

NORMALIZATION OF LONELINESS: INVESTIGATING THE EFFECTS OF INTENSIVE VIRTUAL ENVIRONMENT USE***YALNIZLIĞIN NORMALLEŞMESİ: SANAL ORTAMIN UZUN SÜRELİ KULLANIM ETKİLERİNİN İNCELENMESİ***Mehtap TUNÇ ZENGİN¹
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Normalization of Loneliness: Investigating The Effects of Intensive Virtual Environment Use.

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<https://doi.org/10.5281/zenodo.16784912>**Abstract**

As a result of the COVID-19 pandemic, prolonged lockdowns and restrictive measures pushed individuals to spend more time in virtual environments, prompting a reassessment of perceptions related to loneliness in these spaces. This study examines whether such a shift signifies the normalization of loneliness, particularly through its impulsive and compulsive expressions. Employing quantitative methods, the research investigates the relationship between impulsivity, compulsive internet use, and loneliness, using data collected from 774 university students through three scales. The data were analyzed using reliability tests, factor analysis, normality checks, correlation, and MANCOVA. Findings reveal that virtual environment loneliness varies significantly by gender, field of study, marital status, and employment status. Single students reported higher levels of virtual socialization, while social sciences students and unemployed participants demonstrated higher levels of virtual sharing and trust. Notably, no differences were found based on university location. There is a significant association between impulsivity and compulsive internet use, with attentional impulsiveness negatively correlated with preoccupation, loss of control, and mood modification. Preoccupation affects all dimensions of virtual loneliness, while mood modification impacts only socialization. Motor impulsiveness and physical restlessness influence virtual socialization, and non-planning impulsiveness affects virtual trust. The results underscore the complex interplay between personality traits, digital behavior, and loneliness in the virtual age.

Keywords: COVID-19, Loneliness, Virtual Environment.**Öz**

COVID-19 pandemisiyle birlikte uygulanan uzun süreli karantina ve kısıtlamalar, bireylerin sanal ortamlarda daha fazla vakit geçirmesine neden olmuş ve bu durum, yalnızlık algılarının yeniden değerlendirilmesini beraberinde getirmiştir. Bu çalışma, özellikle dürtüsel ve kompulsif eğilimler üzerinden, bu değişimin sanal ortamlarda yalnızlığın normalleşmesine işaret edip etmediğini incelemektedir. Nicel yöntemlerin kullanıldığı araştırmada, dürtüsellik, kompulsif internet kullanımı ve yalnızlık arasındaki ilişki, 774 üniversite öğrencisinden toplanan verilerle analiz edilmiştir. Veriler; güvenirlik testleri, faktör analizi, normallik testi, korelasyon ve MANCOVA analizleriyle değerlendirilmiştir. Bulgular, sanal ortam yalnızlığının cinsiyet, öğrenim alanı, medeni durum ve istihdam durumuna göre anlamlı farklılık gösterdiğini ortaya koymaktadır. Bekâr öğrenciler daha fazla sanal sosyalleşme yaşarken, sosyal bilimler öğrencileri ve işsiz bireyler daha yüksek paylaşım ve güven düzeyleri bildirmiştir. Dürtüsellik ile kompulsif internet kullanımı arasında anlamlı bir ilişki bulunmuş; dikkat dürtüsellliği ile zihinsel meşguliyet, kontrol kaybı ve ruh hali düzenleme arasında negatif korelasyon saptanmıştır. Zihinsel meşguliyet tüm yalnızlık boyutlarını etkilerken, ruh hali düzenleme yalnızca sosyalleşmeyi etkilemiştir. Bulgular, bireysel eğilimler, dijital davranışlar ve yalnızlık arasında dijital çağın özgün koşullarına özgü karmaşık bir ilişkiyi gözler önüne sermektedir.

Anahtar Kelimeler: COVID-19, Yalnızlık, Virtual Environment.

INTRODUCTION

Globally, the COVID-19 epidemic has greatly impacted many facets of peoples' life. The changes in the educational landscape brought about by the epidemic have had a particularly negative effect on university students. Students have been forced to leave their academic institutions and their friends behind due to the sudden closure of universities and the need for social separation and isolation measures. The universities' permanent closures forced students to leave their rented rooms in the city and return to their home countries on multiple occasions. The idea that technology-enabled remote education may help to partially solve the issue of educating people in circumstances where physical presence is not practicable has been bolstered by the ensuing transition to online courses. However, several students faced technological challenges, like not being able to enter virtual classrooms when taking online classes. Students may experience feelings of loneliness and isolation even with the availability of technology because of their remote location from their academic environment, lack of social connection with teachers and peers, and the overall mood of the university. We investigated the prevalence of loneliness among college students during the pandemic-related remote learning period because of this discovery.

The COVID-19 epidemic has had a profound influence on the lives of people, particularly university students, who have had to adapt to a new mode of learning through online distance education because of school closures. Given the increasing use of virtual worlds, it is crucial to analyze its consequences, particularly its potential good or negative influence on feelings of isolation. The literature indicates a prevalence of unfavorable correlations between the use of virtual environments and feelings of loneliness. This project seeks to evaluate data from a field study to improve our understanding of how loneliness becomes accepted as normal and how it is connected to the widespread usage of virtual environments. This study utilizes three prominent scales: the Barratt Impulsivity Scale Short Form, Virtual Environment Loneliness Scale, and Compulsive Internet Usage Scale. This research aims to contribute to the normalization process of loneliness by analyzing the impacts of extensive utilization of virtual worlds. The association between loneliness and impulsivity and compulsivity arises from the extensive research conducted on the profound use of the Internet, which leads to feelings of loneliness. However, the purpose of this study is to comprehend how loneliness becomes a normal experience among individuals who heavily rely on the Internet during the COVID-19 pandemic.

