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Behavioral Functions Associated With Wanting to Reduce Internet Use

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Someone might want to spend less time on an activity when there are other things they would rather be doing, but the activity fulfills some necessary function that prevents them from changing their behavior (e.g., going to work when they would prefer to stay home). Alternatively, a person might want to reduce time spent on a highly preferred or habitual activity because they find themselves unable to manage their behavior, as in overeating or chronic procrastination. This registered report compared internet use by people who wanted to reduce the amount of time they spend on the internet with internet use by people who did not. Eight hundred nineteen respondents completed a self-report measure of problematic internet use, the Young Diagnostic Questionnaire (YDQ), and an indirect functional assessment of behavioral factors that motivate internet use, the Preliminary Internet Consequences Questionnaire (ICQ-P). People who reported wanting to reduce internet use were more likely to have YDQ scores ≥5 than people who did not. They also had higher total ICQ-P scores and endorsed ICQ-P items related to negative reinforcement (i.e., escape from or avoidance of demands, social interaction, and thoughts or feelings) more than people who did not want to reduce their internet use. There were no group differences in endorsement of any positive reinforcement factors. Taken together, group differences support the theory that excessive unwanted internet use is a problem behavior maintained by negative reinforcement.

Keywords: avoidance, functional behavioral assessment, internet consequences questionnaire, positive reinforcement, negative reinforcement

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Several self-report scales have been developed to assess the presence or severity of problematic internet use (Tokunaga & Rains, 2016). Less attention has been devoted in studying the factors that motivate people to use the internet. Research investigating functions of internet use typically examines cognitive (Bozoglan et al., 2014; Weiser, 2001) or social (Wongpakaran et al., 2021) consequences, to the exclusion of environmental consequences like sensory reinforcement or escape from demand (Carr, 1994). As such, a functional behavioral assessment of internet use may provide novel insights into why people use the internet by identifying environmental consequences that motivate internet use (Hassan & Kyonka, 2021).

Functional behavioral assessments are "designed to obtain information about the purposes (functions) a behavior serves for a

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person" (Peterson & Neef, 2020, p. 628). They often involve direct observation of the behavior by a behavior analyst or other therapist, but behavior rating scales have been used to identify variables that maintain a range of behaviors, including gambling (Dixon & Johnson, 2007; Weatherly et al., 2011) and video gaming (Buono et al., 2016, 2017, 2020; Sprong et al., 2014). In many of these instruments, the individual or a caregiver rates the frequency of the behavior under different circumstances on a 7-point Likert scale with options *never*, *almost never*, *seldom*, *half the time*, *usually*, *almost always*, and *always*. When a respondent endorses multiple items related to the same behavioral function (i.e., assigns them relatively high ratings), the behavior is said to be maintained by that function.

In research using the Gambling Functional Assessment (Dixon & Johnson, 2007) and a revised version (Weatherly et al., 2011), gamblers were more likely to endorse items related to positive reinforcement than negative reinforcement. However, problem gamblers were more likely than recreational gamblers to endorse items related to negative reinforcement (Miller et al., 2010; Weatherly & Terrell, 2014; Weatherly et al., 2010). In other words, all gamblers derived enjoyment or experienced desired outcomes as consequences of their gambling (positive reinforcement), but problem gamblers also tended to gamble to escape other parts of their lives (negative reinforcement).

The Preliminary Internet Consequences Questionnaire (ICQ-P) assesses the extent to which different consequences maintain the respondent's internet use (E. G. E. Kyonka, Naidu, et al., 2023). It is similar in format to other self-report functional assessment questionnaires, and it may likewise be useful in identifying the variables that maintain the target behavior, in this case internet use. Respondents rate the frequency with which 30 statements apply to their internet use on a 7-point Likert scale. Five statements relate to each of six behavioral functions. Three involve positive reinforcement, and three involve negative reinforcement. Scores can be calculated for each behavioral function, with possible scores of 0–30. Higher scores indicate greater endorsement of the behavioral function.

The three positive reinforcement functions the ICQ-P assesses are (a) conditioned tangible reinforcement (e.g., earning money and getting discounts or gifts), (b) positive social reinforcement (e.g., attention, friendship, or community experienced online), and (c) sensory reinforcement (e.g., sensation-seeking, enjoying online images, video, or music). The ICQ-P also assesses three negative reinforcement functions: (a) demand (escape from or avoidance of the demands of work, school, or other responsibilities), (b) social escape/avoidance (i.e., escape from or avoidance of social conflict or awkwardness), and (c) cognitive escape/avoidance (i.e., escape from or avoidance of one's own thoughts or feelings).

