

# The Effects of Boredom, Loneliness, and Distress Tolerance on Problem Internet Use Among University Students

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**Abstract** The purpose of this study was to examine whether boredom proneness and/or loneliness predict problem internet use (PIU) and whether these possible associations are moderated by distress tolerance. The study used a sample of 169 undergraduate university students known to be regular internet users, and measured the impact of PIU on their life by examining the relationship between PIU and academic performance. As predicted, boredom proneness was significantly associated with PIU and was a significant predictor of PIU in a model that included loneliness and distress tolerance. Loneliness was also significantly associated with both boredom and PIU, but was not a significant predictor of PIU in the model. There was no evidence that distress tolerance moderated either of these associations. As predicted, higher levels of PIU were associated with lower levels of academic performance, leading us to the conclusion that university students who are prone to experiencing boredom tend to use the internet to seek out more stimulating and satisfying activities, which in turn can lead to problematic internet use patterns that can negatively affect their academic performance.

**Keywords** Problem internet use · Boredom · Loneliness · Academic performance · Distress tolerance · Internet addiction

## Introduction

The evidence that excessive internet use constitutes an “addiction” was not sufficient for internet addiction to be included as a diagnostic category in the recently released Diagnostic and Statistics Manual of Mental Disorders—Fifth Edition (DSM-5; American Psychiatric

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Association; APA 2013). However, there is a general consensus among researchers and clinicians that some individuals use the internet excessively, such that they experience tolerance and withdrawal symptoms, and suffer negative psychological, social, and occupational outcomes as a result of internet use. This profile has been termed “problem internet use” (PIU; Shapira et al. 2003; Widyanto and Griffiths 2006; Young 2009), and it shares many similarities with addictive behaviour, while remaining agnostic with regard to causal mechanisms and maintenance.

Unlike substance abuse or gambling, most people need to use the internet for daily activities, study, work and recreation, making it difficult to identify, monitor and regulate what constitutes problematic behaviour. Most previous research has concentrated on the extreme end of problematic internet use such as excessive video gaming, online gambling, and online sexual behaviour, engaged in by a relatively small group of people (Shapira et al. 2003; Widyanto and Griffiths 2006; Young 2009). While these groups are clearly important, a much larger proportion of the population potentially experiences negative (problematic) outcomes due to more moderate and normative internet use (Widyanto et al. 2011). This more moderate level of problematic internet use has been under-researched relative to the more extreme forms.

It is the level of control and impact on one’s life, rather than the amount or type of internet use, that defines internet use as problematic. University students are one group of internet users who spend many hours per day on the internet searching for specific information related to their studies, browsing the internet generally, and using social networking sites (SNSs) and other communication tools, placing them at greater risk of developing problem internet behaviours (Derbyshire et al. 2013; Kittinger et al. 2012; Kuss et al. 2013; Morahan-Martin and Schumacher 2000). They are also a group for whom problem internet use may manifest as having a direct and quantifiable impact on academic performance. The purpose of this study was to test a model that predicts problem internet use and academic performance among a sample of university students.

## **Problematic Internet Use**

As noted above, DSM-5 does not include internet addiction as a diagnostic category, but does include it as a target for further investigation, recognizing its potential significance as a mental health issue, but highlighting the lack of consensus over its status. This is perhaps a good thing for research, since pathologising problematic internet use could lead to a focus on extreme or non-normative internet behaviours and efforts to define levels of addiction, rather than a focus on the potentially problematic effects of a range of (perhaps socially normative) internet behaviours amongst specific populations. The use of the terms “problem” and “use” rather than “addiction” and “internet” are intended to convey the notion of a spectrum of technology-related distress and dysfunction without a nosological commitment to the nature of the pathology and the “substance”.

Davis (2001) argues for two distinct types of PIU: a specialised type and a generalised type. The specialised type encompasses users who are dependent on a particular internet activity or function, while generalised PIU refers to general internet use (e.g., browsing, social networking) as a source of adjustment and functioning problems. Research is showing that many people spend large amounts of time browsing the internet. This propensity coupled with the increased accessibility of web browsers via mobile devices suggests that general internet use has the potential of being far more intrusive in daily life (problematic) on a much wider scale than the activities with narrow appeal which are the focus in specialised types of PIU.