LITERATURE REVIEW

With the advent of digital technologies, communication channels and platforms have become more ubiquitous and effortless, leading to increased connectivity among people. With social media, also known as social networking sites, SNS, users can build their own networks of friends and followers and share their own content with them. The way people engage with one another has been completely transformed by these media platforms, especially among young adults who use them the most (Pitmann Reich, 2016 Smith, 2015). Ruggiero (2000) highlights that compared to the mass media of the 20th century, the newer digital technologies offer interactivity, demassification, and asynchronicity, which makes them more appealing and engaging for users. However, the reasons for using social networks vary widely, and one of them is to meet new people. By contrasting the "rich getting richer" and "poor getting poorer" models, Bessiere et al. (2004) provided evidence in favor of the social dilocation hypothesis by demonstrating that among people with high initial social resources, communicating online to meet new people was associated with an increase in depressive symptoms. However, meeting new people online was linked to a decrease in depressive symptoms in individuals who had limited social resources initially, supporting the social compensation theory. The authors discussed that participating in online interactions with unfamiliar individuals can facilitate the development of social resources for those who do not possess such resources in face-to-face environments. Yet, the body of research on the subject shows mixed results regarding how "weak tie" relationships in online communication affect the psychological health of people who are lonely and socially isolated. The Covid outbreak has resulted in a significant increase in loneliness due to social distancing measures, resulting in people being physically separated from their loved ones.

Loneliness is considered a significant contributor to human suffering, and its definition has been widely discussed in the literature. Perissinotto, Cenzer, and Covinsky (2012) define loneliness as the subjective feeling of lacking companionship, not belonging, and feeling isolated. Meanwhile, according to Perlman and Peplau (1981), loneliness is an unpleasant feeling that arises when a person's social network is lacking in either a quantitative or qualitative sense. It is important to understand that loneliness does not equate to being alone, as it can manifest in both social situations (Page & Scanian, 1994). Weiss (1974) notes that feelings of loneliness are a common experience, with most individuals experiencing loneliness at some point in their lives. Therefore, it is crucial to understand the multidimensional nature of loneliness and how it impacts individuals' psychosocial well-being, particularly during times of crisis such as the COVID-19 pandemic. The COVID-19 pandemic brought about unprecedented changes in how people interact with each other, leading to an increase in social isolation and feelings of loneliness for many individuals (Hawkley & Cacioppo, 2010). The pandemic may have also impacted how individuals perceive and experience loneliness. In this context, the concept of "normalization" refers to the degree to which a particular phenomenon or behavior becomes perceived as commonplace or acceptable within society (Fernández-Castilla et al., 2018). The normalization of loneliness may imply that individuals are more likely to accept and acknowledge feelings of loneliness as a typical part of life, rather than seeing it as something to be ashamed of or hidden (Tornstam, 1992). Therefore, investigating the potential normalization of loneliness during the pandemic can provide important insights into how individuals cope with social isolation and loneliness and inform interventions to support mental health during and after the pandemic.

METHODOLOGY

This research employed a quantitative approach to investigate the variables and subjects of interest, using both descriptive and research methodologies. Specifically, this study aimed to examine the concept of loneliness in relation to impulsivity and compulsivity, and to investigate potential new loneliness-related issues that may have arisen from the increased use of virtual environments during the COVID-19 pandemic.

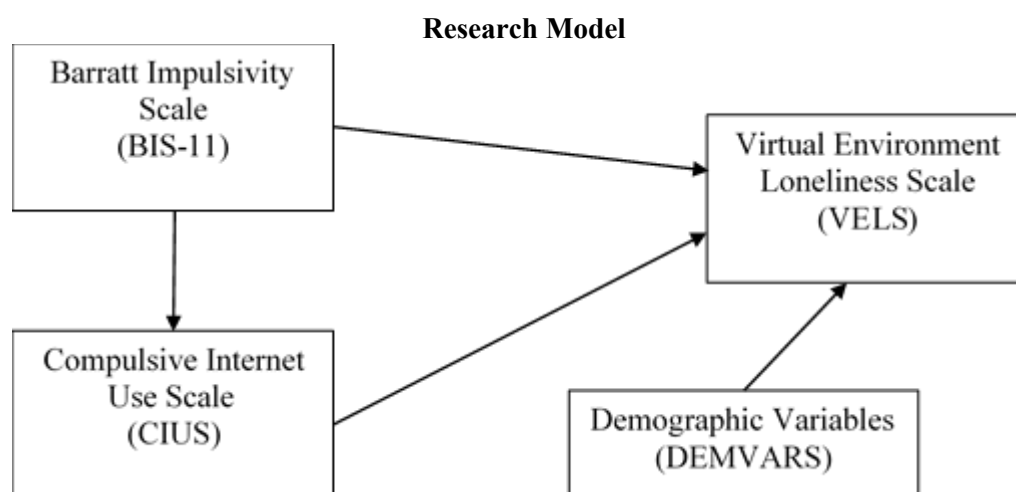
The present study was conducted on a diverse group of undergraduate students from various universities located in Istanbul and other parts of Turkey during the 2021-2022 academic year, including preparatory school students. The study group comprised of 774 students, with 512 female and 262 male students, all between the ages of 18-30. Participants were recruited from a total of 138 departments across both state and foundation universities, from a total of 120 universities in Turkey. Notably, the study aimed to ensure diversity in the sample by not making any distinction between faculties or departments.

The Turkish version of the Barratt Impulsivity Scale-11 (BIS-11) was developed by a team of researchers, including Hüseyin Güleç, Lut Okay, Medine Yazıcı Güleç, Musa Turhan, Gonca Karakul, Meliha Zengin, and Matthew S. Stanford. The scale underwent a translation and adaptation process to ensure cultural and linguistic equivalence with the original English version. Two hundred and thirty-seven university students and eighty-three psychiatric patients with psychosis and drug misuse were given the scale to evaluate its internal consistency and reliability. For each group, Cronbach's Alpha coefficients were computed to evaluate the convergent validity of the BIS-11's subscale and overall scores. Furthermore, the factor structure and retest reliability of the BIS-11 in Turkish were also looked at.