The aim of functional assessment is to identify variables that maintain the target response through positive reinforcement or negative reinforcement (Miltenberger, 2016). Positive reinforcement is when the delivery of a consequence strengthens or increases the probability of the response that produced it (Skinner, 1981) because it is satisfying or desired (Thorndike, 1911). With negative reinforcement, responses are strengthened by the removal of a consequence (Baron & Galizio, 2005).

In applied behavior analysis, identifying the consequences that maintain a behavior is a critical first step in changing that behavior (Peterson & Neef, 2020). Maximally effective interventions for modifying behavior might involve the functions that are most reinforcing overall, or those that are uniquely associated with wanting to change. Most people's internet use is maintained by multiple functions (E. G. E. Kyonka, Naidu, et al., 2023; Weiser, 2001), so our main objective with this research was to determine the types of reinforcement that are particularly associated with wanting to change one's internet use. To accomplish this objective, we quantified systematic differences in the behavioral functions that maintain the internet use of people who do and do not report that they want to reduce their internet use.

Core Hypotheses

Hypothesis 1: The desire to reduce internet use is associated with problematic internet use as measured by the Young Diagnostic Questionnaire (YDQ; Young, 1998). The so-called problematic internet users may be less likely to want to reduce internet use than nonproblematic internet users simply because they value internet use more. Conversely, it is also possible that problematic internet users are more likely to want to reduce internet use than nonproblematic internet users.

The YDQ was originally developed to identify possible internet addicts. It may seem paradoxical that a person with an addiction to something would be more likely to want to reduce their use of it than a nonaddicted person. However, the desire to reduce internet use may reflect an inability to modulate the behavior relative to other activities rather than a lack of perceived value for that activity. Wanting to reduce use and being unable to stop once engaged in a behavior are the features of addiction (e.g., Griffiths, 2005; Tucker et al., 2022). A person who is not addicted to use the internet might not feel the desire to reduce their use because they can stop at will, and thus, already modulate their internet use to the desired level. If problematic internet users are addicted to internet use, they might want to reduce their internet use, but feel unable to stop.

Hypothesis 2: ICQ-P responses of people who want to reduce their internet use are different from the ICQ-P responses of people who do not want to reduce their internet use. We compared responses of those two groups to evaluate whether total ICQ-P scores differed and whether the subscales endorsed by the groups differed.

A difference in the total ICQ-P score indicates that internet use is more reinforcing for one group than the other. Total ICQ-P scores for people who want to reduce their internet use might be lower than the scores of people who do not want to reduce their use because internet use is a less-preferred activity than other available options. For example, a person who desires to reduce internet use might be obligated to use the internet for work, school, or to fulfill other responsibilities. This outcome could indicate that desire to reduce internet use is a time-management issue. Conversely, total ICQ-P scores for people who want to reduce their internet use might be higher even though internet use has comparatively higher subjective value because the individual has other few desirable options for leisure activities or because they are unable to modulate their behavior. This outcome would indicate that the desire to

reduce internet use is a problematic behavior that could be reduced using behavior modification techniques.

Endorsing (i.e., rating highly) ICQ-P items related to a particular behavioral function indicates that the respondent's internet use may be motivated by that function. If a person endorses one function more than the others, addressing that particular function through intervention may be the most effective approach for reducing their internet use. For example, someone who uses the internet primarily because they derive satisfaction from online social interaction may rate the ICQ-P attention items higher than other items. Such a person might reduce their internet use by finding other ways to socialize. Conversely, someone who uses the internet to procrastinate from doing homework and chores may rate the ICQ-P demand items more highly than other items. This person might reduce their internet use with an escape extinction procedure that prevents them from avoiding homework and chores.

Systematic group differences in endorsement of different behavioral functions are potential predictors of wanting to change that could be leveraged as targets for interventions. For example, suppose most people endorse attention, sensory reinforcement, and escape from demand as maintaining their internet use, but only those who want to reduce their internet use endorse cognitive avoidance. This hypothetical group difference in response pattern would suggest that interventions designed in helping the people to reduce internet use should focus on cognitive avoidance, for example, by helping people to develop alternative ways of coping with persistent or unwanted thoughts and feelings.