Several researchers have proposed models of generalised PIU, which stand in contrast to the addiction focus of clinical models. For instance, Davis (2001) argued for a cognitive-behavioural model of PIU in which maladaptive cognitions and/or social isolation predict generalised PIU. In particular, internet users who experience a lack of relatedness with family and friends, or people who use technology to procrastinate and avoid their responsibilities may develop PIU. LaRose et al. (2003) proposed a social-cognitive model in which the internet provides the stimulus for a spectrum of problems ranging from lapses of control to excessive internet use for persons with deficient self-regulation processes.

Tokunaga and Rains (2010) used structural equation modelling to compare possible aetiologies based on correlations derived from meta-analyses of a range of studies. They tested a “clinical” model in which psychosocial problems led to internet use, with internet “problems” as the outcome, as well as a non-clinical “self-regulation” model in which psychosocial problems predicted PIU, which in turn led to time spent using the internet. According to Tokunaga and Rains, support was found for the non-clinical self-regulation model in that time spent on the internet predicted PIU and not the other way. This finding supports the view that generalised PIU is not a clinical issue but rather one of poor self-regulation. In other words, general problematic internet behaviours appear to be less about the internet and more about poor self-regulation.

PIU has been associated with several negative psychological outcomes such as low self-esteem (Armstrong et al. 2000; Caplan 2002; Kim and Davis 2009; Niemz et al. 2005), anxiety (Dowling and Brown 2010; Kelley and Gruber 2010; Park et al. 2013) and depression (Caplan 2002; Dowling and Brown 2010; Fortson et al. 2007; Kelley and Gruber 2010; Mitchell et al. 2009; Park et al. 2013; Tokunaga and Rains 2010). Some studies have described psychological variables such as self-esteem, anxiety, and depression as outcomes of PIU, other studies have employed these variables as predictors of PIU. Although this distinction may be important when concentrating on specialised PIU, inasmuch that it differentiates between causes and consequences of a potential psychological disorder, this is not the case when referring to everyday generalised PIU. That is, generalised PIU is not necessarily associated with other psychological disorders. As mentioned previously, PIU is a broad concept in which a majority of users who engage in inappropriate or excessive internet use do not experience psychological disorders, but instead waste time, procrastinate or get distracted by the internet, which may lead to milder negative personal, social or professional problems.

Another area that has been the focus of investigation is the association between PIU and academic performance (Derbyshire et al. 2013; Junco 2012; Junco and Cotten 2012; Kirschner and Karpinski 2010; Rosen et al. 2013). Researchers have shown that time spent on Facebook has a negative association with grade point average (GPA; Junco 2012; Junco and Cotten 2012; Kirschner and Karpinski 2010; Rosen et al. 2013). Some have even identified possible mechanism for this association. For example, Rosen et al. (2013) observed 263 students in their homes and noted that students who had accessed texting and social media more frequently while studying tended to spend less time on-task and switched tasks more frequently. Better grades were obtained by students who had study plans that avoided these distractions. Perhaps students find it increasingly difficult to sustain attention on a single task when there is the constant opportunity to multitask via networked mobile devices, which may be problematic if students frequently switch tasks and fail to complete the set task. Again, this would suggest a problem with poor self-regulation and not internet use per se—the internet merely provides a very accessible source of distraction. It may also be that using the internet is more immediately rewarding than studying for which the payoff is in the future.

## Psychosocial Predictors of PIU

Previous studies have shown that individual difference factors such as extraversion (Mottram and Fleming 2009), neuroticism (Tsai et al. 2009), openness to experience (Kuss et al. 2013), sensation seeking (Shi et al. 2011), impulsivity (Meerkerk et al. 2009; Mottram and Fleming 2009; Shi et al. 2011), and shyness (Caplan 2002; Chak and Leung 2004) are associated with PIU, as well as other psychological factors such as social anxiety (De Leo and Wulfert 2013; Lee and Stapinski 2012). However, if PIU is a result of deficient self-regulation as proposed by LaRose et al. (2003) and supported by Tokunaga and Rains (2010), then everyday (“situational”) problems should be just as predictive as mood problems like depression (which is the major predictor in most studies). Given that university students report having to cope with academic and social stressors (situational problems) whilst completing their studies (Bitsika et al. 2010), this study will focus on two such stressors as possible predictors, namely boredom and loneliness.

