Apps and Copes: Predicting Adolescent and Adult Internet Addiction

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Abstract

Internet addiction (IA) levels of individuals can be predicted by different Internet applications they use, their frequency of usage, and their coping responses. Moreover, these specific predictors vary between age demographics. Using multiple regression analyses, we inspected the Internet application usage and coping response tendencies of 449 Internet users aged 16-71 to determine which applications and coping responses had the highest associations with IA, and whether these predictors varied among adolescents, young adults, mid adults, and late adults. Across the age groups, key predictors for high IA scores include frequent video gaming, online sexual activity, discussion forum usage, and high levels of maladaptive coping. Combinations of significant predictors differed between age groups, and signify that IA is prognosticated differently by age, and these variabilities should be taken into consideration when diagnosing and treating IA.

Introduction

Internet use has been in a dramatic upswing in the last decade, and the number of users developing problematic Internet habits is no exception to this growing trend (Internet World Stats, 2020; Al-Ansari et al., 2020). Though the Internet's vast offering of facilities can be beneficial, there is no shortage of concomitant risks. Excessive Internet use to the point of Internet addiction (IA) can have many negative consequences. These include social problems, poor school or work performance, and a diverse selection of health detriments (McNicol & Thorsteinsson, 2017). Previous studies have found that the risk of IA has positive associations with affective disorders (Kumar et al., 2018), neurotic personality traits (Kayiş et al., 2016), maladaptive coping responses (Zhou et al., 2017), and specific online activity such as online gaming and social applications (Kuss et al., 2013). Because age influences interests and

inclinations, it may also play a role in determining which predictors are most significant in predicting IA in adolescents as compared to in adults.

Research Questions

This study aims to predict IA in adolescents and three adult age groups by using variables including Internet activities that individuals use most frequently (e.g. web browsing, online shopping, video gaming) and different coping response styles (e.g. emotional coping, detached coping).

The primary research questions under investigation are as follows:

1. Which Internet applications have the most impact in predicting that someone will experience IA?
2. How do different coping response styles influence the likelihood that someone will be addicted to the Internet?
3. How do these predictors for IA compare and contrastbetween adolescents, young adults, mid adults, and late adults?

Statement of Purpose

IA is a growing social issue and a widespread public health threat. The long term effects of IA are yet to be thoroughly studied considering the Internet's recent and unprecedented rise in sophistication and prevalence, especially for today's youth who are the first to be able to be immersed in technology from the start of their lives. As Internet use is continually being integrated as a necessity in work and education, clinicians must be able to identify the signs and comorbidities of IA. The results of this study may shed light on and raise awareness of different online and offline behavioral symptoms of IA. These findings can then be taken into consideration as practitioners develop IA intervention programs and carry out studies for further

prevention and treatment. For example, outreach programs could promote healthy Internet habits on Internet applications and sites which have a high volume of at-risk Internet users. Additionally, practitioners treating individuals with problematic Internet usage can target the interlinked symptom of maladaptive coping response and focus on mitigating its effects whilst employing adaptive alternatives.

Literature Review

Individuals' personalities give each person distinct inclinations and ways of thinking and feeling. Because of their behavior-influencing nature, personality traits are considered to have an important impact on Internet use and IA (Kayiş et al., 2016). Zhou et al. (2017) examine adolescent IA in relation to the presence of and levels of the big five personality traits in a sample of middle school students in Wuhan and Shanghai, China. The personality traits delineated by the Big Five personality test entail agreeableness, conscientiousness, extraversion, openness to experience, and neuroticism. In this study, Zhou et al. (2017) also evaluated whether coping style would play a mediating role between the big five personality traits and adolescent IA.

Using multiple regression analyses, Zhou et al. (2017) found that agreeableness and conscientiousness have a negative association with IA, whereas neuroticism, extraversion, and openness have a positive association with IA, though the latter two traits had a relatively less significant correlation. However, this particular study also recognized that extraversion and openness to experience had a strong association with high usage of emotion-focused coping style which, in the mediation analysis, was found to have a positive relationship with adolescent IA. On the other hand, problem-focused coping was found to have no mediating effect on the relationship between the big five personality traits and IA.

Stavropoulos et al. (2018) studied IA in regards to a specific predictor, population, and subset of IA: Hikikomori symptoms, Massively Multiplayer Online (MMO) gamers, and Internet Gaming Disorder (IGD), respectively. The *Diagnostic and Statistical Manual for Mental Disorders* recognizes IGD as a condition in which individuals exhibit "persistent and recurrent use of the internet to engage in games (8-10 h of gameplay per day, and at least 30 h per week)" (American Psychiatric Association, 2013, p. 795). The term 'Hikikomori' refers both to the phenomenon of social recluses as well as the individuals themselves, typically young adult males, who voluntarily withdraw from society for more than six months, and meanwhile often cease attending school or work (Kato, 2020; Vogel, 2012). Hikikomori mental characteristics include low self-worth, loneliness, dysfunctional coping, and other psychopathological features that have marked overlap with those of IGD (Stavropoulos et al., 2018). Though such phenomenon originated in Japanese society, it is neither country nor culture-bound, as an increasing amount of studies have reported its existence in a multitude of countries including India, Spain, Italy, Brazil (Kato, 2020), and as spotlighted by Stavropoulos et al. (2018), The United States and Australia.

With a sample of Australian and American young adult players of MMO games, Stavropoulos et al. (2018) hypothesized that MMO gamers with higher Hikikomori scores will have higher IGD scores and that there is a positive relationship between playing time and association between Hikikomori and IGD. Hikikomori scores were defined by a four-item scale measuring "(1) spending most of the day and nearly every day at home (duration of at least 6 months); (2) avoiding social situations...(3) avoiding social relationships...; and (4) significant distress or impairment due to social isolation" (Teo et al., 2015, pp. 65-66). Using one linear regression analysis and one moderation analysis per country, Stavropoulos et al. (2018) found

that in both countries, Hikikomori symptoms are associated with increased IGD scores and that this relationship is magnified as game-playing time increases.

Social media allows users to build and initiate relationships, engage in discourse, and simply absorb content, whether informational, interpersonal, or purely for entertainment (Weller, 2016). As Internet and social media usage increases, excessivity is inevitable for some and is associated with behavioral addiction (Hawi & Samaha, 2019). Using a study sample of undergraduate students at a private Lebanese university, Hawi and Samaha (2019) examine similarities between social media addiction (SMA) and IA through comparing their relationships with predictor variables including agreeableness, conscientiousness, openness to experiences, emotional stability, self-esteem, frequency of checking account, and Internet usage.

With regression analyses, Hawi and Samaha (2019) were able to find that personality traits including agreeableness, conscientiousness, openness to experiences, and emotional stability were all negatively associated with IA and SMA. There are slight differences in predictors for each of the addiction types such as low extraversion predicting IA but not SMA as well as independent self-construal having a negative association with SMA, but no bearing in predicting IA. Overall, Hawi and Samaha (2019) concluded that IA and SMA have a strong and significant correlation, with high commonalities between predictor variables indicating great similarity between the two conditions.

Zhou et al. (2017), Stavropoulos et al. (2018), and Hawi and Samaha (2019) all delve into their study to predict IA and focus on predictor variables involving personality traits or other psychological features. The differences therein lay between the populations studied, as well as the specific predictors and aims of each study. Zhou et al. (2017) studied Internet addiction in regards to middle schoolers in China, Stavropoulos et al. (2018) in regards to MMO gamers in

Australia and The United States, and Hawi and Samaha (2019) in regards to undergraduate students in Lebanon.

Both Zhou et al. (2017) and Hawi and Samaha (2019) include some variation of the big five personality traits in their predictor variables, with the former also incorporating coping responses and the latter having a few extra emotional and technology usage predictors. The overlapping predictor variables yield similar relationships with IA, with the exception of Hawi and Samaha (2019) finding a negative association with openness to experiences, whereas Zhou et al. (2017) concluded a slight positive association for this predictor. Stavropoulos et al.'s (2018) study is a little different in that it sought to find how MMO gamers' Hikikomori symptom levels may act as risk factors specifically for IGD. These measured symptoms are not directly tied in with personality traits but are rather a behavioral reflection of them. However, traits that tend to show up within Hikikomoris and individuals with IGD do include low self-esteem and unhealthy coping methods, which are congruent with some predictors found to be positively associated with IA in the studies of Zhou et al. (2017) and Hawi and Samaha (2019).

