.042	0.982	-0.424	0.672	[0.904, 1.07]
(Intercept)	-3.77	0.906	0.023	-4.17	< 0.001	[0.004, .136]
IAT-R	0.083	0.023	1.09	3.68	< 0.001	[1.01, 1.14]
(Intercept)	-3.54	0.935	0.029	-3.79	< 0.001	[0.005, 0.181]
CIUS	0.110	0.034	1.12	3.25	0.001	[1.04, 1.20]
(Intercept)	-4.09	1.21	0.017	-3.37	< 0.001	[0.002, 0.180]
IRPS	0.076	0.026	1.08	2.94	0.003	[1.03, 1.14]

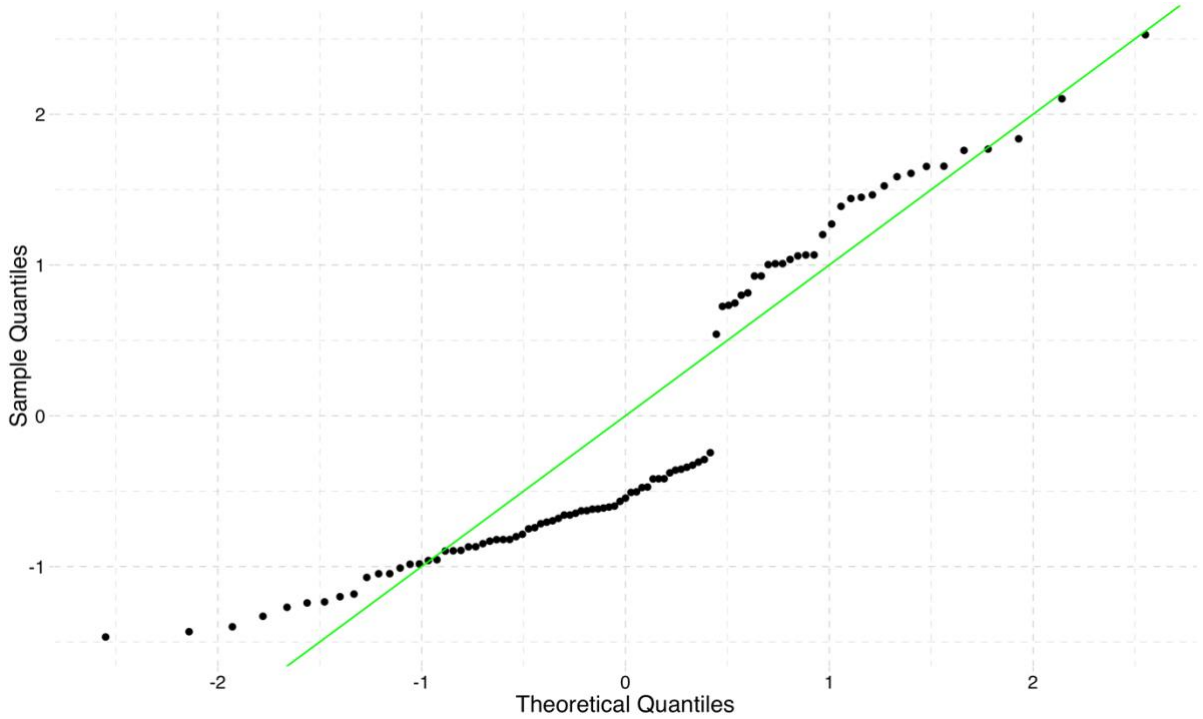

Figure 2: Distribution of residuals.