The Virtual Environment Loneliness Scale A measuring tool called the Virtual Environment Loneliness Scale was created by Korkmaz et al. (2014) to assess how lonely people feel in virtual environments—a subject that hasn't received enough attention in the literature. The scale was applied to 354 people in the first instance and 141 people in the second; all the participants were undergraduate students under the age of thirty. By using item-factor total correlation, adjusted correlation, experimental and diagnostic factor analyses, and item discrimination calculations, the

validity of the scale was established. To determine the scale's reliability, the internal consistency coefficient and stability levels were also computed. Three factors comprise the scale: virtual socialization, virtual sharing, and virtual loneliness. It has twenty items and is measured on a 5-point Likert-type scale (from strongly disagree [1] to strongly agree [5]). With a total score of 0.506, the scale also had a 0.662 Cronbach's Alpha reliability coefficient, 0.662 Guttman Split-Half value, and 0.662 Spearman-Brown reliability coefficient. The scale's sub-dimensions of virtual socialization (0.842), virtual sharing (0.809), and virtual loneliness (0.614) all had respectable Cronbach's Alpha values.

The Compulsive Internet Usage Scale (CIUS) was developed as a psychometrically sound and valid tool for assessing the severity of compulsive internet use. The questionnaire was translated into Turkish, as there was no Turkish version available. The CIUS includes 14 items that can be rated on a 5-point Likert scale, and it was tested in three studies with 447 intensive internet users in the first study, 229 heavy internet users in the second study, and 17,000 unselected internet users in the third study. It showed good factorial stability between different subsamples over time. The instrument had high internal consistency and concurrent validity, and high cor-relations with criterion variables show good validity. The CIUS is a psychometrically robust, valid, and easy-to-use measurement tool for assessing compulsive internet use.



Graph 1. Research Model

The study indicates that there may be a relationship between the factors based on the data analysis that determine the Virtual Environment Loneliness Scale (VELs), the Barratt Impulsivity Scale (BIS-11), the Compulsive Internet Use Scale (CIUS), and the demographic variables of the participants. This study proposes that impulsivity and compulsive Internet usage have a combined effect on loneliness, indicating that these factors are associated with increased feelings of loneliness in virtual environments. In other words, it aims to explore if compulsive Internet usage affect virtual environment loneliness differently after accounting for impulsive behaviors.

The data for the study were collected from voluntary student participants who completed the designated data collection tools. Prior to administration, participants were given instructions on how to properly fill out the form, and the application process took approximately 15 minutes. The survey was prepared and distributed online through a shared link. Upon data collection, the data were entered into statistics software. Descriptive statistical analyses were initially performed. Prior to beginning the actual analysis, the normality assumption of the data was checked, and the factors were computed by considering the scales' reverse items. To identify the factors, reliability and factor analyses were carried out. The statistical software Jamovi v2.5.6 was used for all statistical analyses.

RESULTS

Descriptive Statistics

Different demographic variables, including gender, age, marital status, employment status, university type, location, field of study, and length of Internet usage, were included as control variables in addition to the constructs in the proposed research model. To provide an overview of the participants, some descriptive statistics were reported. The sample consisted of 774 participants, of which 66% were female and 34% were male. Most participants (66%) were aged between 20-25, and 27.8% were under 20 years old. Nearly all participants (98%) were single. In terms of university type, 35% of participants attended a foundation university and 65% attended a state university. To account for the impact of the pandemic lockdowns on students' location, the location of the university was divided into "In Istanbul" and "Outside of Istanbul", with 60% and 40% respectively. In terms of field of study, 56% of participants studied natural sciences and 44% studied social sciences. The employment status of the participants showed that 20% were employed and 80% were unemployed.

Table 1. Participants' demographics

Demographics	Items	Percent (%)
Gender	Female	66
	Male	34
Age	Under 20	27
	Between 20-25	66
	Between 26-30	5
	Above 30	2
Marital Status	Married	2
	Single	98
Status of University	Foundation University	35
	State University	65
Location of University	In Istanbul	60
	Outside Istanbul	40
Field of Study	Natural Sciences	56
	Social Sciences	44
Employment status	Employed	20
	Unemployed	80

The demographic values for the participants are shown in Table 1. As for the social media use, the data revealed that the mean value for spending time on social media is 4 hours with a standard deviation of 2.38 hours. Moreover, many participants, accounting for 64%, spend the most time on social media during the peak hours of 20:00-24:00. Conversely, only 1% of the participants spent their time on social media during the working hours of 9:00-12:00.

Inferential Statistics

We started with the reliability analysis, which is used to determine the consistency and stability of the measurements of a scale. Stated differently, it assesses if the scale's items reliably and consistently measure the same construct. The internal consistency of the scale is determined by Cronbach's alpha, the most widely used reliability metric. A high Cronbach's alpha signifies a high degree of correlation between the scale's items, indicating the scale's reliability. Conversely, a statistical method called exploratory factor analysis (EFA) is employed to determine the underlying factors or dimensions that a scale's items measure. It is employed to lower the scale's item count and validate the scale's construct

validity. Factor analysis examines how the items in the scale are related to each other and identifies the factors that best explain these relationships. Therefore, by conducting both reliability and factor analysis, we can ensure that the scales we are using are measuring the constructs we are intended to measure, are consistent and reliable, and have a strong construct validity.

After setting out the dimensions of compulsive Internet use and impulsivity, it is important to analyze the correlations between them. For this purpose, Spearman's rho values calculated.

At this stage, a MANCOVA analysis was used to examine the relationships between the factors obtained from three different scales utilized. A statistical method called MANCOVA (Multivariate Analysis of Covariance) is used to examine the relationship between several dependent variables and one or more independent variables while accounting for the influence of additional covariates. By supporting multiple dependent variables, it expands on the capabilities of ANCOVA (Analysis of Covariance) and offers a more thorough understanding of how independent variables affect these dependent variables collectively.