Methodology

Discussion of Data

The data is comprised of an international sample of 449 Internet users who provided more than the minimum usable data required for hypothesis testing. Individuals in the sample are sourced from various English-speaking Internet outlets including social media, self-help groups, and psychology research pages. Of the 449 participants, 64.1% are female and 35.9% are male. The participants range from 16 to 71 years of age and are divided into four subgroups: 163 adolescents (aged 16-19 years), 170 young adults (aged 20-34), 90 mid adults (aged 35-54), and 25 late adults (aged 55-71), with one missing value. North Americans (USA or Canada) constitute the majority (51.0%) of the participants, followed by Australia or New Zealand

(39.9%), Asia (4.5%), and Europe (4.7%). Using cut-off scores from the *Assessment of Internet and Computer Game Addiction* (AICA-S), participants are classified as either *regular*, *problematic*, or *addictive* Internet users.

The international aspect of the population of interest is preferable because the Internet and IA are cross-continental by nature and foster user-experience relatability on a global scale. Through examining observations from a multitude of geographic regions, the results are more generalizable through an international lens. The majority of the observations are adults, and the smaller number of adolescents in the sample creates a potential limitation on thoroughly comparing the two subgroups. By sourcing participants from Internet outlets, we can ensure that the participants are Internet users. This is important because this study examines the characteristics of Internet use and Internet users themselves that influence IA in individuals.

Data Collection

We collected the dataset from the *Cyberpsychology, behavior and social networking* publication "Internet Addiction, Psychological Distress, and Coping Responses Among Adolescents and Adults." The University of New England's (UNE) Human Research Committee approved this study's data collection. Participants were recruited through a variety of English-speaking Internet arenas including forums (e.g.,gamespot.com), IA self-help groups (e.g., olganon.org), psychological research pages (e.g., socialpsychology.org), and social media (e.g., Facebook).

The data was originally produced through self-reported surveys which followed standard study design procedure: participants consented and were informed that their responses were anonymous and confidential and that they had the liberty to withdraw from the study at any time. Participants who selected an age under 16 were automatically dismissed from the study. For the

purposes of this study, we disregarded sex, country code, employment status, living situation, education, depression, anxiety, and stress as predictor variables, as they are not directly relevant to our questions focusing on Internet activities and coping responses predicting IA score. Missing values will be omitted from their respective analyses.

Variables

IA score: participant's Internet addiction score as gleaned from the AICA-S. IA score is quantitative and ranges from 0 - 27 points. Cut-off scores consist of *regular* use (based on 6.5 points or less), *problematic* use (based on 7 to 13 points), and *addictive* use (based on 13.5 points or more).

age group: participant is either an adolescent (16-19 years old), young adult (20-34 years old), mid adult (35-54 years old), or a late adult (55-71 years old). Age group is categorical.

video games: excessive use of online games (e.g., first-person shooter, roleplaying, simulation). Video games is quantitative and measured in the AICA-S on a 5-point Likert scale where 0 = *Never*, 1 = *Seldom*, 2 = *Sometimes*, 3 = *Often*, 4 = *Very Often*.

other online games: excessive use of other online games (e.g., casual browser games, mobile games). Other online games is quantitative and measured in the AICA-S on a 5-point Likert scale where 0 = *Never*, 1 = *Seldom*, 2 = *Sometimes*, 3 = *Often*, 4 = *Very Often*.

social networks: excessive use of social networks and/or online communities (e.g., Facebook, Instagram). Social networks is quantitative and measured in the AICA-S on a 5-point Likert scale where 0 = *Never*, 1 = *Seldom*, 2 = *Sometimes*, 3 = *Often*, 4 = *Very Often*.

web browsing: excessive web browsing, surfing, and/or information research (e.g., Wikipedia). Web browsing is quantitative and measured in the AICA-S on a 5-point Likert scale where 0 = *Never*, 1 = *Seldom*, 2 = *Sometimes*, 3 = *Often*, 4 = *Very Often*.

video streaming: excessive consumption of online videos and/or use of streaming portals (e.g., YouTube, GoogleVideo). Video streaming is quantitative and measured in the AICA-S on a 5-point Likert scale where 0 = *Never*, 1 = *Seldom*, 2 = *Sometimes*, 3 = *Often*, 4 = *Very Often*.

online shopping: excessive online shopping (e.g., eBay, Amazon, Gumtree). Online shopping is quantitative and measured in the AICA-S on a 5-point Likert scale where 0 = *Never*, 1 = *Seldom*, 2 = *Sometimes*, 3 = *Often*, 4 = *Very Often*.

online sexual activity: excessive online sexual activity (e.g., adult content, pornographic media). Online sexual activity is quantitative and measured in the AICA-S on a 5-point Likert scale where 0 = *Never*, 1 = *Seldom*, 2 = *Sometimes*, 3 = *Often*, 4 = *Very Often*.

gambling: excessive online gambling (e.g., poker, casinos, betting). Gambling is quantitative and measured in the AICA-S on a 5-point Likert scale where 0 = *Never*, 1 = *Seldom*, 2 = *Sometimes*, 3 = *Often*, 4 = *Very Often*.

email: excessive use of email in the forms of writing, reading, and/or sending emails (e.g., Hotmail, Gmail, YahooMail). Email is quantitative and measured in the AICA-S on a 5-point Likert scale where 0 = *Never*, 1 = *Seldom*, 2 = *Sometimes*, 3 = *Often*, 4 = *Very Often*.

discussion forums: excessive use of online discussion forums and/or chatrooms. Discussion forums is quantitative and measured in the AICA-S on a 5-point Likert scale where 0 = *Never*, 1 = *Seldom*, 2 = *Sometimes*, 3 = *Often*, 4 = *Very Often*.

instant messaging: excessive use of online instant messaging. Instant messaging is quantitative and measured in the AICA-S on a 5-point Likert scale where 0 = *Never*, 1 = *Seldom*, 2 = *Sometimes*, 3 = *Often*, 4 = *Very Often*.

rumination: a form of maladaptive coping response measured for adolescents where one obsessively and repeatedly thinks about their problem (e.g., *I had negative thoughts about*

myself, I thought of the problem all the time). Rumination is quantitative and measured in the *Measure of Adolescent Coping Strategies* (MACS) on a 4-point Likert scale where 0 = *I did not use,* 1 = *I used sometimes,* 2 = *I used quite a bit,* 3 = *I used almost all the time*.

acting out: a form of maladaptive coping response measured for adolescents where one is destructive to themselves or others in response to stress (e.g., *I yelled or screamed at other people who were not involved in the situation, I tried to harm myself*). Acting out is quantitative and measured in the MACS on a 4-point Likert scale where 0 = *I did not use,* 1 = *I used sometimes,* 2 = *I used quite a bit,* 3 = *I used almost all the time*.

self-care: a form of adaptive coping response measured for adolescents where one actively cares for and protects their well-being during periods of stress (e.g., *I tried to look after myself by getting plenty of sleep, I tried to look after my health by eating food that was good for me*). Self-care is quantitative and measured in the MACS on a 4-point Likert scale where 0 = *I did not use,* 1 = *I used sometimes,* 2 = *I used quite a bit,* 3 = *I used almost all the time*.

seeking social support: a form of adaptive coping response measured for adolescents where one reaches out to companions for support during periods of stress (e.g., *I asked for ideas from a friend whom I could trust, I spent time with someone I wanted to be with*). Seeking social support is quantitative and measured in the MACS on a 4-point Likert scale where 0 = *I did not use,* 1 = *I used sometimes,* 2 = *I used quite a bit,* 3 = *I used almost all the time*.

distraction/stoicism: a form of adaptive coping response measured for adolescents where one shifts their focus away from their stress (e.g., *I tried to take my mind off the situation, I tried to see the funny side of things*). Distraction/stoicism is quantitative and measured in the MACS on a 4-point Likert scale where 0 = *I did not use,* 1 = *I used sometimes,* 2 = *I used quite a bit,* 3 = *I used almost all the time*.

avoidant coping: a form of maladaptive coping response measured for adults where one avoids and escapes from their stressors rather than trying to deal with them (e.g., *Sit tight and hope it all goes away, Distance myself so I don't have to make any decision about the situation*). Avoidant coping is quantitative and measured in the *Coping Styles Questionnaire* (CSQ) on a 4-point Likert scale where 0 = *Never*, 1 = *Sometime*s, 2 = *Often*, 3 = *Always*.

emotional coping: a form of maladaptive coping response measured for adults where one allows their feelings and emotions to lead their actions when distressed (e.g., *Become miserable or depressed, Take my frustrations out on the people closest to me*). Emotional coping is quantitative and measured in the CSQ on a 4-point Likert scale where 0 = *Never*, 1 = *Sometime*s, 2 = *Often*, 3 = *Always*.

rational coping: a form of adaptive coping response measured for adults where one confronts their stressor and works to overcome it while viewing their problem more logically (e.g., *See the thing as a challenge that must be met, Work out a plan for dealing with what has happened*). Rational coping is quantitative and measured in the CSQ on a 4-point Likert scale where 0 = *Never*, 1 = *Sometime*s, 2 = *Often*, 3 = *Always*.

detached coping: a form of adaptive coping response measured for adults where one separates their negative emotions from the problem in order to face it (e.g., *See the problem as something separate from myself so I can deal with it, Do not see the problem or situation as a threat*). Detached coping is quantitative and measured in the CSQ on a 4-point Likert scale where 0 = *Never*, 1 = *Sometime*s, 2 = *Often*, 3 = *Always*.