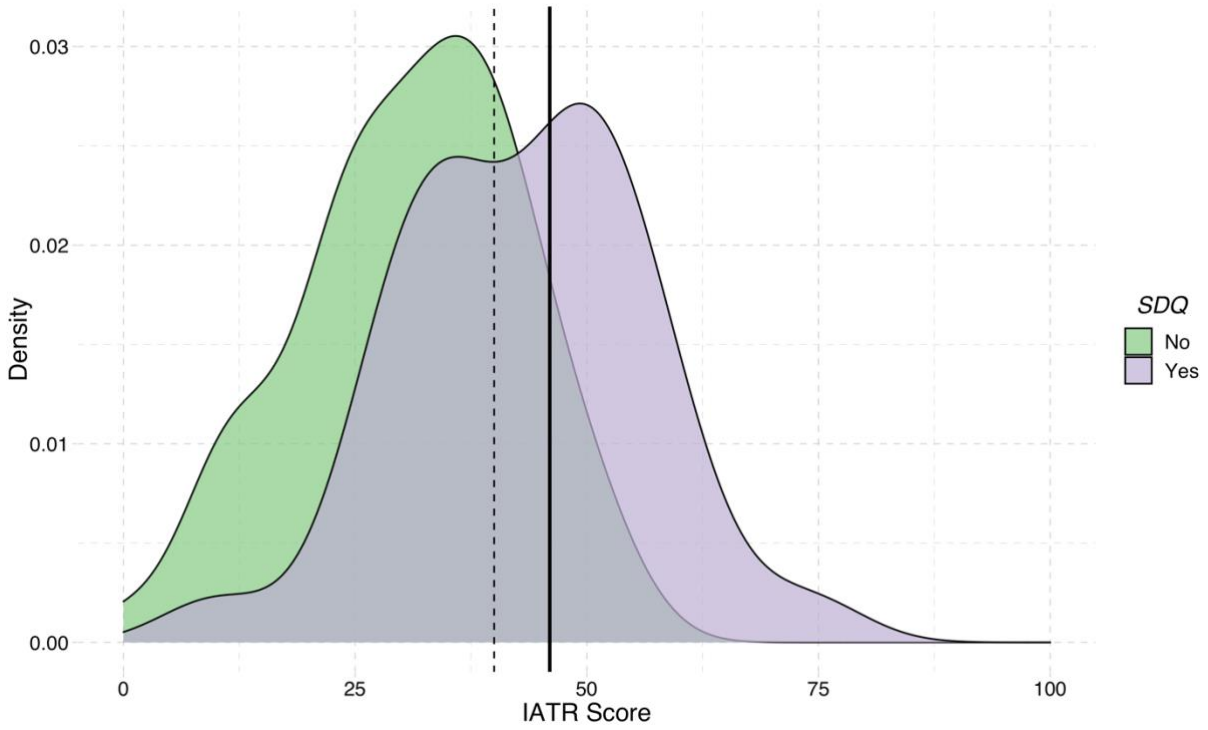

Figure 4: IAT-R Score Distribution Differentiated by the SDQ

Density curves depicting the IAT-R scores for the current sample. SDQ data was used to plot two curves. The vertical solid black line represents a cut-off score of 46 that was determined using the predictive logistic regression model. The vertical broken black line represents a cut-off score of 40 that was originally suggested by the authors of the IAT-R. The x-axis represents the entire range of possible final scores for the IAT-R.