Although very few studies have explicitly examined boredom in a PIU context (see Lin et al. 2009), boredom has been associated with general internet use (Davis 2001; LaRose et al. 2003) and the use of SNSs (Pempek et al. 2009). Boredom is a common experience and is particularly likely when tasks (e.g., study tasks) rely on self-sustained attention (Eastwood et al. 2012). Boredom is a non-optimal state of arousal that is produced when there is a mismatch between one’s need for arousal and the availability of desirable stimulation from the environment (Eastwood et al. 2012). It is an aversive state that occurs when individuals are not able to engage attention with internal or external information required for participating in a satisfying activity. This state can be alleviated by seeking stimulation that raises arousal, therefore, one approach to dealing with boredom is to turn to the internet via networked mobile devices. Rosen and colleagues (2013) conducted a naturalistic study of student habits and found that the enticement of technology often proved too much for students to remain focused on a specific set task. If university students find lecture attendance, studying and working on assessments boring at a given instant they may turn to technology to regulate their arousal levels and alleviate this state.

Loneliness is a second factor that has been frequently associated with PIU (Ang et al. 2012; Barthakur and Sharma 2012; Caplan 2002, 2007; Ceyhan and Ceyhan 2008; Davis 2001; Dowling and Brown 2010; Kim et al. 2009; Morahan-Martin and Schumacher 2000; Odaci and Kalkan 2010). Although early theorists suggested that internet use could cause loneliness by drawing users away from social interaction (Kraut et al. 1998), evidence points to the reverse, indicating that individuals who feel lonely spend more time using the internet (Amichai-Hamburger and Ben-Artzi 2003; Morahan-Martin and Schumacher 2000) to alleviate their loneliness. It is likely that the internet provides lonely individuals with an opportunity to interact with others online, and there is a widely held view among researchers that lonely individuals can use the internet to expand their social networks as well as engage in computer-mediated social interactions that may be easier and less threatening than face-to-face interaction. Indeed, previous research has shown that university students attempt to establish and maintain new relationships with other students via SNSs such as Facebook (Skues et al. 2012). Hence, university students who report greater feelings of loneliness may spend more time on the internet to establish new relationships and escape the negative feelings associated with loneliness.

Although previous research has shown that PIU is associated with negative outcomes, most of these studies have not emphasised understanding the underlying mechanisms that lead to

PIU. We argue that mild problems may arise when the internet is habitually used to alleviate boredom and loneliness. If regulation/delay of gratification is insufficient then the internet is a ready distraction. For this reason, it is argued in this study that an increasing number of university students (and the wider community more generally, though the focus of this study is on university students) are less capable of withstanding a negative psychological state such as boredom and loneliness when they do not receive sufficient stimulation from the environment to maintain optimum arousal levels. The ability to deal with such a state is referred to as *distress tolerance* (Simons and Gaher 2005). When tolerance is low for situations that produce a negative psychological state, it is hypothesised that students will attempt to escape this distressing situation by using mobile devices or a computer to browse the internet or use SNS. To this end, individuals use technology to control the amount of stimulation they receive, thereby providing relief from the distress. In other words, students will turn to their networked-mobile devices or computers to escape these distressing situations via the internet. Furthermore, the habitual use of the internet as an escape from distressing situations may lead to poor academic performance observed in those university students who experience PIU.

## The Current Study

The purpose of this study was to test a structural model in a sample of university students in which common states such as boredom and loneliness are associated with PIU and academic performance. It was hypothesised that boredom and loneliness would be positively associated with PIU, which, in turn, would be negatively associated academic performance. It was also hypothesised that be distress tolerance would moderate the effects of boredom and loneliness on PIU.

## Method

### Participants

The participants were 169 third year undergraduate psychology students from a Melbourne metropolitan university. However, four students did not provide data relating to their academic performance, whilst one student did not respond to the boredom items. These five participants were deleted listwise. The final sample of 164 students comprised 73.8 % women and 26.2 % men with an average age of 26.86 years ( $SD=7.88$ ). The response rate was 75.1 %.

### Measures

Participants completed an online questionnaire containing measures of PIU, boredom, loneliness, and distress tolerance, as well as demographics including sex, age, time spent using the internet for different activities and past academic performance. The details for the measures are given below.