Reliability and Exploratory Factor Analysis

Exploratory Factor Analysis is a statistical method used to identify the number of underlying factors that can explain the correlation among a set of variables. It is commonly used in social science research to uncover the latent structure of a questionnaire or survey data. In this study, exploratory factor analysis was performed using Jamovi v.2.5.6 statistical software to identify the common themes or factors in the dataset. However, factor analysis requires certain assumptions to be met, including a linear relationship between variables, absence of multicollinearity, inclusion of relevant variables, and an actual correlation between variables and factors. To assess the reliability of the scales used in the study, Cronbach's Alpha coefficient was computed. A value of 0.70 or higher is generally considered acceptable for internal consistency reliability. The results presented in this study indicate that the scales have satisfactory levels of reliability, with Cronbach's alpha values exceeding 0.70. Overall, these findings suggest that the scales used in the study are reliable and suitable for further analysis.

The Barratt Impulsivity Scale (BIS-11) was analyzed by identifying the reverse scaled items and excluding those that did not contribute to increasing the Cronbach's Alpha value. The resulting Cronbach's Alpha value is 0.866. The factor, Attentional Impulsiveness, included all reverse scaled items. On the other hand, the factor, Cognitive Impulsiveness included one reverse scaled item. The analysis revealed that the identified factors explained 41.8% of the overall variance in the data.

As a result of the exploratory factor analysis conducted on the collected survey data, the factors Attentional Impulsiveness, Motor Impulsiveness, Non-Planning Impulsiveness, Physical Restlessness, and Cognitive Impulsiveness were obtained as shown in Table 2.

Table 2. F factor Loadings and % of Variance for Barratt Impulsivity Scale

Construct	Item	Factor Loadings	% of Variance
Attentional Impulsiveness	I am a careful thinker*	0.665	13.46
	I act by thinking*	0.637	
	I am someone who thinks about the future*	0.625	
	I plan my affairs carefully*	0.604	
	I pay attention to job security*	0.594	
	I can control myself*	0.583	
	I plan my journeys well in advance*	0.528	
Motor Impulsiveness	I act without thinking	0.692	9.99

Non-Planning Impulsiveness	I say things without thinking	0.595	
	I don't act as I think	0.571	
	I do business without thinking	0.505	
	I don't pay attention	0.375	
	I get bored easily when I must solve difficult problems	0.351	
	Sometimes I change my house	0.589	8.09
	I shop without thinking	0.536	
	I change jobs often	0.525	
	I spend more than I earn	0.492	
	I change my hobbies	0.394	
Physical Restlessness	I cannot sit still during lessons or games	0.580	5.26
	I cannot sit comfortably during lessons or at the cinema	0.573	
Cognitive Impulsiveness	I concentrate easily*	-0.550	4.96
	While thinking, sometimes irrelevant thoughts occur in my mind	0.528	
	I have floating thoughts	0.400	

KMO Measure of Sampling Adequacy: Overall MSA=0.896

Bartlett's Test of Sphericity: $\chi^2=5378$, df=253, $p < 0.001$

Note. 'Minimum residual' extraction method was used in combination with a 'varimax' rotation

* Reverse-scaled items

The KMO measure of sampling adequacy is a statistical tool used to determine whether a dataset is suitable for factor analysis. Meanwhile, Bartlett's test of sphericity is used to test the assumption that the variables in the population correlation matrix are uncorrelated. This test provides a probability value that indicates whether the correlation matrix has significant correlations among the variables in the dataset, which is a prerequisite for factor analysis to work. Both the KMO and Bartlett tests are performed on the entire dataset. The KMO statistic ranges from 0 to 1, with values over 0.6 considered acceptable. A KMO value over 0.5 and a significance level for Bartlett's test below 0.05 indicate that there is a significant correlation in the data, making it suitable for factor analysis. Based on these statistics, it can be concluded that the dataset used in the study is appropriate for factor analysis.

Table 3. Model Fit Measures for Barratt Impulsivity Scale

RMSEA 90% CI					Model Test		
RMSEA	Lower	Upper	TLI	BIC	χ^2	df	p
0.0443	0.0387	0.0500	0.925	-612	373	148	< .001

RMSEA is a goodness-of-fit statistic commonly used in structural equation modeling to evaluate the fit of a hypothesized model to the observed data. It assesses how well the model fits the data, considering the complexity of the model and the degrees of freedom. A lower RMSEA value indicates

a better fit of the model to the data, and values below 0.05 indicate a good fit. In the context of the present study, the RMSEA value was used to evaluate the fit of the proposed five-factor model to the data. The results indicate that the model significantly predicts the observed values, suggesting a good fit between the hypothesized model and the data.

The Compulsive Internet Usage Scale (CIUS) analysis did not require any reverse-scaled items to be specified. Items that, when removed from the analysis, increased Cronbach's Alpha value were excluded. For all factors in this scale, Cronbach's alpha value is 0.915. This indicates a high level of internal consistency among the items in the scale. The three-factorial model used to analyze this scale explained 62.5% of the overall variance, indicating that it was an appropriate model for understanding the data.

As a result of the exploratory factor analysis conducted on the collected survey data, the factors Preoccupation, Loss of Control, and Mood Modification were obtained as shown in Table 3.

Table 4. Factor Loadings and % of Variance for Compulsive Internet Usage Scale

Construct	Item	Factor Loadings	% of Variance
Preoccupation	I consider being on the Internet even if I'm not online	0.759	26.71
	I look forward to connecting to the Internet	0.722	
	I do my (home) work in a hurry to get on the Internet	0.665	
	I become restless, agitated, or uneasy when I am unable to access the Internet.	0.608	
	I use the Internet instead of attending to my daily responsibilities at work, school, or with my family.	0.607	
	I'm sleep deprived because of the internet	0.578	
	Rather than spend time with others, such as my spouse, kids, parents, or friends, I would rather use the Internet.	0.545	
Loss of Control	I think I should use the internet less	0.719	15.21
	It is hard for me to stop using the Internet for so long.	0.634	
	Even though I want to stop, I still use the Internet.	0.496	
Mood Modification	I turn to the Internet when I'm depressed or want to let go of bad feelings.	0.907	14.84
	I go online when I feel bad	0.809	

KMO Measure of Sampling Adequacy: Overall MSA=0.912

Bartlett's Test of Sphericity: $\chi^2=5667$, $df=78$, $p < 0.001$

Note. 'Minimum residual' extraction method was used in combination with a 'varimax' rotation

The KMO value was 0.912 and the significance level for Bartlett's test's p-value was below 0.001, suggesting that there was substantial correlation in the data and indicating that the dataset was appropriate for factor analysis.