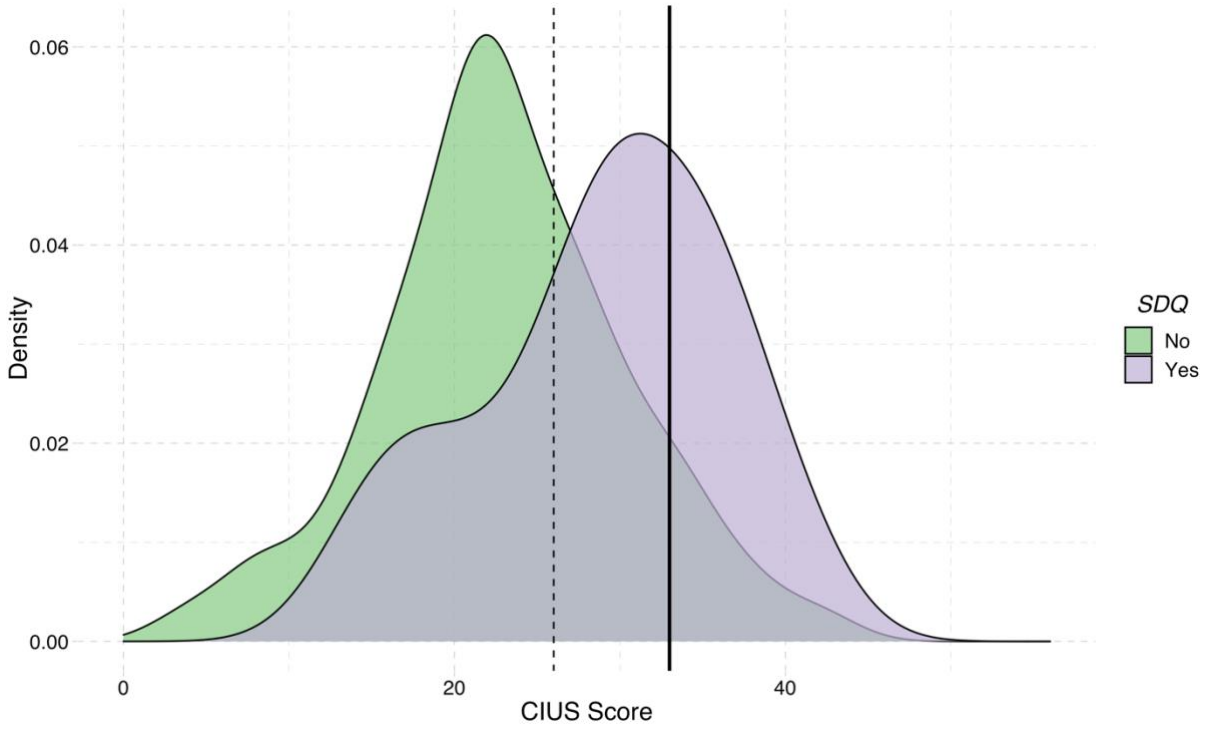

Figure 3: CIUS Score Distribution Differentiated by the SDQ

Density curves depicting the CIUS scores for the current sample. SDQ data was used to plot two curves. The vertical solid black line represents a cut-off score of 33 that was determined using the predictive logistic regression model. The vertical broken black line represents a cut-off score of 28 that was originally suggested by the authors of the CIUS. The x-axis represents the entire range of possible final scores for the CIUS.

