



OPEN The role of cognitive flexibility and psychological well-being in the effect of mindfulness on problematic internet use

Gülin Yazıcı Çelebi¹, Sunay Güngör¹ & Feridun Kaya²✉

With the widespread use of digital technologies today, the Internet has become an indispensable part of life but has also led to negative outcomes such as problematic internet use in some individuals. Problematic internet use is seen as a critical risk factor that negatively impacts individuals' academic, social, and psychological functioning. Research has presented a lot of evidence in recent years that psychological resources, such as mindfulness, cognitive flexibility, and psychological well-being, play a noteworthy role in protecting individuals against such risky behaviors. This study aimed to examine the chain (serial) mediation roles of cognitive flexibility and psychological well-being in the effect of individuals' mindfulness on problematic internet use. The majority of the participants in this study, using a cross-sectional, correlational design, were female (73.1%), their socio-economic level was moderate (70.4%), and their mothers (69.6%) and fathers (52.3%) had secondary school education. It was found that the majority of the participants used the Internet for 2–4 h a day (44.2%). Participant age ranged between 18 and 26 (Mean = 19.16, SD = 1.52). Data were collected using a Personal Information Form, the Mindfulness Scale, the Cognitive Flexibility Inventory, the Psychological Well-Being Scale, and the Problematic Internet Usage Scale. When the research findings were examined, it was found that mindfulness had a positive significant relationship with cognitive flexibility and psychological well-being. Negative significant relationships were observed between problematic internet use and mindfulness, cognitive flexibility, and psychological well-being. When the mediation analyses of the study were examined, it was determined that both cognitive flexibility and psychological well-being had mediation roles in the relationship between mindfulness and problematic internet use. In addition, it was revealed that cognitive flexibility and psychological well-being had a chain (serial) mediation role in the relationship between mindfulness and problematic internet use. It was determined that as the mindfulness levels of individuals increased, their cognitive flexibility and psychological well-being levels increased, too. On the other hand, it was observed that having high levels of mindfulness, cognitive flexibility, and psychological well-being decreased problematic internet use levels. In addition to these results, it was found that the relationship between mindfulness and problematic internet use was mediated by cognitive flexibility and psychological well-being. The findings obtained from the research were discussed in light of the literature, and various suggestions were made.

Keywords Mindfulness, Cognitive flexibility, Psychological well-being, Problematic internet use, Serial mediation

It is an undeniable fact that the widespread use of digital technology has significantly changed daily life and that the Internet has become an indispensable part of it^{1,2}. This is because the Internet meets almost every need with the many conveniences and entertainment/recreation possibilities it offers. However, its involvement in life to such an extent also has some adverse effects apart from its benefits. The Internet has paved the way for various maladaptive behaviors such as internet addiction and problematic internet use^{3,4}. Problematic internet use (PIU) is defined as the inability of a person to control their internet use or excessive internet use that may lead to

¹Faculty of Letters, Department of Psychology, Gümüşhane University, Gümüşhane 29000, Türkiye.

²Faculty of Letters, Department of Psychology, Atatürk University, Erzurum 25000, Türkiye. ✉email: feridunkaya25@gmail.com

social, psychological, and emotional difficulties⁵. Kuss et al.⁶ describe this situation as the inability to stop online activities. This situation is common in all age groups, but it has become an increasingly worrying public health concern, especially among young people⁷. Using the Internet for purposes other than intended, using it more than necessary, and feeling restless when there is no Internet have become common situations, and therefore, problematic internet use has become a topic of increasing interest for clinicians and researchers^{3,8}.

The concept of problematic internet use is defined as the disruptions experienced by individuals in important dimensions of their lives, such as family and work, due to internet use, failure to control the use, and compulsive use⁹. Statistics show that there are approximately 5.44 billion internet users worldwide as of 2024, which corresponds to two-thirds of the world's population¹⁰. As a result of the research conducted by the Turkish Statistical Institute, it was determined that 88% of the population in Türkiye used the internet in 2024 and this usage was 96.5% in the 16–24 age group¹¹.