Table 5. Model Fit Measures for Compulsive Internet Usage Scale

RMSEA	RMSEA 90% CI		TLI	BIC	Model Test		
	Lower	Upper			χ^2	df	p
0.0613	0.0503	0.0729	0.959	-87.7	125	32	< .001

For the Model Fit Measures for Virtual Environment Loneliness Scale, results show that our three-factorial model significantly predicts the observed values.

The Virtual Environment Loneliness Scale (VELS) was examined in terms of internal consistency and factor structure. The analysis revealed that no items needed to be reversed to obtain valid results. Furthermore, items that had a negative impact on Cronbach's Alpha were removed from the analysis. The Cronbach's alpha value was found to be high, 0.914, indicating that the VELS has excellent internal consistency. In addition, the results of the factor analysis demonstrated that the three-factorial model provided a good fit to the data, explaining 63.2 percent of the overall variance. These findings suggest that the VELS is a reliable and valid tool for assessing loneliness in virtual environments.

As a result of the exploratory factor analysis conducted on the collected survey data, the factors Virtual Socialization, Virtual Sharing, and Virtual Trust were obtained as shown in Table 6.

Table 6. Factor loadings and % of variance for Virtual Environment Loneliness Scale

Construct	Item	Factor Loadings	% of Variance
Virtual Socialization	In the virtual environment, I share a lot of similarities with those around me.	0.826	26.4
	In the virtual environment, people who are close to me share my interests and viewpoints.	0.758	
	In the virtual setting, I feel at ease with everyone around me.	0.744	
	I feel close to some people in the virtual world.	0.733	
	I am a very social person online.	0.699	
	I feel myself as a member of a group in the virtual environment	0.454	
	There are people I can chat with more online.	0.795	18.8
Virtual Sharing	I can confide in more people on the internet.	0.767	
	I can be better understood by people on the internet.	0.701	
	Virtual environments get rid of real-life problems for me.	0.778	18.0
Virtual Trust	My virtual pals have my greater trust than my friends in real life.	0.645	
	Virtual environments make me forget my introversion and unhappiness.	0.591	
	I am much more comfortable on the virtual environment than in real life.	0.511	

KMO Measure of Sampling Adequacy: Overall MSA=0.914

Bartlett's Test of Sphericity: $\chi^2=6520$, $df=78$, $p < 0.001$

Note. 'Minimum residual' extraction method was used in combination with a 'varimax' rotation

To understand the association between compulsive internet use and impulsivity, correlation analysis performed among the factors found in EFA.

Table 7. Correlation Analysis Between Compulsive Internet Usage and Impulsivity
Correlation Matrix

		IMP1	IMP2	IMP3	IMP4	IMP5
COMP1	Spearman's rho	- 0.260	0.288	0.163	0.181	0.201
	df	772	772	772	772	772
	p-value	<.001	<.001	<.001	<.001	<.001
COMP2	Spearman's rho	- 0.166	0.153	0.066	0.117	0.197
	df	772	772	772	772	772
	p-value	<.001	<.001	0.068	0.001	<.001
COMP3	Spearman's rho	- 0.077	0.122	0.020	0.111	0.232
	df	772	772	772	772	772
	p-value	0.032	<.001	0.581	0.002	<.001

Note: Preoccupation (COMP1), Loss of Control (COMP2), Mood Modification (COMP3), Attentional Impulsiveness (IMP1), Motor Impulsiveness (IMP2), Non-Planning Impulsiveness (IMP3), Physical Restlessness (IMP4), Cognitive Impulsiveness (IMP5).

Analysis showed that there are significant correlations among the dimensions, except that there are no correlations between Non-Planning Impulsiveness (IMP3) and Loss of Control (COMP2) ($p=0.068$), and Mood Modification (COMP3) ($p=0.581$).

In MANCOVA, dependent variables are multiple outcome measures that are hypothesized to be influenced by the independent variables. Independent variables are factors or predictors that are hypothesized to influence the dependent variables. These can be categorical or continuous. Finally, covariates are continuous variables that are not of primary interest but are controlled for to remove their influence on the dependent variables. Covariates help in reducing error variance and increasing the statistical power of the test.

Purpose of MANCOVA was suitable for our research goals. Firstly, to control for extraneous variables by including covariates, MANCOVA controls for potential confounding variables that might affect the dependent variables. The second step is to look at how different independent variables affect different dependent variables. In this manner, it enables us to study the simultaneous effects of one or more independent variables on several dependent variables. To check for interactions, thirdly. The interaction effects of independent variables and covariates on the dependent variables can be evaluated using MANCOVA. In our analysis we have three dependent variables to explain virtual environment loneliness: Virtual Socialization (VIRT1), Virtual Sharing (VIRT2), and Virtual Trust (VIRT3). The independent variables in the model are Preoccupation (COMP1), Loss of Control (COMP2), and Mood Modification (COMP3) that measure compulsive Internet usage. As for covariates we have Attentional Impulsiveness (IMP1), Motor Impulsiveness (IMP2), Non-Planning Impulsiveness

(IMP3), Physical Restlessness (IMP4), and Cognitive Impulsiveness (IMP5) measuring the impulsivity levels.

Our research question is that how does the compulsive Internet usage demonstrate its effect on virtual environment loneliness through impulsive behaviors? In other words, we are analyzing the effect of compulsive Internet usage (independent variable) on virtual environment loneliness (dependent variables), while controlling for impulsive behaviors (covariate) to explore if compulsive Internet usage affect virtual environment loneliness differently after accounting for impulsive behaviors as shown in our research model.