Research Hypotheses

1. Which Internet applications are significant in predicting that someone will experience Internet addiction (IA)?
    - Null Hypothesis: There are specific Internet applications positively and negatively associated with IA score.
    - Alternate Hypothesis: There are not any specific Internet applications positively and negatively associated with IA score.
2. How do different coping response styles influence the likelihood that someone will be addicted to the Internet?
    - Null Hypothesis: There is a significant positive relationship between maladaptive coping response and IA score.
    - Alternate Hypothesis: There is no significant positive relationship between maladaptive coping response and IA score.
3. How do these predictors for IA compare between adolescents and the three adult subgroups?
    - Null Hypothesis: Between the four age groups, significant Internet application predictors will vary, but effects of significant coping response predictors will not vary.
    - Alternate Hypothesis: Between the four age groups, there will be no difference in significant Internet application predictors, and no similarities in effects of coping response predictors.

Description of the Analyses

To investigate the first research question, we aggregated all 449 participants' responses to the 5-point Likert scale for the 11 different online activities, assigning the scale rating of each specific activity to a predictor variable. The response variable log(Y) is IA score. Using stepwise regression with α to enter and α to remove both equal to 0.05, we generated the following multiple regression model:

$$\log(Y) = \beta_0 + \beta_1 X_1 + \beta_5 X_5 + \beta_7 X_7 + \beta_{10} X_{10} + E \quad (1)$$

For the third research question, we used the same predictor variables, except we subsetted the data into four groups according to age category in order to compare the significant predictors for each age group. The response Y is IA score. All the following multiple regression models were generated for each respective age group using stepwise regression with α to enter and α to remove both equal to 0.20. In models (1) – (5), X_4 and X_8 were found to be insignificant and were thus omitted.

Adolescents:

$$Y = \beta_0 + \beta_3 X_3 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_9 X_9 + \beta_{10} X_{10} + E \quad (2)$$

Young Adults:

$$Y = \beta_0 + \beta_7 X_7 + \beta_9 X_9 + \beta_{10} X_{10} + \beta_{11} X_{11} + E \quad (3)$$

Mid Adults:

$$Y = \beta_0 + \beta_1 X_1 + \beta_3 X_3 + \beta_5 X_5 + \beta_7 X_7 + E \quad (4)$$

Late Adults:

$$Y = \beta_0 + \beta_1 \mathrm{X}_1 + \beta_2 \mathrm{X}_2 + \beta_3 \mathrm{X}_3 + E \quad (5)$$

where the variables are defined as follows:

- X_1 is the Likert frequency scale rating the participant assigns to videogaming
- X_2 is the Likert frequency scale rating the participant assigns to other online gaming
- X_3 is the Likert frequency scale rating the participant assigns to social networking
- X_4 is the Likert frequency scale rating the participant assigns to web browsing
- X_5 is the Likert frequency scale rating the participant assigns to video streaming
- X_6 is the Likert frequency scale rating the participant assigns to online shopping
- X_7 is the Likert frequency scale rating the participant assigns to online sexual activity
- X_8 is the Likert frequency scale rating the participant assigns to online gambling
- X_9 is the Likert frequency scale rating the participant assigns to email usage
- X_{10} is the Likert frequency scale rating the participant assigns to discussion forum usage
- X_{11} is the Likert frequency scale rating the participant assigns to instant messaging

To assess the second research question, we created two subsets of data to test the relationship between coping response and IA to account for the difference in coping response predictors between adolescents and adults. In all the following models, the response variable (Y) represents IA score for each participant. For adolescents, there were originally five predictors categorized as coping response styles: *rumination, acting out, self-care, seeking social support*, and *distraction/stoicism*. The former two are regarded as maladaptive coping responses while the latter three are regarded as adaptive coping responses. After using stepwise regression with α to

enter and α to remove both equal to 0.30, only three of the five predictors remained for the following multiple regression model:

$$Y = \beta_0 + \beta_{DS}\,\mathrm{X}_{DS} + \beta_R \mathrm{X}_R + \beta_{SC}\mathrm{X}_{SC} + E \quad (6)$$

where X_{DS} is the 4-point Likert scale rating for *distraction/stoicism*, X_R is the 4-point Likert scale rating for *rumination*, and X_{SC} is the 4-point Likert scale rating for *self-care*.

For adults aged 20-71, there were originally four predictors categorized as coping response styles: *avoidant, emotional, rational,* and *detached*. The former two are regarded as maladaptive coping responses, and the latter two are adaptive. One multiple regression model was generated for each of the three adult subgroups using stepwise regression with α to enter and α to remove both equal to 0.15. *Detached coping* does not appear in any of the following models. The multiple regression model for each respective adult subgroup are as follows:

Young Adults:

$$Y = \beta_0 + \beta_{Rat}\,\mathrm{X}_{Rat} + \beta_{Emo}\mathrm{X}_{Emo} + \beta_{Av}\mathrm{X}_{Av} + E \quad (7)$$

Mid Adults:

$$Y = \beta_0 + \beta_{Rat}\,\mathrm{X}_{Rat} + \beta_{Emo}\mathrm{X}_{Emo} + E \quad (8)$$

Late Adults:

$$Y = \beta_0 + \beta_{Rat}\,\mathrm{X}_{Rat} + \beta_{Emo}\mathrm{X}_{Emo} + E \quad (9)$$

where X_{Rat} is the 4-point Likert scale rating for *rational coping*, X_{Emo} is the 4-point Likert scale rating for *emotional coping*, and X_{Av} is the 4-point Likert scale rating for *avoidant coping*.

Plan to Analyze Data

Minitab will be used to analyze the data. Residual plots and normal plots will be observed to determine if the model is appropriate to use, or if a transformation is necessary.

Multicollinearity between predictors will be evaluated through examining the correlation matrix and VIF values, and appropriate action to remove collinearity will be taken as needed. Evaluating model reliability though a split sample approach with a training and validation set will be considered.

For each model, we will obtain an adjusted R-squared value to ascertain how much variability in IA score is collectively explained by the given model's predictors. The coefficient output will also be observed for each model, specifically for the estimated slopes of each predictor in conjunction with its p-value, to determine each predictor's significance, if any, in predicting IA. Tests for overall significant regression will also be conducted and used to analyze the significant online application and coping response predictors of each model, and how these predictors vary across the four age groups.

We may also like to investigate some relationships between age, sex, IA score, and IA predictors. Potential analyses one-factor ANOVA and an analysis of covariance to evaluate whether the adjusted means of IA score are equal across females and males while controlling for the effect of age.

Results

This study examines the critical issue of IA across adolescents, young adults, mid adults, and late adults. The plethora of Internet applications that users can indulge in, as well as different coping responses are factored in as potential IA predictors. The purpose of this study is to identify the specific Internet applications that are correlated with IA, learn whether coping response affects IA, and to see how these predictors vary between adolescents and different age subgroups of adults.

The population we aim to study is Internet users, aged sixteen and above, from around the world. Aptly, our sample consists of 449 Internet-using participants who were globally sourced for this study from various English-speaking Internet outlets. 64.1% of the participants are female and 35.9% are male. Participants' ages range from 16 to 71 years and are divided into four subgroups: 163 adolescents (aged 16-19), 170 young adults (aged 20-34), 90 mid adults (aged 35-54), and 25 late adults (aged 55-71). Areas of residence represented by the participants include North America (51.0%), Australia or New Zealand (39.9%), Asia (4.5%), and Europe (4.7%).