Method

Participants

We recruited 821 English-speaking American respondents aged 18–83 years (M = 37.34 years, SD = 13.70 years) from prolific academic (https://www.prolific.co/). In a comparison of crowdsourcing platforms for behavioral research, prolific participants were more naïve, more diverse, and less dishonest than MTurk participants, and they produced data of comparable quality (Peer et al., 2017). To ensure that all respondents were regular internet users and to minimize the likelihood that desire to reduce internet use was confounded with amount of time spent online, the survey was only available to people who indicated that they focus on a device with a screen (mobile phone, tablet, laptop, and desktop) for an hour or more at a time at least once per day. Table 1 shows demographic characteristics of respondents. Respondents' median age of 35 was 0.1 years older than the median age of adults in the 2020 U.S. Census (U.S. Census Bureau, 2022). By self-report, respondents were 0.93 times as likely to be female. Compared to the general U.S. population, self-identified Asian/Pacific Islanders were overrepresented, and self-identified Black/African American and Hispanic/Latino respondents were underrepresented in the sample.

An a priori power analysis in G*Power (Faul et al., 2007, 2009) indicated that a sample of 820 participants (with at least 328 respondents in the smaller group) was sufficient to detect an effect size of d = 0.2 with 80% power. We analyzed responses from 821 respondents, including 351 who reported wanting to reduce their internet use and 468 who did not.

Measures and Procedure

Eligible participants who selected the survey were directed to a landing page on PsyToolkit, a free, web-based service for programming and running online surveys (Stoet, 2010, 2017). After selecting a checkbox to indicate informed consent, participants were asked to report demographic information, to answer the yes/no question "Do you wish you spent less time on the internet?" and to estimate how many hours they spend online in a typical week. They were then asked to complete the ICQ-P. The 30 statements about

Table 1
Self-Reported Demographics and Internet Use Characteristics

Characteristic	Reduction group (N = 351)				Nonreduction group (N = 468)			
	N	%	*M*	*SD*	*N*	%	*M*	*SD*
Age (years)			34.19	11.93			39.62	14.37
Sex								
Female	188	53.56			198	42.31		
Male	150	42.74			261	55.77		
Prefer to self-describe[a]	13	3.70			9	1.92		
Ethnicity[b]								
Asian or Pacific Islander	50	14.25			44	9.40		
Black or African American	27	7.69			38	8.11		
Hispanic or Latino	34	9.69			39	8.33		
Native American or Alaskan native	5	1.42			7	1.50		
White	252	71.79			369	78.85		
Multiracial or biracial	18	5.13			10	2.14		
A race/ethnicity not listed here	6	1.71			1	0.21		
Amount of internet use (hours per week)			44.28	23.48			47.27	28.33
Frequency of internet use								
Daily	97				137			
Multiple times every day	254				330			

Note. Number (N) and percentage (%) of participants endorsing each characteristic or mean (M) and standard deviation (SD) for respondents who selected "yes" (reduction group) and "no" (nonreduction group) in response to the question, "Do you wish you spent less time on the internet?"
[a] Participants self-described as agender (N = 4), genderqueer (N = 2), nonbinary (N = 13), postgender, and transgender man. [b] Participants could self-select multiple categories, so total percentage >100.

different behavioral functions (conditioned tangible reinforcement, attention, sensation-seeking, escape from demand, social avoidance, and cognitive avoidance) and one attention check appeared one at a time in random order. The last component of the survey was the YDQ (Young, 1998). The YDQ consists of eight yes/no questions adapted from the APA's diagnostic criteria for pathological gambling (1994). Answering "yes" to ≥5 questions indicates problematic internet use (Young, 1998; but cf. Beard & Wolf, 2001; Dowling & Quirk, 2009, for possible alternative scoring criteria). The YDQ has a unidimensional factor structure, test–retest reliability consistently above 0.7, and YDQ scores are positively correlated with scores on other instruments that assess problematic internet use (Laconi et al., 2014; Wartberg et al., 2017), which indicates that it is reliable and valid. When participants finished the survey, they were directed back to prolific to provide a completion code for payment.