Table 8. MANCOVA Multivariate Tests Results

Multivariate Tests		value	F	df1	df2	p
COMP1	Pillai's Trace	0.09259	5.557	12	2094	<.001
	Wilks' Lambda	0.908	5.715	12	1842	<.001
	Hotelling's Trace	0.10111	5.853	12	2084	<.001
	Roy's Largest Root	0.09657	16.851	4	698	<.001
COMP2	Pillai's Trace	0.02386	1.399	12	2094	0.159
	Wilks' Lambda	0.976	1.400	12	1842	0.159
	Hotelling's Trace	0.02418	1.400	12	2084	0.158
	Roy's Largest Root	0.01712	2.987	4	698	0.018
COMP3	Pillai's Trace	0.05639	3.343	12	2094	<.001
	Wilks' Lambda	0.944	3.367	12	1842	<.001
	Hotelling's Trace	0.05846	3.384	12	2084	<.001
	Roy's Largest Root	0.04509	7.869	4	698	<.001
COMP1 * COMP2	Pillai's Trace	0.07222	1.148	45	2094	0.233
	Wilks' Lambda	0.929	1.146	45	2068	0.235
	Hotelling's Trace	0.07416	1.145	45	2084	0.237
	Roy's Largest Root	0.03363	1.565	15	698	0.078
COMP1 * COMP3	Pillai's Trace	0.05265	1.247	30	2094	0.168
	Wilks' Lambda	0.948	1.245	30	2044	0.169
	Hotelling's Trace	0.05371	1.244	30	2084	0.171
	Roy's Largest Root	0.02491	1.739	10	698	0.069
COMP2 * COMP3	Pillai's Trace	0.04122	0.748	39	2094	0.872
	Wilks' Lambda	0.959	0.747	39	2062	0.873
	Hotelling's Trace	0.04190	0.746	39	2084	0.874
	Roy's Largest Root	0.02163	1.162	13	698	0.304
COMP1 * COMP2 * COMP3	Pillai's Trace	0.07621	0.910	60	2094	0.672
	Wilks' Lambda	0.925	0.911	60	2077	0.670
	Hotelling's Trace	0.07874	0.912	60	2084	0.668
	Roy's Largest Root	0.04522	1.578	20	698	0.052
IMP1	Pillai's Trace	0.00550	1.283	3	696	0.279
	Wilks' Lambda	0.994	1.283	3	696	0.279
	Hotelling's Trace	0.00553	1.283	3	696	0.279
	Roy's Largest Root	0.00553	1.283	3	696	0.279
IMP2	Pillai's Trace	0.01620	3.820	3	696	0.010
	Wilks' Lambda	0.984	3.820	3	696	0.010
	Hotelling's Trace	0.01647	3.820	3	696	0.010
	Roy's Largest Root	0.01647	3.820	3	696	0.010
IMP3	Pillai's Trace	0.02255	5.353	3	696	0.001
	Wilks' Lambda	0.977	5.353	3	696	0.001
	Hotelling's Trace	0.02307	5.353	3	696	0.001
	Roy's Largest Root	0.02307	5.353	3	696	0.001
IMP4	Pillai's Trace	0.00785	1.836	3	696	0.139
	Wilks' Lambda	0.992	1.836	3	696	0.139
	Hotelling's Trace	0.00791	1.836	3	696	0.139
	Roy's Largest Root	0.00791	1.836	3	696	0.139
IMP5	Pillai's Trace	0.00211	0.491	3	696	0.689
	Wilks' Lambda	0.998	0.491	3	696	0.689
	Hotelling's Trace	0.00212	0.491	3	696	0.689
	Roy's Largest Root	0.00212	0.491	3	696	0.689

Note: Virtual Socialization (VIRT1), Virtual Sharing (VIRT2), Virtual Trust (VIRT3). Preoccupation (COMP1), Loss of Control (COMP2), Mood Modification (COMP3), Attentional Impulsiveness (IMP1), Motor Impulsiveness (IMP2), Non-Planning Impulsiveness (IMP3), Physical Restlessness (IMP4), Cognitive Impulsiveness (IMP5).

MANCOVA Multivariate test results indicate that the independent variables Preoccupation (COMP1) ($p < 0.001$) and Mood Modification (COMP3) ($p < 0.001$) affect virtual environment loneliness. On the other hand, Loss of Control (COMP2) does not affect it. Similarly, all possible combinations of compulsive Internet usage do not affect it.

As for the covariates, among all, only Motor Impulsiveness (IMP2) ($p < 0.010$) and Non-Planning Impulsiveness (IMP3) ($p < 0.001$) variables affect virtual environment loneliness. Attentional Impulsiveness (IMP1), Physical Restlessness (IMP4), and Cognitive Impulsiveness (IMP5) do not affect it.

Table 9. MANCOVA Univariate Tests Results

Univariate Tests						
	Dependent Variable	Sum of Squares	df	Mean Square	F	p
COMP1	VIRT1	15.62663	4	3.90666	3.62120	0.006
	VIRT2	45.10298	4	11.27575	9.76773	<.001
	VIRT3	51.06652	4	12.76663	16.26487	<.001
COMP2	VIRT1	2.08481	4	0.52120	0.48312	0.748
	VIRT2	4.13928	4	1.03482	0.89642	0.466
	VIRT3	8.73095	4	2.18274	2.78084	0.026
COMP3	VIRT1	28.42393	4	7.10598	6.58675	<.001
	VIRT2	3.10623	4	0.77656	0.67270	0.611
	VIRT3	2.99619	4	0.74905	0.95430	0.432
COMP1 * COMP2	VIRT1	16.02338	15	1.06823	0.99017	0.464
	VIRT2	17.25022	15	1.15001	0.99621	0.457
	VIRT3	14.52126	15	0.96808	1.23335	0.241
COMP1 * COMP3	VIRT1	12.63174	10	1.26317	1.17087	0.307
	VIRT2	14.23778	10	1.42378	1.23336	0.266
	VIRT3	12.38244	10	1.23824	1.57754	0.109
COMP2 * COMP3	VIRT1	11.91077	13	0.91621	0.84926	0.607
	VIRT2	7.58483	13	0.58345	0.50542	0.922
	VIRT3	8.49951	13	0.65381	0.83296	0.625
COMP1 * COMP2 * COMP3	VIRT1	15.98148	20	0.79907	0.74069	0.785
	VIRT2	20.55428	20	1.02771	0.89027	0.600
	VIRT3	9.95250	20	0.49762	0.63398	0.889
IMP1	VIRT1	2.14891	1	2.14891	1.99189	0.159
	VIRT2	0.00909	1	0.00909	0.00787	0.929
	VIRT3	0.52368	1	0.52368	0.66718	0.414
IMP2	VIRT1	8.19387	1	8.19387	7.59514	0.006
	VIRT2	9.33992	1	9.33992	8.09080	0.005
	VIRT3	0.72383	1	0.72383	0.92217	0.337
IMP3	VIRT1	0.13635	1	0.13635	0.12638	0.722
	VIRT2	1.81719	1	1.81719	1.57416	0.210
	VIRT3	10.19005	1	10.19005	12.98227	<.001
IMP4	VIRT1	5.75285	1	5.75285	5.33248	0.021
	VIRT2	1.18961	1	1.18961	1.03051	0.310
	VIRT3	0.10278	1	0.10278	0.13095	0.718
IMP5	VIRT1	0.62597	1	0.62597	0.58023	0.446
	VIRT2	0.98740	1	0.98740	0.85534	0.355
	VIRT3	1.01983	1	1.01983	1.29928	0.255
Residuals	VIRT1	753.02391	698	1.07883		
	VIRT2	805.76259	698	1.15439		
	VIRT3	547.87444	698	0.78492		