Descriptive Statistics

Our response variable of interest is IA, more closely specified as IA score. IA score is determined by responses to the *Assessment of Internet and Computer Game Addiction Screener* (AICA-S) and ranges from 0 to 27 points. Cut off ranges of 0 to 6.5, 7 to 13, and 13.5 to 27 points respectively categorize participants as having the IA status of either *regular*, *problematic*, or *addictive* Internet use. Participants were more than twice likely to be a *regular* Internet user (68.84%) than to be a *problematic* Internet user (24.42%). The proportion of *addictive* Internet users in the sample tailed behind at 6.74%. As age group category increases from adolescents to late adults, the mean IA score subtlety decreases with each increment. The mean IA score within each age group falls within the category of *regular* Internet use, with only the mean adolescent IA score (6.54) slightly edging above to *problematic* Internet use. However, the IA score SD for each age group ranges from 2.38 to 4.38, exhibiting a fair amount of variability. Distributions of Internet use category within each age group are provided in Table 1 below.

Table 1

IA Score Summary and Distribution of IA Status by Age Group

Age Group	IA Score		Regular		Problematic		Addictive	
	Mean	SD	n	%	n	%	n	%
Adolescents	6.54	3.98	96	60.76	50	31.65	12	7.59
Young Adults	6.46	4.38	101	63.12	47	29.38	12	7.50
Mid Adults	4.40	3.53	77	87.50	6	6.82	5	5.68
Late Adults	3.71	2.38	22	91.67	2	8.33	0	0.00

Participants also rated how frequently they used eleven specific Internet applications on a 5-point Likert scale from 0 (*Never*) to 4 (*Very Often*) as part of the AICA-S. The usage frequency of each respective application may be related to IA score and thus, is used as explanatory variables for IA score uniformly across all age groups. *Social networks* (Mean: 3.01; SD: 1.29) and *web browsing* (Mean: 3.11; SD: 1.02) appear to be the overall most popular Internet applications within this sample. Meanwhile, there is less frequent use of *gambling* (Mean: 0.19; SD: 0.63) and *online sexual activity* (Mean: 0.84; SD: 1.19) both overall and within each age group. The other applications are all rated rather moderately in frequency. The Likert scale responses are summarized in Table 2 below.

Table 2
Summary of Internet Application Usage Overall and per Age Group

	Overall		Adolescents		Young Adults		Mid Adults		Late Adults	
Internet Application	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Video Games	1.16	1.38	1.56	1.47	1.15	1.35	0.56	1.01	0.80	1.32
Other Online Games	1.56	1.26	1.69	1.20	1.56	1.27	1.56	1.28	0.72	1.24
Social Networks	3.01	1.29	2.95	1.40	3.18	1.19	2.86	1.27	2.92	1.32
Web Browsing	3.11	1.02	2.77	1.18	3.32	0.83	3.37	0.79	3.00	1.08
Video Streaming	2.62	1.16	2.80	1.19	2.75	1.10	2.11	1.06	2.44	1.16
Online Shopping	1.95	1.10	1.78	1.13	2.05	1.11	2.03	0.97	2.04	1.27
Sexual Activity	0.84	1.19	1.01	1.28	0.93	1.22	0.50	0.89	0.28	0.89
Gambling	0.19	0.63	0.25	0.75	0.19	0.66	0.09	0.32	0.08	0.40
Email	2.63	1.11	2.20	1.10	2.82	1.03	2.93	1.01	3.04	1.21
Discussion Forums	1.14	1.21	0.85	1.14	1.31	1.27	1.29	1.20	1.24	1.13
Instant Messaging	1.85	1.42	1.88	1.47	1.99	1.43	1.57	1.35	1.76	1.20

Another set of explanatory variables used are coping responses. While coping responses can be categorized more broadly as maladaptive or adaptive for both adolescents and adults, adolescent coping responses include *rumination, acting out, self-care, seeking social support*, and *distraction/stoicism* while adult coping responses include *avoidant, emotional, rational,* and *detached coping*. This discrepancy is attributed to the difference in coping responses assessment administered to each group, with MACS tailored for the 16-19-year-old participants and CSQ tailored for participants aged 20 and above.

Both assessments utilized a 4-point Likert scale for participants to rate different scenarios or statements relating to how they would react to feel about difficult and/or stressful situations. For the 96 adolescents with *regular* Internet use, acting out is rated especially low as a coping response with a median of 0.33. However, its number of high outliers and right-skewed quality is

and unusual feature, indicating diversity in responses. Rumination and self-care also appear to be slightly right skewed. Apart from these, seeking social support and distraction/stoicism are generally moderately rated with approximately symmetric distributions. Figure 1 below contains the boxplots showing these distributions.

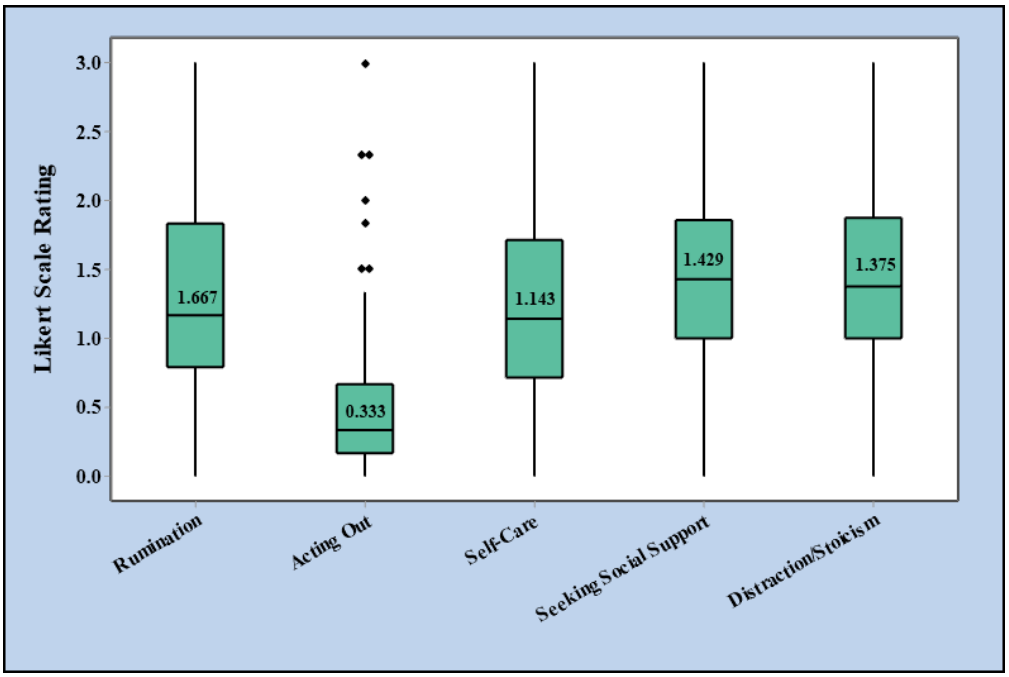

Figure 1. Boxplots of the coping responses' Likert scale ratings for the 96 adolescents with regular Internet use

The other 62 adolescents were found to have either *problematic* or *addictive* Internet use, based on their MACS score. These two IA statuses were combined to form one group, in which acting out was also rated rather infrequently (Median: 0.5), with a heavy right skew. Similar to the distribution of coping response ratings for adolescents with *regular* Internet use, *seeking social support* and *distraction/stoicism* were rated rather moderately with approximately symmetric distributions. The main difference regarding the *problematic* and *addictive* adolescent group is that the distribution for *rumination* is now left skewed with a median of 1.67, a 0.5 jump

from the *regular* group's median for *rumination*. The boxplots for these distributions are found in Figure 2 below.

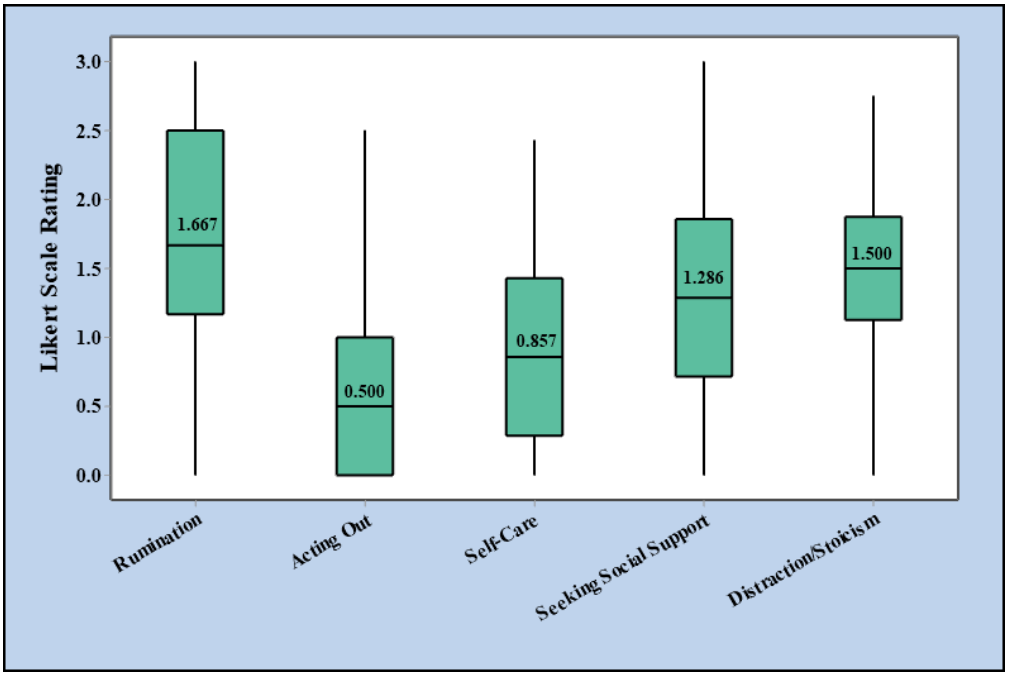

Figure 2. Boxplots of the coping responses' Likert scale ratings for the 62 adolescents with either problematic or addictive Internet use