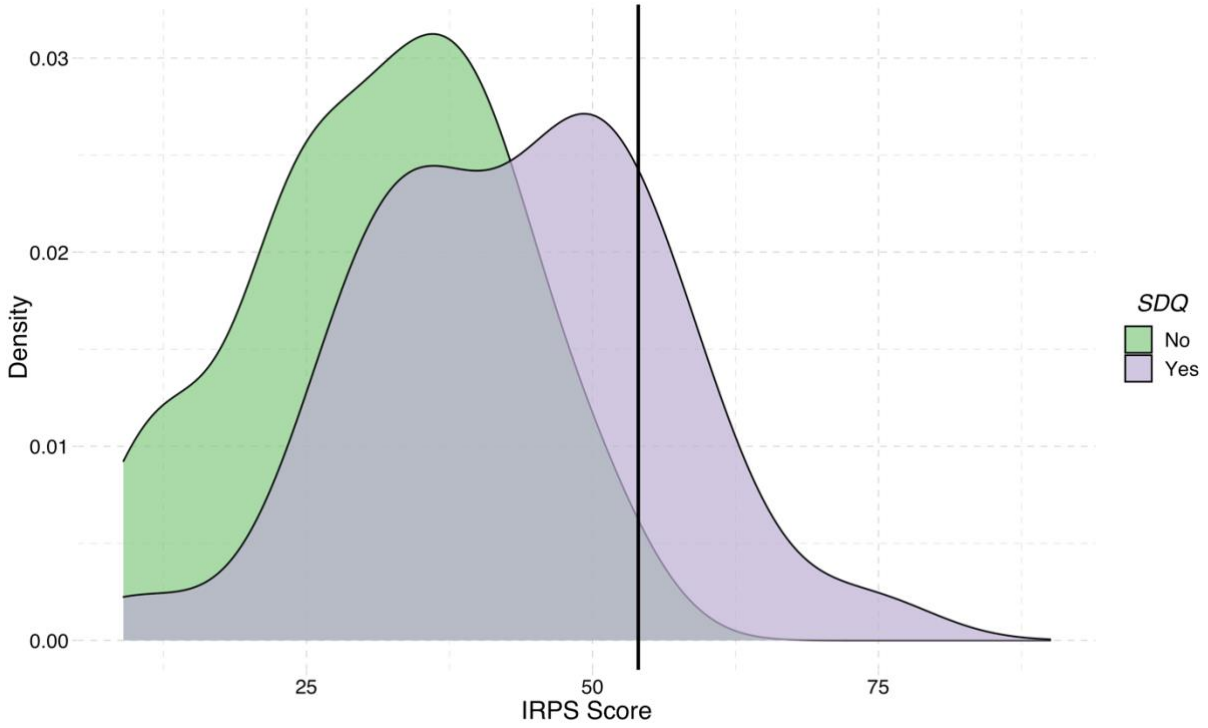

Figure 5: IRPS Score Distribution Differentiated by the SDQ

Density curves depicting the IRPS scores for the current sample. SDQ data was used to plot 2 curves. The vertical solid black line represents a cut-off score of 54 that was determined using the predictive logistic regression model. No cut-off score was suggested by the original authors. The x-axis represents the entire range of possible final scores for the IRPS.

DISCUSSION

This study investigated the convergent and face validity of Internet 'addiction' diagnostic questionnaires: the IAT-R, CIUS and IRPS. The correlation analysis revealed strong positive relationships between all three questionnaires and the PCA identified a single component upon which the three questionnaires mapped well, suggesting good convergent validity of the three questionnaires. This indicates that they measure a common construct which was identified as addiction. Cut-off scores of 46 for the IAT-R, 33 for the CIUS and 54 for the IRPS were determined. These are inconsistent with the scores suggested by the questionnaires' authors, thus pointing to their weak face, and hence, construct validity.

The IAT-R, CIUS and IRPS were strongly positively correlated to one another, suggesting their strong convergence. The questionnaires were designed using existing DSM-IV criteria for pathological gambling, substance abuse, or a combination of the two. These criteria all measure addiction, which likely explains the strong correlations and hence good convergent validity of the questionnaires. The results of this study concurred with a psychometric comparison study (N = 225) that found a strong correlation ($r = .90$, $p < .01$) between the IAT and IRPS (Widyanto et al., 2011). The similar psychometric factor structure of the IAT and IAT-R has allowed for the extrapolation of this conclusion to the IAT-R (Mak and Young, 2020). Existing studies do not compare and investigate the relatedness between any combination of the IAT-R, CIUS and IRPS, so the correlation results cannot yet be verified and should be approached with caution.

The SDQ had a weak positive correlation with the IAT-R, CIUS and IRPS. Theoretically, the self-report questionnaires (Widyanto et al., 2011) should have been more strongly correlated with the self-reported SDQ, making this finding of particular interest. Most individuals seeking help for Internet addiction are self-defined addicts (Kim et al., 2013), so this should be well-reflected in self-report questionnaires where the individual evaluates their own behaviour. The weak correlation perhaps points to either an individual who wrongly believes that they are an Internet 'addict', or a questionnaire that is an ineffective diagnostic tool.