#### *Problem Internet Use Questionnaire (PIUQ; Demetrovics et al. 2008)*

The PIUQ is a 30 item measure which assesses three domain of problem internet use: obsession (with the internet), control (unable to stop using it), and neglect (dropping other tasks to use the internet). Participants were asked to indicate the extent to which each statement

is true of them using a 5-point scale ranging from 1 (*rarely*) to 5 (*always*) with higher scores corresponding to more obsession, less control and more neglect. As previously discussed there is no universally agreed upon measure for PIU. Several scales have been designed and psychometrically tested such as the Internet Addiction Test (IAT; Young 1998), the Internet Related Problem Scale (IRPS; Widianto et al. 2008) and the PIUQ (Demetrovics et al. 2008). These scales differ in terms of their conceptualization and psychometric properties. The PIUQ was selected because it provides a dimensions measure of problems associated with *general* internet use, and has been validated in non-clinical adolescent and young adult samples (Demetrovics et al. 2008; Kelley and Gruber 2010; Koronczai et al. 2011).

#### *Boredom Proneness Scale (BPS—Farmer and Sundberg 1986)*

The BPS is a 28-item scale that has been found to be reliable and valid in samples of university students. Participants were asked to rate how well items describe their experience of boredom on a seven-point scale ranging from 1 (*highly disagree*) to 7 (*highly agree*). Item scores were averaged with higher BPS scores indicating more boredom proneness.

#### *The UCLA Loneliness Scale Version 3 (Russell 1996)*

The UCLA Loneliness Scale Version 3 is a 20-item measure of loneliness that has been found to be both reliable and valid among undergraduates (Russell 1996). Participants were asked to indicate their responses on a four-point scale ranging from 1 (*never*) to 4 (*always*). After reverse scoring negatively worded items, the scores were averaged for all items with higher scores on this measure corresponding to higher levels of loneliness.

#### *The Distress Tolerance Scale (DTS; Simons and Gaher 2005)*

The DTS is a 15-item measure that assesses four components of distress tolerance: ability to tolerate distress, absorption in negative emotions, attempts to regulate their response, and appraisal of distress. The four components can be combined to yield a global distress tolerance score. Participants were asked to use a five-point Likert scale from 1 (*Strongly Disagree*) to 5 (*Strongly Agree*) to indicate the extent to which each item described their beliefs about feeling distressed or upset. Ratings are averaged within each component to produce the four component scores, which are summed to produce to global score. Higher scores indicate lower distress tolerance.

#### *Academic Performance*

Academic performance was operationalized by calculating the mean grade from two core second year psychology units. These two psychology units were pre-requisite units taken immediately before the academic unit in which these data were collected. Possible scores ranged from 0 to 100.

#### **Procedure**

Approval for the current research was obtained from the university's Human Research Ethics Committee. Participants were invited to take part in the research during the first week of

tutorials via an information sheet distributed in class by their tutor. The information sheet emphasised to students that (a) their participation in the survey was completely voluntary, (b) all processed data would be anonymous, (c) their decision to participate (or not) would not affect their academic evaluation / relationship with the university (d) they were free to discontinue participation at any time, and (e) they were free to omit any questions they did not wish to answer. Participants who agreed to be involved in the study were able to access the online questionnaire through the university learning management system, where a URL was placed to complete the online questionnaire measuring internet use, psychological outcomes and other demographic information (e.g., gender, age). Return of a completed online questionnaire was taken as consent to participate. Participants completed the survey during the first week of semester at a location and time of their choosing. Data were downloaded at the end of the first week. Responses to the questionnaires were scored and the data analysed.

## Results

Data were analysed using SPSS Version 21.0 and MPlus Version 7.1. Prior to analysis, data were screened for outliers and errors, and assumptions for model fitting were tested. In order to assign meaning to estimated constructs in the model, one-factor congenetic models were used to assess whether boredom proneness, loneliness, and distress tolerance were unidimensional. In addition, a confirmatory factor analysis model was performed for the items on the PIU. Contrary to the previously reported structure of this instrument, a single factor model fitted better than either a two-factor and three-factor model. Given that boredom proneness, loneliness, distress tolerance and PIU were found to be unidimensional, as well as taking into consideration the relatively small sample size of the study, single indicator latent variables were used to operationalize these constructs. The means and standard deviations for each of the variables in this study can be seen in Table 1.

In this sample, participants spent, on average, 170.15 min per day using the internet for various activities including study, email, paid work, SNS use, surfing the internet, gaming, shopping, banking and gambling. More specifically and relevant to generalised PIU, participants spent 55.93 min per day ( $SD=71.77$ ) using SNSs or surfing the internet. As can be seen in Table 1, no correlation was found between PIU and time spent online using SNSs and surfing the internet.