201 of the adults aged 20-71 were classified as having *regular* Internet use. Across the age subgroups for adults with *regular* Internet use, median Likert scale ratings for each coping response were close together, with the most deviation coming from a 0.27 difference in detached coping median for young adults and late adults. Generally, the distributions across the different adult age categories and coping responses are approximately symmetric, with one or a few outliers present in each coping category. *Rational coping* tends to be rated the highest, with medians centered around 1.69 to 1.88. *Emotional coping* has lower ratings, with scale rating medians ranging from 0.78 to 0.94. Figure 3 below exhibits these distributions.

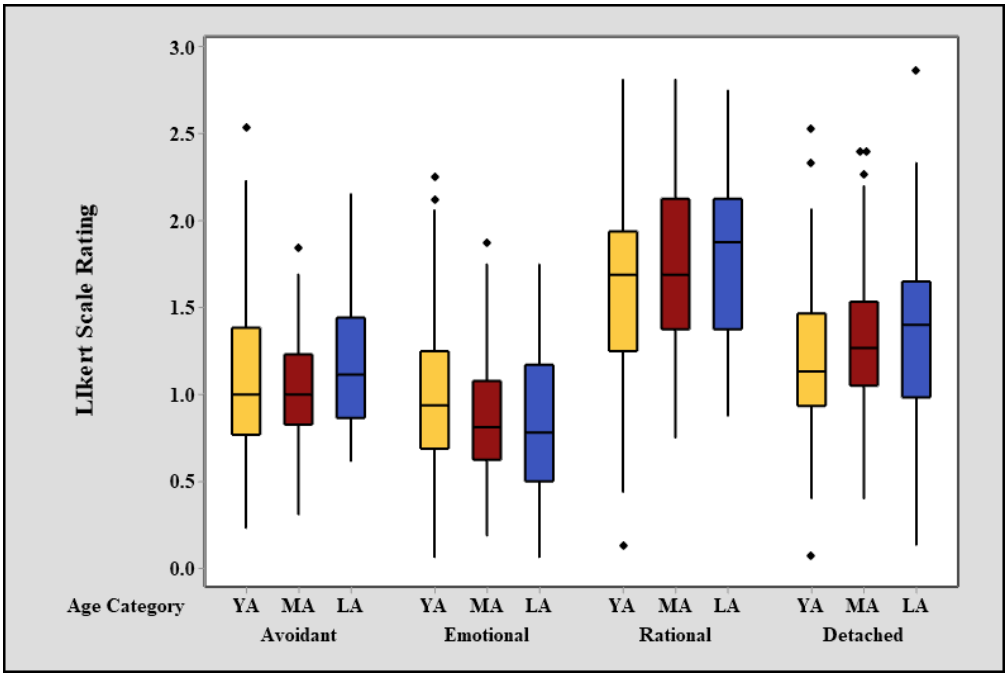

Figure 3. Boxplots of the coping responses' Likert scale ratings across all three adult age categories for the 201 adults with regular Internet use

72 adults were found to exhibit either *problematic* or *addictive* Internet use. These two IA categories were combined to form one group. In this group, the distributions of Likert scale ratings for each coping response were much less uniform within coping response than in the previous distributions for adult *regular* Internet use. Several of the distributions are skewed either left or right and there are overall less patterns to be seen. The medians scale ratings across all coping types and age groups tend to not exceed 1.5, with many of them hovering around or below 1.0. These distributions are provided in Figure 4 below.

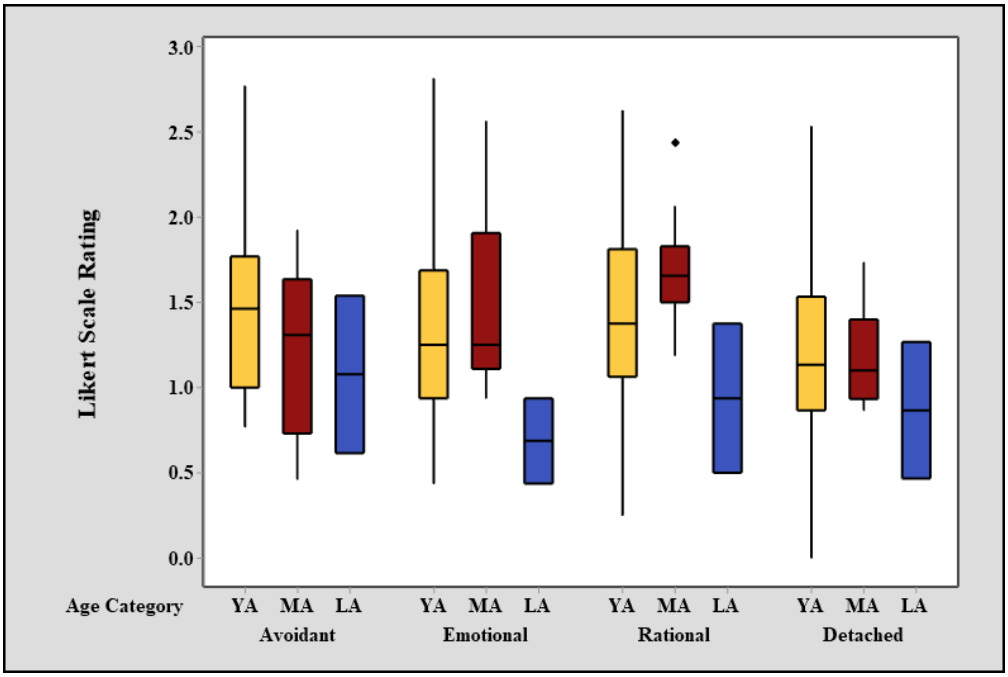

Figure 4. Boxplots of the coping responses' Likert scale ratings across all three adult age categories for the 72 adults with problematic or addictive Internet use

Inferential Statistics

Research Question 1

In the first research question, we sought to determine which Internet applications have strong correlations with IA score, both across all age groups as well as within each age group. The original multiple regression model (1) for log(IA score) on Internet applications for all participants was generated with stepwise selection, with an α of 0.05 for entry and for removal. Through the test for significant overall regression, Model (1) was found to be significant ($F(4, 423) = 24.00$, $p < 0.001$, $R^2_{Adjusted} = .177$), indicating that at least one of the variables in Table 3 was statistically significant in predicting IA score. The regression coefficients reveal that higher usage frequency of *video games*, *video streaming*, *online sexual activity*, and *discussion forums* is correlated with higher IA scores, with the regression having a loglinear relationship.

Table 3

Regression Coefficients of log(IA Score) on Online Applications for All Participants

Term	*Coefficient*	*SE*	*95% CI*	*T-Value*	*p*
Constant	0.436	0.031	(0.374, 0.498)	13.87	0.000
Video Games	0.030	0.010	(0.011, 0.050)	3.08	0.002
Video Streaming	0.057	0.011	(0.035, 0.080)	4.98	0.000
Online Sexual Activity	0.036	0.011	(0.013, 0.058)	3.15	0.002
Discussion Forums	0.030	0.011	(0.009, 0.050)	2.84	0.005

To evaluate model (1)'s reliability, we used a split sample approach, dividing the data into a training set and a validation set. Model (1) was then fit onto the training set and the resulting regression line equation was used to predict each observation in the validation set. R_T^2 was found to be 0.420 and R_V^2 was found to be 0.430, resulting in a shrinkage of -.010, indicating that model (1) is reliable in predicting subsequent samples in the population.