The IAT-R was most strongly correlated with the SDQ out of the three questionnaires. This points to the IAT-R having the highest potential clinical value out of the three questionnaires. Widyanto et al. (2011) found slightly weaker correlations of the IAT ($r = .40$, $p < .01$) and IRPS ($r = .40$, $p < .01$) with the SDQ. The population parameters in this study were similar to the ones in the current study so it is possible that the inconsistent results could be attributed to varying degrees of the social desirability bias often seen in self-report measures (Durmaz et al., 2020). This is characterized by an individual who can over- or under-report their behaviours to conform to society's norms. Incorporating information obtained from the participant's close relations could potentially eliminate this bias, thus forming a more accurate account of the individual's behaviour (Larson, 2019). IAT information has been extrapolated to the IAT-R due to the lack of studies investigating the IAT-R (Mak and Young, 2020). Existing literature also does not include correlation information on the CIUS and an SDQ so these results cannot yet be corroborated.

PCA revealed one factor that was interpreted as addiction. It was concluded that the questionnaires have good convergent validity and measure the same construct. Widyanto et al. (2011) identified 3 and 4 factors for the IAT and IRPS respectively but did not investigate their combined principal components. They loosely concluded that the IAT and IRPS were measuring the same construct, lending some support to the results of the current study. These results need to be approached with caution because they have not been reported upon previously. Unexplained variance in previous studies has been attributed to

cultural differences (Moon et al., 2018), potentially explaining the results of this study. However, this has yet to be explored.

The correlation analysis and PCA results point to the overall good convergent validity of the IAT-R, CIUS and IRPS. It is thus believed that that they measure a similar construct: addiction. The nature of this measured addiction however is still to be determined.

Logistic regression found the IAT-R to be the only significant predictor in identifying individuals with problematic Internet behaviours. The IAT-R is likely to be the questionnaire with the highest clinical relevance, if any. The IAT-R also had the highest correct classification rate of 76% as compared to 42% for the IAT (Kim et al., 2013). It is possible that the revised version of the IAT has greater differential power, but this has not been investigated previously. It is thus advised that these results be approached with caution. Logistic regression models with each questionnaire as the sole predictor identified all three questionnaires as significant predictors. The high positive correlations between the questionnaires can explain the similar significance of all three questionnaires. Due to the insignificance of the CIUS and IRPS in the full regression model, it is concluded that they have weak construct validity as they are unable to significantly predict Internet 'addicts'.

A cut-off score of 46 was determined for the IAT-R to differentiate between 'normal' and 'problematic' Internet users. This is 6% higher than the suggested cut-off score of 40 (Mak and Young, 2020), suggesting weak face validity of the IAT-R. A longitudinal study (N = 1005) examining the differential power of the IAT measured a mean score of 42.1 for non-addicts and 57.8 for self-proclaimed addicts and determined a cut-off score of 50 (Tateno et al., 2018). However, this study was specific to the Japanese population, and was conducted using the IAT, not the IAT-R. It is possible that the improvements made to the IAT brought this threshold down closer to the suggested cut-off scores, thus explaining the results of the current study. It should be noted that Mak and Young (2020) adopted the IAT cut-off scores for the IAT-R and did not conduct additional investigations to determine new IAT-R cut-off scores. The suggested IAT-R scores may thus not be accurate. However, the lack of research on the IAT-R makes this the only reference point.

A cut-off score of 33 was determined for the CIUS to differentiate between 'normal' and 'problematic' Internet users. This was higher than the suggested score of 28 out of 56 (Meerkerk et al., 2009), signalling the weak face validity of this questionnaire. Assessors are advised to modulate this for different countries/cultures at their own discretion, which can potentially explain the inconsistencies in scores. A Japanese study comparing the IAT and CIUS (N = 4886) concluded that CIUS cut-off scores should be 18 and above for 'mild addiction', and 23 and above for 'severe addiction' (Yong et al., 2017). Guertler et al. (2014) found these to be 18 and 21 respectively for a population of problematic and pathological gamblers. It is likely that specific cultural and comorbid populations show varying patterns of Internet use. The current study did not account for these differences directly, which may explain the inconsistent results. The aforementioned studies used IAT cut-off scores to establish CIUS thresholds. The inconsistencies in IAT scores and factor structures makes this method flawed and needing of improvement. The current study adopted a different method, which could explain the determined cut-off score that was higher than the original. Confirmation studies using this method, with necessary improvements would be beneficial in determining the true cut-off scores for the CIUS whether the CIUS needs to be modulated for different cultural and comorbid populations.