**Table 1** Means, standard deviations and intercorrelations for boredom proneness, loneliness, distress tolerance, problem internet use and academic performance

	<i>M</i>	<i>SD</i>	$\alpha$	1	2	3	4	5
1. Boredom proneness	3.46	.94	.81	–				
2. Loneliness	2.35	.67	.88	.58***	–			
3. Distress tolerance	3.08	.85	.91	-.49***	-.51***	–		
4. Problem internet use	2.15	.68	.92	.45***	.32***	-.32***	–	
5. Academic performance	73.01	10.17	–	-.11	-.14	.16*	-.21**	–
6. Time spent online	55.93	71.77	–	.03	-.14	-.08	-.06	.02

Time spent online comprises SNS use and surfing the internet

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

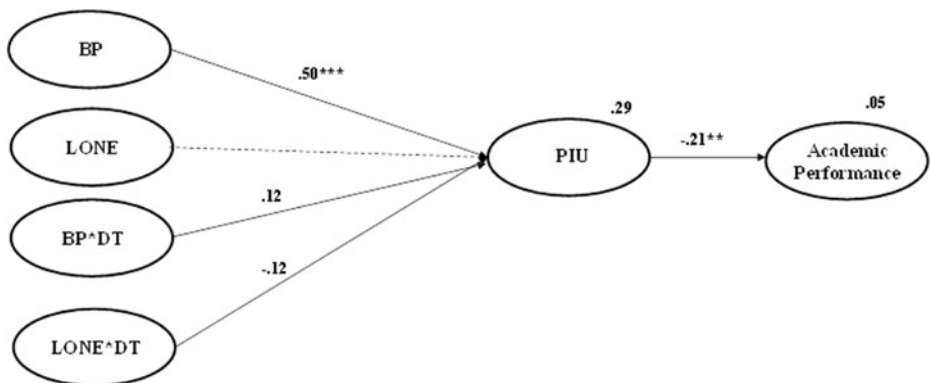


A structural model was specified to test whether distress tolerance moderates the relationship between boredom proneness and PIU, and between loneliness and PIU, where PIU in turn predicted academic performance. The structural model was estimated using maximum likelihood (ML) estimation of the covariance matrix. Moreover, the unconstrained approach (see Marsh et al. 2004) in which indicator variables are centred and products of the centred indicators form the indicators of the latent interaction terms were used. Unexpectedly, the initial model testing revealed a non-positive definite matrix in which loneliness was identified as the problematic variable. Loneliness was subsequently removed from the model. The revised model without loneliness provided an adequate fit to the data,  $\chi^2(13)=32.21$ ,  $p=.002$ , CFI=.949, RMSEA=.090; SRMR=.038, explaining 28 % of variance in PIU and 5 % of variance in academic performance. More specifically, the results showed that the direct effect between boredom proneness and PIU was significant. However, while boredom proneness was significantly associated with distress tolerance, the relationship between distress tolerance and PIU was not significant. PIU was significantly negatively associated with academic performance, although the association was relatively weak.

In sum, students who reported higher levels of boredom proneness tended to report PIU, and students who reported problems with their internet use tended to score lower in academic performance. Distress tolerance did not moderate the relationship between boredom proneness and PIU (Fig. 1).

## Discussion

The purpose of this study was to examine whether boredom and/or loneliness predict PIU, whether PIU impacts academic performance, and whether any effects of boredom or loneliness on PIU are moderated by distress tolerance. It was proposed that boredom and loneliness are stressors that drive PIU in university students, particularly amongst those with a low tolerance to distress, and that PIU would have an adverse effect on academic performance in this population. As predicted, boredom proneness was significantly associated with PIU and was a significant predictor of PIU in the model that included loneliness and distress tolerance. Loneliness also was associated with PIU and boredom proneness, although it was not a



**Fig. 1** A structural model of boredom proneness, distress tolerance, problem internet use and academic performance



significant predictor when included alongside boredom proneness in the model. There was no evidence that distress tolerance moderated either of these associations. Finally, PIU was significantly associated with academic performance with higher levels of PIU predicting lower levels of academic performance.