Originally, IA score was to be the predictor for model (1). However, the normal probability plot for the response IA score indicated right-skewness of the residuals, as shown on the left in Figure 5. By modifying the response variable to be log(IA score), the normality assumption was satisfied for model (1), as shown on the right in Figure 5. Using the log transformation also resolved the issue of homoscedasticity violation as shown when comparing the residual plots in Figure 6. On the left side of Figure 6, the residuals are more clustered around values between -5 and 0 for a response of log(IA) score whereas there is less spread and patterns on the right graph displaying the residual plot for a response of log(IA score).

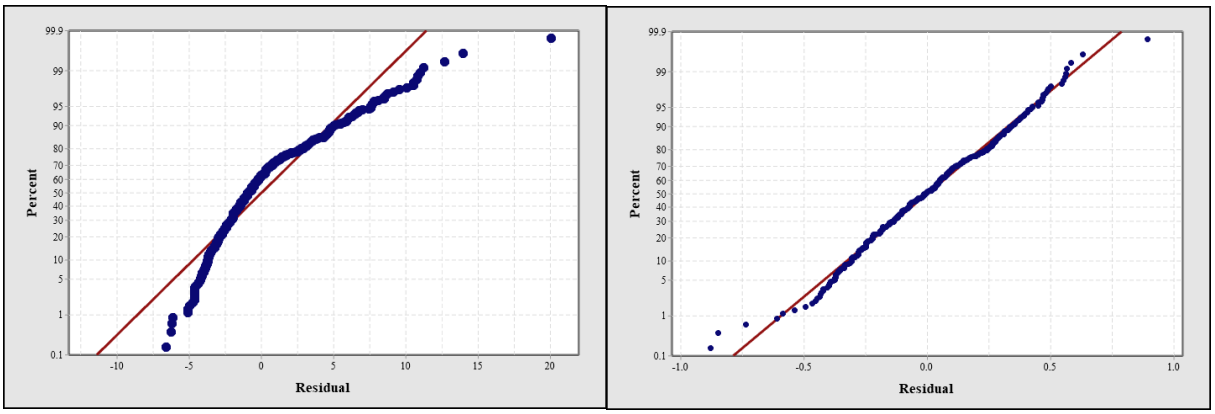

Figure 5. Normal probability plots for response IA score (left) and log(IA score) (right) against model 1 predictors

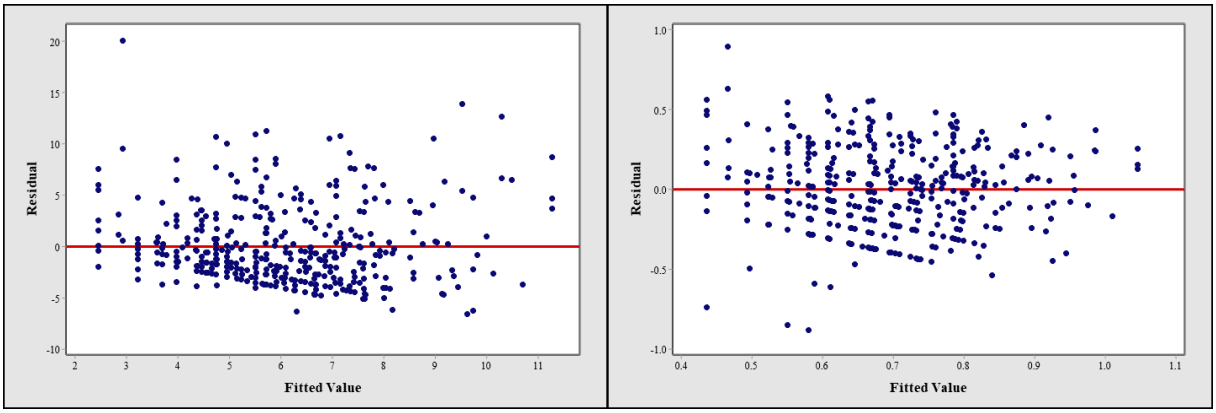

Figure 6. Residual plots for response IA score (left) and log(IA score) (right) against model 1 predictors

The third research question's issue of interest was that of which significant Internet application predictors varied, if at all, between the four age groups, and to what extent. The data was subsetted by age group, and uniformly using stepwise selection an α of 0.20 for both entry and removal, models (2), (3), (4), and (5) were generated for adolescents, young adults, mid adults, and late adults, respectively. The results for each model's test for overall significant regression are summarized in Table 4 below, each of the models (2) – (5) being found to be statistically significant in predicting IA score.

Table 4

Summary of Tests for Overall Significant Regression for Each Age Group's Internet Application Model

Model	*F-Value*	*p*	$R^2_{Adjusted}$
2	F(6, 151) = 5.93	< 0.001	0.159
3	F(4, 155) = 8.90	<0.001	0.166
4	F(4, 83) = 8.10	<0.001	0.246
5	F(3, 20) = 6.92	0.002	0.436

In reference to the third research question, different age groups displayed different significant predictors within the realm of Internet applications, thus supporting our hypothesis. While there is no one predictor that is common to all four age groups, the predictors *social networks* and *online sexual activity* are both significant in three of the age groups, albeit in different combinations of age groups.

We may retrospectively restrict the significance level to 5% and observe that the remaining most significant predictors are *video streaming* and *discussion forums* for adolescents, *online sexual activity, email, discussion forums,* and *instant messaging* for young adults, *video games, social networks*, and *video streaming* for mid adults, and *video games* and *other online games* for late adults. Of these predictors, all are positively related to IA score, except for *email* with respect to young adults and *other online games* with respect to late adults which are both negatively related to IA score. These relationships are emboldened in Table 5.

Interestingly, online application predictors that may be positively associated with IA score for one age group may be negatively associated with IA score for another. To illustrate, *email* is negative for young adults yet positive for adolescents, and *social networks* is negative for late adults yet positive for adolescents and mid adults.

Table 5

Regression Coefficients of IA Score on Online Applications by Age Group

Variable	*Coefficient*	*SE*	*95% CI*	*T-Value*	*p*
		Adolescents			
Constant	**2.067**	1.012	(0.068, 4.066)	2.04	0.043
Social Networks	0.339	0.222	(-0.100, 0.777)	1.53	0.129
Video Streaming	**0.863**	0.251	(0.367, 1.360)	3.44	0.001
Online Shopping	-0.457	0.277	(-1.005, 0.091)	-1.65	0.101
Online Sexual Activity	0.363	0.238	(-0.107, 0.833)	1.52	0.130
Emails	0.434	0.306	(-0.170, 1.038)	1.42	0.158
Discussion Forums	**0.652**	0.268	(0.123, 1.181)	2.44	0.016
		Young Adults			
Constant	**6.380**	0.979	(4.446, 8.315)	6.52	0.000
Online Sexual Activity	**0.946**	0.273	(0.408, 1.485)	3.47	0.001
Email	**-0.923**	0.334	(-1.582, -0.264)	-2.77	0.006
Discussion Forums	**0.633**	0.279	(0.081, 1.184)	2.27	0.025
Instant Messaging	**0.524**	0.245	(0.040, 1.009)	2.14	0.034
		Mid Adults			
Constant	-0.394	0.987	(-2.356, 1.569)	-0.40	0.691
Video Games	**0.837**	0.330	(0.181, 1.493)	2.54	0.013
Social Networks	**0.754**	0.264	(0.230, 1.279)	2.86	0.005
Video Streaming	**0.875**	0.327	(0.224, 1.526)	2.67	0.009
Online Sexual Activity	0.671	0.404	(-0.134, 1.475)	1.66	0.101
		Late Adults			
Constant	**4.74**	1.03	(2.60, 6.89)	4.61	0.000
Video Games	**1.321**	0.334	(0.626, 2.017)	3.96	0.001
Other Online Games	**-1.023**	0.351	(-1.755, -0.290)	-2.91	0.009
Social Networks	-0.456	0.294	(-1.070, 0.158)	-1.55	0.137

Note. Bold = where 95% CI did not include zero.

High leverage observations were identified from models (2) – (5). Using the high leverage cutoff of 0.076, there were no high leverage points from model (2). However, two observations exceeded the high leverage cutoff of 0.075 for model (3), four observations exceeded the high leverage cutoff of 0.114 for model (4), and three observations exceeded the high leverage cutoff of 0.333 for model (5). When these observations were removed, we performed a stepwise regression with α of 0.20 for entry and removal to generate three other

models for the adult subgroups, and we were left with a different regression output as outlined in Table 6 below. The most significant predictors ($p < 0.05$) in these new models are *online sexual activity* and *instant messaging* for young adults, *social networks* and *video streaming* for mid adults, and *emails* for late adults, all of which are positively associated with IA score.