A cut-off score of 54 was determined for the IRPS to differentiate between 'normal' and 'problematic' Internet users. The IRPS does not have a proposed cut-off score (Armstrong et al., 2000), significantly reducing the scale's construct validity. The classification of individuals as normal or problematic users is left to the subjective judgement of the assessors. The Likert scale does not offer any descriptors for 8 out of the 10 possible numerical ratings, worsening the subjectivity of the scale. The IRPS does however instruct respondents to answer regarding their leisure Internet use, which is an important feature not seen in other questionnaires. The IRPS has been minimally investigated in the literature so the results of this study cannot be corroborated. It is suggested that relevant changes be made to improve the construct validity and overall effectiveness of the IRPS.

The cut-off score analyses in the current study casts doubt on the face and construct validity of the IAT-R, CIUS and IRPS. There is a gap in the literature investigating such aspects of these questionnaires, further highlighting the need to do so. Research corroborating or contesting these results is necessary before these tools can assume a diagnostic role in identifying distressed individuals.

The IAT-R, CIUS and IRPS have one common flaw: the lack of differentiation of reasons for Internet use (Widyanto et al., 2011). Each respondent provides behavioural information by considering their Internet behaviours as a whole, choosing to focus on a specific function such as online shopping or gaming, or selecting an application like Netflix. This discretionary selection occurs without the assessors' knowledge. For example, an individual who answers with response to their online gambling behaviours may be misdiagnosed as an Internet 'addict' due to high scores on a questionnaire that measures addiction. Pathological Gambling is an official diagnosis that would suit this individual more and could dictate their future treatment (Petry et al., 2014). The IRPS is the only questionnaire that instructs respondents to consider "non-business-related Internet use" (Armstrong et al., 2000), but this lacks the required additional specificity. Further issues arise from asking individuals to select a single reason for Internet use when it is often used for multiple reasons simultaneously (Hunsaker and Hargittai, 2018). Internet 'addiction' questionnaires need to overcome the lack of clear and specific instructions to function effectively in our complex, digitized world.

Limitations

This study was limited by a small sample size (N = 93) resulting in potentially undetected differences and patterns. Participants were not screened for any underlying psychological conditions such as other addictions, compulsive behaviours or anxiety and depression, which could have significantly impacted their questionnaire scores (Floros et al., 2014). Self-report questionnaires investigating taboo areas such as addiction, unsocial attitudes or crimes are often impaired by the social desirability bias (Krumpal, 2013), which can affect the accuracy of the information provided. The logistic regression model residuals were not perfectly normally distributed, suggesting that improvements can be made.

Future Directions

The field of Internet addiction requires improved methodology for investigating its existence and the validity of diagnostic questionnaires being used to prove that it exists. Most of the literature testing for questionnaire validity employs psychometric factor analyses to prove that Internet addiction has characteristics parallel to those seen in substance or behavioural addictions (Moon et al., 2018). However, these studies often do not capture innate aspects of addiction such as

tolerance and withdrawal well. Investigation into the construct validity of these questionnaires is severely lacking. This can be informed upon by more in-depth study of cut-off scores, interpretation of questionnaire items and their structure, and enhanced by providing more specific instructions to respondents. Questionnaires should be able to minimize bias and maximize precision in diagnosing individuals before being applied to clinical settings, and research should be geared towards attaining this.

The IAT-R is arguably the most relevant Internet 'addiction' diagnostic tool but has the smallest bank of studies. It would be prudent to focus resources on investigating this and running validity studies with larger sample sizes, while studying predictors such as cultural differences in more diverse populations and employing measures to alleviate the social desirability bias. Additional questions specifying the reason for Internet use and differentiating between popular online applications such as Netflix and Facebook etc. is also necessary.