Study procedures were reviewed and approved by the university's institutional review board and carried out in accordance with the declaration of Helsinki. Unless stated otherwise, all inferential statistical tests were conducted with familywise $\alpha = .05$. Preregistration details, deidentified data, statistical output, and other study materials can be accessed at the behavioral functions associated with wanting to reduce internet use project site on the Open Science Framework (E. G. E. Kyonka, Garcia, et al., 2023).

Results

Q–Q plots of YDQ and ICQ-P scores of respondents who reported that they want to reduce their internet use (the reduction group) and YDQ and ICQ-P scores of participants who did not want to reduce their internet use (nonreduction group) revealed no deviations from normality. The association between YDQ scores and wanting to reduce internet use was Spearman's $\rho = 0.39$. The association between YDQ and ICQ-P scores for all 819 respondents was $r = 0.57$.

Responses on the YDQ met Young's (1998) criteria for problematic internet use for 107 (30.48%) reduction group respondents, and for 49 (10.47%) nonreduction group respondents. A chi-square test indicated that respondents in the reduction group were significantly more likely to have YDQ scores ≥5 than respondents in the nonreduction group, $\chi^2(1, N = 819) = 52.11$, $p < .001$. The log odds ratio was −1.32 with 95% confidence interval (CI [−1.695, −0.949]) and Cohen's w was 0.25, indicating the effect was small. Although the standardized effect size was small, the difference was notable. Two thirds (68.6%) of respondents with YDQ scores ≥5 reported wanting to reduce their internet use, whereas only 37.4% of respondents with lower YDQ scores wanted to reduce their internet use.

To assess whether internet use was more reinforcing for one group than for the other, we examined ICQ-P total scores. The ICQ-P total is the sum of the 30 item scores, with a minimum possible value of 0 and a maximum of 180. A higher score indicates that the individual experiences greater reinforcement from internet use. Mean ICQ-P totals were 89.68 ($SD = 25.02$) for the reduction group and 82.57 ($SD = 26.07$) for the nonreduction group. Nonsignificant Shapiro–Wilk tests indicated no deviations from normality, and a nonsignificant Levene's test indicated the assumption of homogeneity of variance was not violated. The two-tailed independent samples t test was statistically significant indicating that internet use was more reinforcing for the reduction group than for the nonreduction group, $t(817) = 3.93$, $p < .001$, $d = 0.28$, 95% CI [0.14, 0.42]. However, the difference was small; equivalent to a one-point difference (e.g., "usually" instead of "half the time") on slightly more than one quarter of the items. Additionally, interquartile ranges of ICQ-P total scores for the two groups were similar: 74.5–107 for the reduction group and 65–101 for the nonreduction group. With so much overlap in interquartile ranges, ICQ-P total scores cannot reliably distinguish between those who do and do not want to reduce internet use. Further analysis of specific subscales may reveal patterns of ICQ-P responses associated with wanting to reduce internet use.

To determine whether the subscales endorsed by the groups differed, we entered ICQ-P subscores for all participants into a 2 × 6 mixed-factorial analysis of variance with group (reduction or nonreduction) as the between-subjects factor and behavioral function as the within-subject factor. Each ICQ-P subscore was determined by summing item scores for the five items related to that function to obtain a value between 0 and 30, with higher scores indicating greater endorsement.

The statistically significant main effect of group, $F(1, 817) = 15.46$, $p = .009$, $\eta_p^2 = .02$, and the statistically significant main effect of behavioral function, $F(3.57, 2915.83) = 116$, $p < .001$, $\eta_p^2 = .12$, were qualified by a Group × Behavioral Function interaction, $F(3.57, 2915.83) = 28.45$, $p < .001$, $\eta_p^2 = .03$. A Mauchly's test was conducted to assess the assumption of sphericity and it was found to be violated, $\chi^2(14) = 706.21$, $p < .001$, $\varepsilon = 0.71$. As a result, Greenhouse–Geisser correction factors were applied to the degrees of freedom for the main effect of behavioral function and the interaction to account for the violation of sphericity.

The statistically significant interaction showed that there were differences in the way that respondents from the reduction and nonreduction groups endorsed different behavioral functions. We conducted a simple effects analysis on group with behavioral function as the moderator to identify systematic differences in response patterns. Table 2 shows the results. There were no significant differences in the endorsement of positive reinforcement functions between the two groups. However, reduction-group respondents endorsed all three negative reinforcement functions at significantly higher rates than nonreduction group respondents.