The association between boredom proneness and PIU suggests that university students who are prone to feeling bored are more likely to be pre-occupied with the internet, to neglect other aspects of their lives by (over)using the internet, and to report problems controlling their internet use. This finding is consistent with previous studies that have shown university students often use social networking sites to alleviate boredom (Pempek et al. 2009). Importantly, in our sample boredom was associated with PIU but not with total time spent on the internet, indicating it is the nature of internet activity engaged in while bored, rather than internet use per se, that is problematic.

The relationship between boredom proneness and PIU was predicted to be strongest amongst those relatively low in distress tolerance. However, the findings from this study revealed that distress tolerance did not moderate the relationship between boredom proneness and PIU. It could be that our sample of university students were all relatively low in distress tolerance, although this is unlikely given there was a normal range and distribution of distress tolerance amongst our sample. Another possibility is that the type of distress tolerance measured is not equivalent to boredom tolerance. The DTS specifically measures responses to being “distressed” or “upset”, which are arguably different from feeling bored. It may be better to develop and use a Boredom Tolerance Scale that specifically measures tolerance of and responses to boredom.

Nevertheless, if boredom is a trigger for PIU then identifying mediators or moderators in this relationship is crucial for providing targets for intervention. Removing technological distractions is an obvious preventative strategy, but is highly impractical given that the internet and computers are needed for most kinds of study (cf., Rosen et al. 2013). Researchers could investigate a range of self-regulation strategies as mechanisms that influence the relationship between boredom and PIU instead of focussing on a measure (distress tolerance) that captures one’s ability to withstand an aversive psychological state. According to Koole et al. (2011), one self-regulation strategy that people employ to deal with under arousing situations is attentional deployment. That is, individuals placed in a situation that leads to an undesirable emotion will seek to direct their attention elsewhere, which reduces the impact of the emotion. The majority of self-regulation research focuses on long-term goal-directed behaviour. In contrast less attention is paid to *need-orientated* self-regulation, which refers to the (shorter term) tendency to approach positive affective stimuli and avoid negative affective stimuli (Koole et al. 2011). It is likely avoidable aversive situations may promote need-orientated self-regulation over goal-focused self-regulation. University students need to attend lectures, study, and work on assignments in order to achieve long-term academic goals, however, this goal may be overridden in the short term by the need for sensory arousal that is rewarding. This discussion assumes that university students are consciously choosing to turn to the internet when they are bored. However, it is well known that regulation of our cognitions and behaviours can be non-conscious or implicit (Papies and Aarts 2011). For example, when behaviours are frequently employed, the repeated execution of such behaviours and the rewards associated with them can lead to habit formation – in the case, use of the internet provides an instant reward of stimulating interaction, such that repeatedly turning to the internet to relieve boredom may lead to an unconscious habit of unregulated internet use (LaRose et al. 2001, 2003).

There was a tendency for students with higher levels PIU to have lower academic grade, which is consistent previous research (Junco 2012; Junco and Cotton 2012; Kirschner and Karpinski 2010; Rosen et al. 2013). Due to the ease of access to networked mobile devices, university students may find it difficult to remain on task and tend to switch between tasks. For example, it is likely that students who turn to the internet to avoid academic tasks they find boring will suffer in terms of their academic performance (Junco 2012; Koch et al. 2011; Wood et al. 2012). Not only is it more difficult to make sense of incoming information from the initial task (study), undertaking multiple tasks may create a bottleneck in working memory that limits how much information can be stored and consolidated. Furthermore, the time spent procrastinating on the internet via browsing the internet or using SNSs has an opportunity cost in terms of available time to be spent on study. Thus, it seems reasonable that university students who are distracted by networked devices during their study time would acquire less of the knowledge, skills and strategies needed to perform well in their studies.

Although loneliness was omitted from the model due to poor model fit, perhaps it is worthwhile to consider the validity of current loneliness measures such as the UCLA Loneliness scale (Russell 1996) for internet-use research. That is, the meaning of loneliness may have changed due to the very presence of the internet (Banagan and Skues 2011). Whereas individuals in the past may have felt lonely when they were geographically distal from others, the internet has enabled these same individuals to be electronically proximal, which means they do feel in tune with other around them (Item 1. How often do you feel that you are “in tune” with the people around you?) and do not lack companionship (Item 2. How often do you feel that you lack companionship?). In other words, physical proximity is either equivalent to or has been usurped by electronic proximity. It is recommended that researchers work with target populations (such as university students) who are prolific users of social networking sites, to clarify whether the language used in current measures is consistent with the contemporary day meaning.