The next step would be to test these questionnaires in clinical populations. This has only been published on once, and it was found that the IAT had an efficacy rate of only 42% (Kim et al., 2012). Finding a clinical population of Internet 'addicts' has its own challenges because these individuals typically attend Internet 'addiction' clinics on their own volition or in some cases, are recommended by their loved ones instead of a medical professional (Kim et al., 2012). It can be argued that self-defined addicts do not constitute a clinical population (Zapata et al., 2019) so obtaining large, relevant clinical samples is difficult. This cyclical issue would require significant study to overcome.

Addiction is underlined by a close brain-behaviour relationship, i.e., the biological neural correlates that govern behaviour (Loganathan and Ho, 2021). It could thus be beneficial to investigate Internet addiction from a neuropsychological perspective. A review of neuropsychological studies found that the neurobiological mechanisms in Internet 'addicts', substance use addicts and pathological gamblers were similar, and they concluded that Internet addiction should be classified as an addiction (Brand et al., 2014). Most of these studies investigate participants diagnosed with Internet Gaming Disorder (IGD) and often do not screen for underlying psychological issues or other comorbid addictions that could potentially explain the structural brain changes. Once such methodological flaws are overcome, neuropsychological evidence could prove to be useful in helping end the Internet addiction debate.

CONCLUSION

The fight to have Internet addiction officially listed in the DSM-V continues, and the Internet Addiction Debate has yet to be resolved. Internet addiction has numerous parallels to existing officially recognized addictions, but it is often argued that problematic Internet behaviours do not match the true definition of addiction, and existing evidence is not strong enough to support Internet addiction as a disorder (Van Rooij and Prause, 2014; Petry et al., 2014). There is a resultant fear that Internet addiction is being excessively pathologized (Kardefelt-Winther et al., 2017) and is not a true affliction. The first argument is that Internet addiction should be classified as an impulse control disorder, not an addiction (Lee et al., 2012). The second argument is that the Internet serves as a means to an end, which people use to access their true addictions (Griffiths, 2000). As identified in the current study, the reason for Internet use needs to be specified during assessments (Widyanto et al., 2011) because it is likely that users are addicted to certain applications and functions rather than the Internet itself. Additionally, conceptualizing behavioural addictions without pathologizing common behaviours requires broad-spectrum research (Kardefelt-Winther et al., 2017) that goes beyond the analysis of psychometric factor structures, as seen in previous studies. This requires comparison between diagnostic questionnaires and investigations into the validity of these questionnaires, as seen in the current study which invalidated these questionnaires.

The scientific literature points towards the existence of a similar construct (addiction), but not Internet addiction. Internet addiction is currently used as an umbrella term to encompass all cyber addictions, which are inherently different and should not be classified together. The term itself is ambiguous and univocally defined, making it unfit to serve as a diagnosis, thus denying the existence of Internet addiction. Further distinctions pertaining to active and passive Internet use need to be made. Active or purposeful Internet use refers to activities such as surfing the net or replying to emails. Passive Internet use refers to 'checking' behaviours where an individual aimlessly checks their social media, even just for a few seconds in between other activities (Castellacci and Tveito, 2018). It is thus necessary to develop a new model that considers various kinds of Internet use and identifies different Internet-related disorders that are linked by the involvement of the Internet. This updated model could then be used to design valid and appropriate questionnaires to diagnose these individual disorders, such as Internet Gaming Disorder listed in the ICD-11 (WHO, 2018).

The Internet is an inherent part of our professional, academic, personal, and social lives. Saying that someone is addicted to it is akin to saying that someone with a gambling problem is addicted to a casino, or that someone with a drinking problem is addicted to the liquor store. Not only do the questionnaires examined in this study underperform as diagnostic tools, but they also attempt to investigate something that essentially does not exist.

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