Table 6

Regression Coefficients of IA Score on Online Applications by Adult Subgroup After High Leverage Observation Removal

Variable	*Coefficient*	*SE*	*95% CI*	*T-Value*	*p*
		Young Adults			
Constant	**5.799**	0.954	(3.914, 7.683)	6.08	0.000
Video Games	0.366	0.248	(-0.124, 0.857)	1.48	0.142
Online Sexual Activity	**0.667**	0.275	(0.123, 1.211)	2.42	0.017
Emails	-0.591	0.319	(-1.221, 0.039)	-1.85	0.066
Instant Messaging	**0.593**	0.232	(0.136, 1.051)	2.56	0.011
		Mid Adults			
Constant	-0.083	0.981	(-2.034, 1.868)	-0.08	0.933
Video Games	0.662	0.380	(-0.095, 1.419)	1.74	0.086
Social Networks	**0.736**	0.262	(0.216, 1.257)	2.82	0.006
Video Streaming	**0.871**	0.320	(0.235, 1.507)	2.73	0.008
		Late Adults			
Constant	0.639	0.741	(-0.924, 2.202)	0.86	0.400
Video Games	0.265	0.165	(-0.084, 0.614)	1.60	0.128
Gambling	1.033	0.601	(-0.234, 2.301)	1.72	0.104
Emails	**0.716**	0.222	(0.248, 1.185)	3.22	0.005

Note. The regression output for adolescents did not change and is thus omitted. Bold = where the 95% CI did not include zero.

Research Question 2

In the second research question, we focused on finding the degree of influence that different coping response styles have on IA score. Adolescent coping response data was collected through a questionnaire measuring levels of *rumination, acting out, self-care, seeking social support,* and *distraction/stoicism*. The former two are more broadly categorized as maladaptive coping behaviors while the latter two are adaptive. Using stepwise selection with α for entry and α for removal both set to 0.30, model (6) was generated to describe IA score with

coping response types for adolescents. Model (6) was tested for overall significant regression and was found to be statistically significant in predicting IA score ($F(3, 145) = 15.03$ $p < 0.001$, $R^2_{Adjusted} = .221$), evidencing that at least one coping response predictor is significant.

Confirming our hypothesis, *rumination*, a maladaptive coping response, was found to be positively associated with IA score, while *self-care*, an adaptive coping response, was found to be negatively associated with IA score, as seen in Table 7 below. Curiously, *distraction/stoicism* was found to be positively correlated with IA score, despite being an adaptive coping response. Nevertheless, this predictor was the least significant of the three in model (6) with a 95% CI well-enveloping zero.

Table 7
Regression Coefficients of IA Score on Coping Responses for Adolescents

Variable	*Coefficient*	*SE*	*95% CI*	*T-Value*	*p*
Constant	**4.748**	0.916	(2.938, 6.558)	5.19	0.000
Distraction/Stoicism	0.757	0.598	(-0.424, 1.939)	1.27	0.207
Rumination	**2.001**	0.422	(1.166, 2.835)	4.74	0.000
Self-Care	**-1.969**	0.503	(-2.964, -0.975)	-3.91	0.000

Note. Bold = where 95% CI did not include zero.

The participants within the adult participants completed a questionnaire measuring coping responses in terms of *avoidant coping, emotional coping, rational coping, and detached coping*, with the former two considered maladaptive and the latter two considered adaptive. The data was divided by adult subgroup, and models (7), (8), and (9) were generated for young adults, mid adults, and late adults, respectively. Stepwise regression was the model selection technique of choice, with all three models' predictors derived from an α of 0.15 for both entry and removal. Models (7), (8), and (9) were all found to be statistically significant in predicting IA score, as summarized in Table 8.

Table 8
Summary of Tests for Overall Significant Regression for Each Adult Subgroup's Coping Response Model

Model	*F-Value*	*p*	$R^2_{Adjusted}$
7	F(3, 141) = 25.59	< 0.001	0.353
8	F(2, 73) = 17.07	<0.001	0.300
9	F(2, 19) = 6.60	0.007	0.348

The statistics from models (7) – (9) in tandem with model (6) address both the second and third research questions. The regression outputs presented in Tables 7 and 9 detail the relationships between the dichotomy of coping responses with IA score and how this compares across age groups. From model (7), we are shown that in young adults, *rational coping* is negatively correlated with IA score while *avoidant coping* and *emotional coping* are positively correlated with IA score. This finding supports our hypothesis that maladaptive coping responses are positively associated with IA score while the opposite is true for adaptive coping responses.

However, this trend, both hypothesized and as seen in young adults, is shifted as we observe the regression coefficients for mid adults and late adults. For mid adults, both *rational* and *emotional coping* are positively associated with IA score whereas in late adults, both *rational* and *emotional coping* are negatively associated with IA score, despite the antithesis nature of these two coping responses. It is also noteworthy that *detached coping* was not significant enough to appear in any model, but *rational coping* and *emotional coping* are present in all three.

Considering the more general dichotomy between coping responses to compare predictors across the age groups, certain findings are consistent in that one adaptive coping response is found to be negatively correlated with IA score for adolescents, young adults, and

late adults. Additionally, at least one maladaptive coping response is found to be positively correlated with IA score for adolescents, young adults, and mid adults.

Table 9

Regression Coefficients of IA Score on Coping Responses Across Adult Age Groups

Variable	*Coefficient*	*SE*	*T-Value*	*p*
		Young Adults		
Constant	**3.540**	1.249	2.83	0.005
Rational Coping	**-1.993**	0.601	-3.32	0.001
Emotional Coping	1.253	0.816	1.54	0.127
Avoidant Coping	**3.754**	0.878	4.28	0.000
		Mid Adults		
Constant	-3.702	1.984	-1.87	0.066
Rational Coping	**1.815**	0.851	2.13	0.036
Emotional Coping	**5.227**	0.895	5.84	0.000
		Late Adults		
Constant	**10.767**	2.148	5.01	0.000
Rational Coping	**-3.132**	0.862	-3.63	0.002
Emotional Coping	-2.039	1.199	-1.70	0.105

Note. Bold = where 95% CI did not include zero.

Multicollinearity was not an issue any of the predictors in models (6) – (9) as the VIFs were all below two. Additionally, the regression assumptions were satisfied for each.

Research Question 3

As addressed earlier, our hypothesis for the third research question was well supported as each of the four age categories had different significant predictors for describing IA score. This is mostly noted in the diversity of significant Internet application predictors between groups, as well as the positive or negative association these had with IA score. There is less variation in significant coping response predictors (when strictly categorized by either adaptive or maladaptive) for each of the age groups; however, there is still some discord in regards to

whether each coping response style is positively or negatively related with IA score between the age groups.

Post-Hoc Analysis

We speculated that IA score may have fluctuation between gender when controlling for age. After determining that the interaction term between age and gender was not significant ($p = 0.078$), we performed an analysis of covariance, and failed to reject the null hypothesis that males and females do not have significantly different adjusted mean IA scores ($F(1,424) = 0.60$, $p = 0.438$).

Furthermore, we conjectured that the mean usage frequency of different Internet applications would differ between the genders, loosely hypothesizing that mean *video gaming* frequency would be higher for males and that mean *online shopping* frequency would be higher for females. To ascertain the validity of these claims, we used one-factor ANOVA to compare each of the means of each Internet application predictor across both genders. From this, we concluded the between group variation was insignificant for all Internet applications, except for *video streaming* in which the Tukey pairwise comparison revealed that males (Mean: 2.44) and females (Mean: 2.72) have significantly different mean *video streaming* frequencies.

In summation, these results reveal some key findings for our analyses. Notably, there are specific Internet applications that are positively and negatively associated with IA score. The most common contenders to each age group include *video gaming, social networks, video streaming, online sexual activity,* and *discussion forums*. Furthermore, IA score tends to increase with higher levels of maladaptive coping whereas it decreases with higher levels of adaptive coping. There is generous variation between the significant Internet application predictors and coping response predictors and their effects that are unique to each of the four age groups.

Discussion/Conclusion

The first research hypothesis is supported by our findings of significant Internet applications that are positively and negatively associated with IA score. Because the specific significant Internet applications and combinations of such are unique to each age group, our third research hypothesis is also supported. The second research hypothesis is substantiated by the positive correlations between maladaptive coping responses and IA score found in adolescents, young adults, and mid adults. However, *emotional coping* is found to be negatively correlated with IA score within late adults which weakens this claim. Nevertheless, when tightening the significance criteria to 5%, each age group displays either a positive association between maladaptive coping response and IA score, a negative association between adaptive coping response and IA score, or both, validating the second and third hypotheses.