## Implications

One of the implications from this study is that PIU may indicate poor self-regulation skills, which in turn may have deleterious effects on coping skills. As a result of frequently turning to the internet for distraction and mood regulation, individuals fail to develop or practice more appropriate long-term strategies for regulating habitual behaviours and dealing with negative states. Secondly, with the growing trend towards blended (i.e., a combination of on-campus and online study) and online education, it is important that academics and educational providers understand the predictors of problem internet use and academic performance and the possible relationships between them, both in terms of educational design and the provision of academic support.

## Limitations

Although the response rate was 75.1 %, it is possible that self-selection led to bias in this study, over-representing persons with elevated or lower scores on variables like boredom or loneliness. This type of bias often results in either variable skewness or restriction of range. However, both boredom and loneliness scores were found to be normally distributed in the sample, indicating that skewness was not an issue. Moreover, if there was a restriction of range for the variables in this study, this would weaken the pattern of correlations rather than

strengthen it. It should also be noted that there was an overrepresentation of women in the sample, but no significant mean differences were found in boredom, loneliness, distress tolerance, or PIU between men and women.

A limitation of PIU research in general is the lack of consensus over what constitutes PIU and how best to measure it. Is PIU best captured using a single or multiple factor structure measure? Should there be general or specific PIU measures? More fundamentally, clarification is needed regarding what constitutes “problematic.” It is much easier to recognise that there has been a problem when a person reports distress or dysfunction as a result of internet use. It is much less clear which aspect of internet use causes the problem. Do technology-related problems arise from general excessive use, or is the pattern of use more important? For example the ratio of productive to non-productive time spent online might be a critical determinant of problematic use, or perhaps time is not a critical variable at all, rather interruptions at critical points in other activities render them problematic.

Another limitation of the PIU literature has been the use of self-report survey design. This methodology assumes that individuals possess enough insight into their own behaviour to report it accurately and that they are willing to do so. However, previous research has shown that individuals experience difficulties reporting on their internet use, particularly when asked to specify time spent using the internet (Skues et al. 2014). Therefore, researchers should consider employing multiple methods to test their research questions. Studies like the present one could be strengthened by augmenting questionnaire data with observational measures (e.g., usage logs) or experimental protocols (e.g., laboratory studies in which participants are given different means of coping with boring conditions).

Another avenue for future study is a comparison of trait- and state-based measures. While boredom proneness and loneliness may be underpinned by chronic factors, it is in a particular moment when a person experiences an aversive psychological state that they may turn to the internet. Future research needs to consider methods like controlled experiments or experience sampling in which the behavioural responses to a particular psychological state can be observed as they occur. Although this study focused on psychological states associated with under-arousal, it is equally plausible that university students who feel overwhelmed by study or social interactions turn to the internet to escape these situations and thus regulate their arousal levels. In other words, while those who are under aroused up regulate their arousal levels via the internet, it may be that individuals who are over aroused down regulate their arousal level in a similar manner. For example, a university student who does not persist on a difficult and challenging task may avoid such a task by turning to the internet. In sum, university students may have an optimal level of arousal that is neither too low nor too high, which they achieve using self-regulation strategies that involve technology and internet use.

It is plausible that an omitted variable plays a significant role in the model (see Tomarken and Waller 2003 for a discussion). Perhaps impulsivity or lack of effort could further elucidate the relationship between boredom and PIU, or that behavioural inhibition (BIS)/behavioural activation (BAS) is responsible for maintaining PIU over time. However, it was not possible to determine this since the variable was not included in the model. Finally, although the cross-sectional structural model provided an adequate fit to the data, it is only one plausible representation of the relationships between the variables. Future studies should propose and test several plausible alternative models or collect multiple waves of data in order to test longitudinal models with autoregressive and cross-lagged effects, which would provide an indication of the causal direction of the relationships between boredom, loneliness, distress tolerance and PIU.

## Conclusion

In conclusion, it appears that university students who are prone to experiencing boredom tend to use the internet to seek out more stimulating and satisfying activities, which in turn can lead to internet usage patterns that can negatively affect their academic performance. However, researchers need to consider and address some of the limitations raised in this study, especially relating to the measurement of PIU, the use of self-regulation strategies as a mechanism for explaining associations between boredom and internet use, the validity of self-report measures that have been developed pre the internet, and the inclusion of different research methods to study internet behaviour at a particular moment in time.

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