Note: Virtual Socialization (VIRT1), Virtual Sharing (VIRT2), Virtual Trust (VIRT3). Preoccupation (COMP1), Loss of Control (COMP2), Mood Modification (COMP3), Attentional Impulsiveness (IMP1), Motor Impulsiveness (IMP2), Non-Planning Impulsiveness (IMP3), Physical Restlessness (IMP4), Cognitive Impulsiveness (IMP5).

Univariate tests results show us that Preoccupation (COMP1) affects all virtual environment loneliness factors, Virtual Socialization (VIRT1) ($p<0.006$). Virtual Sharing (VIRT2) ($p<0.001$) and Virtual Trust (VIRT3) ($p<0.001$) respectively.

Mood Modification (COMP3) affects only Virtual Socialization (VIRT1) ($p<0.001$). Motor Impulsiveness (IMP2) affects both Virtual Socialization (VIRT1) ($p<0.006$), and Virtual Sharing (VIRT2) ($p<0.005$). Non-Planning Impulsiveness (IMP3) affects only Virtual Trust (VIRT3) ($p<0.001$). Physical Restlessness (IMP4) affects only Virtual Socialization (VIRT1) ($p=0.021$)

At the final stage, we analyzed the effects of demographic variables on virtual environment loneliness factors.

The media values of these factors are as follows: Virtual Socialization (VIRT1) (Median=3-undecided-), Virtual Sharing (VIRT2) (Median=1-strongly disagree-) and Virtual Trust (VIRT3) (Median=1-strongly disagree-). During the COVID-19 pandemic period university students were undecided that whether virtual environments support socialization or not. They literally would not consider virtual environments proper places for sharing and trust.

Table 10. Brunner-Munzel Tests Results: Differences Between Females and Males

Brunner-Munzel Test				
		Statistic	df	p
VIRT1	Asymptotic	1.689	505	0.092
VIRT2	Asymptotic	3.080	494	0.002
VIRT3	Asymptotic	0.495	547	0.621

Note. $H_a \hat{P}(\text{Female} < \text{Male}) + \frac{1}{2} \hat{P}(\text{Female} = \text{Male}) \neq \frac{1}{2}$

Table 11. Median Values of Females and Males for Virtual Environment Loneliness Factors

Group Descriptives			
	Group	N	Median
VIRT1	Female	512	3.00
	Male	261	3.00
VIRT2	Female	512	1.00
	Male	261	2.00
VIRT3	Female	512	1.00
	Male	261	1.00

The Brunner-Munzel test revealed that there is a difference between female and male students in terms of Virtual Sharing (VIRT2) ($p=0.002$). Female students share in virtual environments less frequently than male students (Table 11). On the other hand, there are no differences between female and male students in terms of other factors, Virtual Socialization (VIRT1) ($p=0.092$) and Virtual Trust (VIRT3) ($p=0.621$)

Table 12. Brunner-Munzel Tests Results: Differences Between Natural Sciences Students and Social Sciences Students

Brunner-Munzel Test		Statistic	df	p
VIRT1	Asymptotic	0.533	703	0.594
VIRT2	Asymptotic	2.223	723	0.027
VIRT3	Asymptotic	0.139	720	0.889

Note. $H_a \hat{P}(\text{Natural Sciences} < \text{Social Sciences}) + \frac{1}{2}\hat{P}(\text{Natural Sciences} = \text{Social Sciences}) \neq \frac{1}{2}$

Table 13. Median Values of Natural Sciences Students and Social Sciences Students for Virtual Environment Loneliness Factors

Group Descriptives			
	Group	N	Median
VIRT1	Natural Sciences	430	3.00
	Social Sciences	344	3.00
VIRT2	Natural Sciences	430	1.00
	Social Sciences	344	2.00
VIRT3	Natural Sciences	430	1.00
	Social Sciences	344	1.00

The Brunner-Munzel test revealed that there is a difference between Natural Sciences students and Social Sciences students in terms of Virtual Sharing (VIRT2) ($p=0.027$). Natural Sciences students share in virtual environments less frequently than Social Sciences students (Table 13). On the other hand, there are no differences between Natural Sciences students and Social Sciences students in terms of other factors, Virtual Socialization (VIRT1) ($p=0.594$) and Virtual Trust (VIRT3) ($p=0.889$)

Table 14. Brunner-Munzel Tests Results: Differences Between Married Students and Single Students

Brunner-Munzel Test		Statistic	df	p
VIRT1	Asymptotic	6.456	16.2	< .001
VIRT2	Asymptotic	2.074	16.8	0.054
VIRT3	Asymptotic	0.241	16.1	0.813