Interpretation of Results

Model (1) presented *video games*, *video streaming*, *online sexual activity*, and *discussion forums* as the most significant predictors for explaining log(IA score) across all participants, and this particular selection of Internet applications can likely be attributed them each being significant within many of the four age groups. Neither *web browsing* nor *gambling* was chosen by the stepwise selections to appear in models (1) – (5). Incidentally, *web browsing* and *gambling* respectively have the highest and lowest overall participant usage. We speculate that because frequent *web browsing* is commonplace across all age groups and all IA statuses, it has little correlation with IA score. On the flipside, *gambling* is invariably infrequent across all age groups and all IA statuses, giving it little relation to IA score.

With regards to the most significant ($p < 0.05$) Internet application predictors for each age group, their corresponding relationships likely reflect the different ways that different age

groups interact with and necessitate such applications. Unexpectedly, *video games* was a significant predictor for mid adults and late adults, despite being less commonly used within these groups than within their younger counterparts. This finding may be due to the relative novelty factor of *video games* for older adults, compared to the younger groups who have had access to them for most of their lives.

One of the few negatively associated Internet application predictors we found was *other online games* for late adults. This trend found was rather counter-intuitive but may be attributed to the phenomenon of late adults downloading mobile games for their children or grandchildren to play, combined with the tendency for late adults to have a greater learning curve with smartphones (Wildenbos et al., 2018). Late adults are already less commonly Internet addicted and those who experience the Internet through *other online games* (on a device they are less adapted to) may just naturally facilitate this negative correlation.

Email may have been negatively correlated with IA score for young adults since this medium is typically associated with formal or professional correspondences for this age group, which is a purpose less likely to be viewed as addictive or enthralling. *Online sexual activity*, however, can be perceived as exactly that to many young adults. It is the only Internet application predictor to be significant in every model (1) – (5) and is highly significant ($p < 0.05$) for young adults. Given pornography's well-documented addictive reputation and DSM-V addiction classification, this is not surprising (American Psychiatric Association, 2013; World Health Organization, 2019).

Despite all age groups displaying a high frequency of *social networks* use, mid adults are the only age group in which this predictor is significant. Since the mid adult age range is when people are most likely to be starting families, moving away from their hometown, etc., they may

need to increasingly rely online communication with family and friends they grew up with, due to increased physical distance. Other age groups may not experience this to the same extent and thus do not need to depend as much on online means to talk with their social group. In the case of late adults having a negative correlation between social networks and IA score, this reasoning stands, as well as holding less Internet literacy (Wildenbos et al., 2018).

In a similar vein, *discussion forums* positively predicted IA score for adolescents and young adults, and *instant messaging* positively predicted IA score for young adults. While Facebook and other media included in *social networks* are typically used to further engage with relationships created offline, *discussion forums* and *instant messaging* are avenues for people to interact with strangers and/or virtual friends with possible shared interests given the topic and discussion-based nature of these applications. Having grown up with the Internet, the younger age groups may have more comfort and familiarity with interacting virtually with others. Furthermore, these age groups are still developing their sense of self and may be more prone to feeling misunderstood and lonely by their immediate peers, thus gravitating toward the Internet to find friends and emotional support.

Focusing on the most significant coping response predictors ($p < 0.05$), *rumination* was positively associated with IA score, whereas *self-care* was negatively associated with IA score for adolescents. Because *rumination* includes repetitive, often intrusive, and worrying thoughts, adolescents who respond to their stress in this manner may spiral into more distress, and turn to the Internet as a source of escapism or to search for information on/help for their situation. This is consistent with Zhou et al.'s (2017) finding that neuroticism, having close ties with rumination, is highly correlated with IA. Meanwhile, adolescents who practice *self-care* to

palliate stress are mainly away from their devices and rather focus on activities such as exercising, being outdoors, and sleeping well.

We found that young adults and late adults who employ higher levels of *rational coping* exhibit lower IA scores, which may be accredited to their habits of logically assessing their situation and consciously monitoring their behavior, including limiting Internet usage. Meanwhile mid adult IA scores have the opposite relationship with *rational coping*, which we believe may be linked to rational-coping mid adults pragmatically seeking to mitigate their problem by researching relevant information online.

Regarding the positive association between *avoidant coping* and IA score in young adults, we believe this occurs because avoidant copers tend to suppress their issues and resort to wishful thinking and escapism into Internet entertainment, the virtual world wherein they can disassociate from real life responsibilities.

Emotional coping positively predicts IA score in mid adults, but negatively predicts IA score in late adults. Because *emotional coping* has much to do with seeking comfort and indulging in what one's feelings want, this discrepancy between mid and late adults may just be a reflection of whether each age group considers the Internet a source of pleasure and/or repose. Since late adults exhibit overall lower IA scores than mid adults, we may deduce that emotional-coping late adults are less likely than mid adults to gravitate towards the Internet to fulfill their emotional desires in times of stress.

Acting out and *seeking social support* were omitted from the model (6). This may be due to the dual nature of these two coping responses in the context of offline versus online behavior, since both may be done just as easily in either medium. *Detached coping* was omitted from

models (7) – (9) and we believe its statistical insignificance may be ascribed to the thin line that *detached coping* can walk between unhealthy and healthy, as in its extremes, detachment can be translated to apathy or a loss of oneself, neither of which are conducive to one's well-being, despite its adaptive classification.

Implications

Internet addiction may seem like a myth in coronavirus-stricken 2020 as the average baseline of individual Internet usage continues to climb. In many countries, people's livelihoods including work, education and social opportunities are making a virtual shift, and people have no choice but to depend on the Internet for most of their day. However, this increasing uniformity and amplification of Internet dependence is not to be confused with every case being problematic, nor does its normalization justify Internet addiction being considered a nonissue.

As people's offline and online lives continuously become intertwined, it is important to identify which applications and which combination of such are most conducive to developing IA. This study spotlighted these applications and how they vary by age group, showing that different demographics respond differently to different Internet facilities. This study also adds to the literature that dimensions of personality, in this case being coping responses, are interlinked with IA. These results can be generalized to the broader field of cyberpsychology to reinforce which Internet activities and stress responses relate to IA, and thereon focus on diminishing these.

Limitations

Some of the Internet application variables were slightly obsolete or the descriptions were a bit vague. For example, *instant messaging*: the dataset did not have a description of this variable, so we were unable to determine if this epithet referred to AOL Instant Messenger, or something more modern like iMessage or Discord. If specific *instant messaging* sites were

explicated, this may have helped in our interpretation of results as we would be better able to gauge its main users, as well as its current relevance.

We would have also removed high leverage points prior to selecting the final models as to be able to avoid the misery of attempting to explain a trend that is the result of one outlier, and also to obtain more accurate, pertinent results. Failure to do so may have led to some attribution dissonance within the discussion.

Suggestions for Future Research

The present study may be expanded on by observing the effects of interacting different Internet applications with different coping responses; for example, is there an association between *emotional coping* interacted with *online sexual activity* and IA score? From these findings, mental health clinicians will be further able to draw connections between patient profiles regarding Internet and mood behavior.

The nature of this study was quite broad in scope. This field of research could benefit by aiming attention at just one Internet application and its IA effects. For instance, future researchers may zero in on only one social media platform within *social networks*, seeing that sites are rapidly diversifying in user audience, content, and culture. Illustrating this, Tiktok may be studied not only in regard to user addiction, but also in exploring its algorithm promotion of certain phenomena: sexual content heavily marketed toward minors and the potential for anyone's "15 minutes of fame." Acknowledging these phenomena, researchers may perform longitudinal studies in how Tiktok molds its young and impressionable userbase over time, hypothesizing an increase in hypersexuality, smartphone addiction, narcissism, and lookism, something that is yet to be thoroughly studied given the app's recent relevance. YouTube, which

falls within *video streaming* may be studied from the angle of the rise of parasocial relationships in the age of "influencers" and how this may be comorbid with affective disorders such as anxiety and depression.

Concluding Remarks

Since the World Wide Web went live to the public in the early 1990s (Grech, 2001), Internet access, usage, and potential for IA has grown exponentially. This addictive potential varies by individual coping response style, by Internet activity habits, and more broadly, all these vary by age group. Through multiple regression analyses, we were able to find roles that key predictors including *video games, online sexual activity, discussion forums*, and adaptive and maladaptive coping responses play in describing IA levels in adolescents, young adults, mid adults, and late adults. These findings may bring clarity to practitioners for early identification of IA symptoms and assist in fine-tuning IA intervention programs to be tailored for each patient profile, taking into consideration their specific Internet inclinations and coping temperament.

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