Table 2
Simple Main Effects of Group on ICQ-P Subscores

Behavioral function	Difference	$F(1, 817)$	p
Positive reinforcement			
Conditioned tangible	−0.72	0.94	.33
Attention	−0.35	0.22	.64
Sensory	0.20	0.08	.78
Negative reinforcement			
Demand	3.03	16.86	<.001
Cognitive avoidance	2.72	13.58	<.001
Social avoidance	2.22	9.04	.003

Note. Difference is mean reduction-group subscore–mean non-reduction-group subscore. If reduction-group responses were one rating higher than non-reduction-group responses for all questions on a subscale, the mean difference for that behavioral function subscale would be 5.0. ICQ-P = Preliminary Internet Consequences Questionnaire.

To illustrate group differences in ICQ-P response patterns, Figure 1 shows means and 95% confidence intervals for each behavioral function and both groups. Both groups had similar endorsement rates for positive reinforcement functions. Group differences for positive reinforcement functions were all less than one point. Respondents who intended to reduce their internet use showed higher endorsement rates for all three negative reinforcement functions, compared to those who did not wish to reduce their internet use. For the negative reinforcement functions, the magnitude of the difference was equivalent to a one-point difference in ratings of one third to half of the items related to that function. Moreover, the smallest difference in endorsement of a negative reinforcement subscale was triple the size of the largest difference in endorsement of a positive reinforcement subscale. Together, the differences in response pattern suggest that the desire to reduce internet use is driven by escape or avoidance, rather than the hedonic or appetitive properties of the internet.

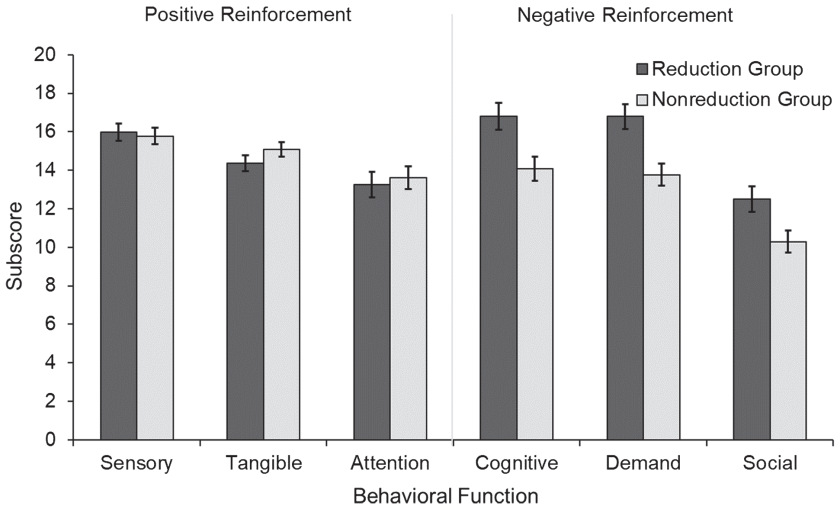
Discussion

The results of comparing the responses of 351 individuals who indicated a desire to reduce their internet use and 468 individuals who reported no desire to reduce their internet use supported both core hypotheses. Consistent with Hypothesis 1, the desire to reduce internet use was associated with problematic internet use. People with YDQ scores ≥5 were more likely to report wanting to reduce internet use than people with lower YDQ scores. Consistent with Hypothesis 2, total ICQ-P scores were different for respondents from the two groups. Reduction-group respondents had higher scores than non-reduction-group respondents, indicating that using the internet was more reinforcing for people who wanted to reduce their internet use than for people who did not. The difference was consistent with the theory that excessive unwanted internet use can be considered a problem behavior. Group differences in total ICQ-P scores were due to differences in the way respondents rated items related to negative reinforcement, with no differences in ratings of positive reinforcement items. Reduction-group respondents consistently selected higher ratings than non-reduction-group respondents for statements about using the internet to escape or avoid demands, offline social interactions, and thoughts or feelings. The systematic differences in endorsement of negative reinforcement functions are further evidence that excessive unwanted internet use is a problem behavior rather than a time-management problem, financial concern, or other issue.