Note. $H_a \hat{P}(\text{Married} < \text{Single}) + \frac{1}{2}\hat{P}(\text{Married} = \text{Single}) \neq \frac{1}{2}$

Table 15. Median Values of Married Students and Single Students for Virtual Environment Loneliness Factors

Group Descriptives			
	Group	N	Median
VIRT1	Married	16	1.50
	Single	747	3.00
VIRT2	Married	16	1.00
	Single	747	1.00
VIRT3	Married	16	1.00
	Single	747	1.00

The Brunner-Munzel test revealed that there is a difference between Married students and Single students in terms of Virtual Socialization (VIRT1) ($p < 0.001$). Married students socialize in virtual environments less frequently than Single students (Table 15). There are no differences between Married students and Single students in terms of other factors, Virtual Sharing (VIRT2) ($p = 0.054$) and Virtual Trust (VIRT3) ($p = 0.813$)

Table 16. Brunner-Munzel Tests Results: Differences Between Employed students and Unemployed students

Brunner-Munzel Test				
		Statistic	df	p
VIRT1	Asymptotic	1.48	239	0.141
VIRT2	Asymptotic	2.59	259	0.010
VIRT3	Asymptotic	2.80	270	0.006

Note. $H_a \hat{P}(\text{Employed} < \text{Unemployed}) + \frac{1}{2}\hat{P}(\text{Employed} = \text{Unemployed}) \neq \frac{1}{2}$

Table 17. Median Values of Employed students and Unemployed students for Virtual Environment Loneliness Factors

Group Descriptives			
	Group	N	Median
VIRT1	Employed	156	3.00
	Unemployed	618	3.00
VIRT2	Employed	156	1.00
	Unemployed	618	1.00
VIRT3	Employed	156	1.00
	Unemployed	618	1.00

The Brunner-Munzel test revealed that there is a difference between Employed students and Unemployed students in terms of Virtual Sharing (VIRT2) ($p < 0.010$), and Virtual Trust (VIRT3)

($p=0.006$). Employed students share in virtual environments less frequently than Unemployed students (Table 17) and they also trust in virtual environments less frequently than Unemployed students. On the other hand, there is no difference between Employed students and Unemployed students in terms of Virtual Socialization (VIRT1) ($p=0.141$)

Other demographic variables, namely, Status of University and Location of University have no effect on virtual environment loneliness of the students.

CONCLUSION

Essentially, the purpose of this study was to investigate whether the widespread use of digital technology during the pandemic has normalized the experience of loneliness. To begin with, the research model included the participant's demographic data as a control variable.

The results show that most participants were female students, and most of them were between the ages of 20-25 and single. Furthermore, the participants were divided into those studying at foundation and state universities and divided based on the location of their university as being in Istanbul or outside of Istanbul. Interestingly, it was found that the peak period for internet usage among participants was between 20:00-24:00, while the lowest usage period was between 9:00 and 12:00. These demographic findings are consistent with previous research on student populations, which have shown that university students are typically young, single, and more likely to be female. Moreover, the higher proportion of participants studying at state universities reflects the prevalence of these institutions in Turkey. The peak internet usage period found in the study is consistent with previous research on internet usage patterns, which have found that late evening hours are popular for online activities. This may be because people have more leisure time during these hours, and there are fewer distractions. Overall, the demographic findings provide important context for interpreting the study's results and help to understand the characteristics of the participant population.

The significant and robust association between impulsivity and compulsive internet usage dimensions is consistent with previous research that has shown that individuals who exhibit impulsive behaviors are more likely to engage in excessive internet use, including social media and online gaming. The negative correlations observed between Attentional Impulsiveness and Preoccupation, Loss of Control, and Mood Modification suggest that individuals who have difficulties with attentional control may be less likely to experience these aspects of compulsive internet use.

Results suggest that compulsive Internet usage factors preoccupation and mood modification along with impulsivity factors motor impulsiveness and non-planning impulsiveness play important role on virtual environment loneliness. Research showed that compulsive Internet usage dimension preoccupation is the primary factor on socialization, sharing and trust on virtual environments. Besides, mood modification affects socialization on virtual environments. Results also suggest that socialization and sharing on virtual environments may be more influenced by motor impulsiveness and physical restlessness. On the other hand, trust on virtual environments may be more influenced by non-planning impulsiveness.

These results suggest that gender, field of study, marital status, and employment status are important demographic factors to consider when examining virtual environment loneliness dimensions. Specifically, females may experience less virtual sharing than males, and singles may experience more Virtual Socialization than married students. Respondents from social sciences may have higher levels of Virtual Sharing compared to those from natural sciences. Additionally, unemployed students may experience higher levels of Virtual Sharing, and Virtual Trust compared to employed students. However, location and status of university did not appear to have a significant impact on virtual environment loneliness dimensions. These results emphasize how crucial it is to take demographic factors into account when attempting to comprehend loneliness in virtual environments and its possible effects on mental health and general well-being. Overall, these findings suggest that impulsivity, compulsive internet use, and demographic variables can all play a role in individuals' experiences of virtual environment loneliness. To create efficient interventions to address these

problems and to gain a deeper understanding of the mechanisms underlying these relationships, more research is required.

SUGGESTIONS

The results of this study suggest several potential avenues for further research. For example, it may be valuable to explore the relationship between digital technology use and loneliness among different age groups or in different cultural contexts. Future research may also investigate the possible long-term impacts on people's social and emotional wellbeing of using more digital technology during the pandemic. Investigating the fundamental causes of these connections could yield important information about practical approaches to deal with loneliness and excessive digital technology use. The dynamic and bidirectional relationship between excessive Internet use and loneliness is another possible area of future research. Further research into this relationship may be able to reveal variables that moderate the relationship and possibly guide interventions aimed at encouraging more healthful digital technology use practices. All things considered, the results of this investigation add to the expanding corpus of knowledge regarding the effects of digital technology use on people's social and emotional health. To properly comprehend the underlying mechanisms and possible ramifications of this intricate relationship, more research is necessary as there is still much to learn.

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