We recruited a balanced sample of male and female adult Americans who use the internet daily for this study, with no other restrictions or stratification. The age, sex, and proportion of self-identified White and non-White survey respondents was similar to those characteristics in the 2020 U.S. general adult population (U.S. Census Bureau, 2022), with slightly lower proportions of

Figure 1

Positive and Negative Reinforcement of Internet Use for Reduction and Nonreduction Groups



Note. Mean ICQ-P subscores for the reduction group and nonreduction group for each behavioral function. Each subscore is the sum of frequency ratings for five 7-point Likert-scale items from the ICQ-P related to the behavioral function. Sensory = positive reinforcement from sensory stimulation; tangible = conditioned positive reinforcement related to the receipt of goods, services, or money; attention = positive reinforcement from online social interaction; cognitive = negative reinforcement from escaping or avoiding intrusive thoughts or feelings; demand = negative reinforcement from escaping or avoiding responsibilities; social = negative reinforcement related to escaping or avoiding offline social interaction. The dark gray bars show means for respondents who reported wanting to reduce their internet use (reduction group), and the light gray bars show means for respondents who reported not wanting to reduce internet use (nonreduction group). Error bars are 95% CIs. ICQ-P = Preliminary Internet Consequences Questionnaire; CI = confidence interval.

Black and Hispanic respondents. As such, the results of this research can be expected to generalize to American internet users as a population, but additional research is needed to determine whether they are as applicable to Black and Hispanic internet users specifically.

The YDQ is used widely as a measure of internet addiction (King et al., 2020; Pan et al., 2020). It has been validated psychometrically (Laconi et al., 2014; Wartberg et al., 2017). Nonetheless, there is disagreement regarding the best way to classify YDQ response patterns, with some researchers reporting that scores of 2–4 on the YDQ are functionally equivalent to higher scores (Dowling & Quirk, 2009), and others suggesting that some items are more reliable indications of problematic internet use than others (Beard & Wolf, 2001). Regardless of the specific criteria used, classification as a problematic or nonproblematic internet user based on YDQ responses is not a clinical diagnosis. Until a consensus emerges around how to define and diagnose problematic internet use (if ever, Moretta et al., 2022; Musetti et al., 2016), a person's self-reported desire to change their behavior may be the best determiner of suitability for behavior modification.

The ICQ-P is a new questionnaire, and its psychometric properties have not yet been validated. Indirect functional behavioral assessments are common in traditional applied behavior analysis (Dufrene et al., 2017; Floyd et al., 2005); however, results of indirect assessments are typically confirmed via direct observation before implementing treatment (Miltenberger et al., 2019). Some of the results presented here, such as the group difference in endorsement of internet use as a means of avoiding thoughts and feelings, cannot be confirmed through direct observation because the relevant events are covert. Self-monitoring procedures (Korotitsch & Nelson-Gray, 1999) provide evidence that could be used to evaluate the validity of the variables identified by a person's ICQ-P ratings. Future research might assess the utility of the ICQ-P through psychometric validation and functional confirmation procedures.

There are several limitations to this observational study. First, respondents included a representative sample of adult Americans who use the internet daily, but the results may not generalize to other populations or subpopulations, particularly Black and Hispanic internet users. Second, the study relied on self-report questionnaires, which may be subject to social desirability bias and may not accurately capture actual behavior. Third, while the YDQ is a widely used measure, some controversy exists regarding its classification criteria. Fourth, the ICQ-P is a new measure, and its psychometric properties have not yet been validated. Finally, the study did not assess the effectiveness of behavioral interventions to address excessive unwanted internet use. Future research is needed to investigate the effectiveness of such interventions.

The characterization of excessive unwanted internet use as a problem behavior that is maintained by negative reinforcement is consistent with behavior analytic and clinical research. Other self-report functional behavioral assessment questionnaires have reported associations between negative reinforcement of gambling and risk of problem gambling (Miller et al., 2010; Weatherly & Terrell, 2014; Weatherly et al., 2010) and between negative reinforcement of video gaming and excessive gaming (Buono et al., 2017, 2020).

When an activity is maintained by negative reinforcement, it may be part of a larger pattern of avoidance behavior (Eustis et al., 2020). There are several behavior-analytic interventions that have been shown to be effective at addressing avoidance, including escape extinction, differential reinforcement of alternative behavior, and instructional control (Chazin et al., 2022). Regardless of the specific motivating factors behind excessive unwanted internet use, if using the internet is a form of avoidance behavior, addressing whatever the person avoids by using the internet may be the best way to resolve their issues with internet use.

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