These figures reveal the importance of the issue. Of course, there are also uses that are appropriate for the purpose and controlled, in other words, “healthy.” However, problematic internet use is also quite common. This situation is defined as a multidimensional syndrome that negatively affects the social, psychological, and professional lives of individuals¹². Recent studies have focused on the adversities caused by the Internet rather than its benefits. There are statistical findings showing that the Internet, which is used intensively by almost every age group, is used 1.24 times more by individuals between the ages of 15–24 than by other age groups¹³. Problematic internet use has increased, especially among adolescents and young adults^{14–16}. According to some studies on the prevalence of internet addiction among students, addiction rates are between 28.2% and 45.1%^{17,18}. This situation increases the importance of studies to be conducted on students and young people. Problematic internet use is considered a serious phenomenon that should not be ignored. Some studies have shown that problematic internet use is related to many variables, such as psychological arousal level, sleep patterns, eating habits^{19,20}, obesity²¹, loneliness²², well-being²³, depression^{24,25}, attention deficit²⁶, anxiety²⁷, social anxiety, and difficulties in social relationships²⁸. This study also aimed to determine the predictors of problematic Internet use. The research was based on acceptance and commitment theory. Acceptance and Commitment Therapy (ACT) is a third-wave behavioral therapy approach that aims to help individuals accept their inner experiences and act in accordance with their values, rather than suppressing or changing them²⁹. Psychological flexibility, the core concept of ACT, is defined as the capacity of an individual to live their lives without avoiding negative inner experiences, focusing on the present moment, and exhibiting behaviors consistent with their values³⁰. This model aims to enable individuals to approach their feelings and thoughts with a non-judgmental awareness and to enrich their behavioral repertoire by accepting unchangeable situations³¹.

Mindfulness, one of the basic concepts of the theory, was included in the research as the independent variable, and cognitive flexibility and psychological well-being were included as mediator variables. It is thought that mindfulness, cognitive flexibility, and psychological well-being will have a protective function on problematic Internet use.

Mindfulness

Mindfulness is defined as an individual's acceptance of the present moment without judgment and consciously directing their attention³². In another definition, it is defined as a “state of living in the moment” in which emotions and thoughts are integrated with action³³. The concept of mindfulness, which has its roots in Eastern culture, has gained widespread use and an area of study in Western culture³⁴. Defined as a deep awareness of individuals about their external and internal world³⁵, the roots of the concept date back to Buddhist philosophy³⁶. Mindfulness, which is based on the principle of concentrating attention and focusing on the moment³⁷, involves being here and now and actively participating in situations. It is reported that this situation supports the individual's well-being³⁸, includes flexibility, non-judgment, and compassion, supports hope, and acts as a shield against hardships³⁵. The opposite of the state of mindfulness can be expressed as automaticity. Automaticity is used to express moving away from mindfulness. During this process, the individual may exhibit behaviors such as not being able to focus on the present moment, not being in the moment, and not being able to act non-judgmentally and acceptingly towards the emotions and thoughts experienced³⁹. It can be said that spending hours on the Internet, surfing aimlessly, and using the Internet without realizing how time passes involves moving away from mindfulness a lot. There are research findings in the literature suggesting that mindfulness is negatively correlated with internet addiction⁴⁰ and that internet addiction can be reduced through mindfulness^{41–43}. Furthermore, there are research findings showing that mindfulness is associated with cognitive flexibility⁵², and problematic internet use is associated with psychological well-being⁶² and cognitive flexibility⁵⁶.

Cognitive flexibility

The concept of cognitive flexibility, first used by Spiro, is defined as “the ability of an individual to spontaneously restructure their knowledge to respond appropriately to demands arising from changing situations”⁴⁴. Dennis and Vander Wal⁴⁵ define cognitive flexibility as “an individual's capacity to adapt their cognitions in response to changing contextual conditions.” This definition encompasses three basic aspects of cognitive flexibility. The first involves the perception that certain situations are beyond the individual's control. The second requires the person to believe that alternative options exist in their life circumstances. The third involves the ability to generate multiple solutions when faced with extraordinary situations^{46,47}. This emphasizes the importance of perceiving options, thinking sequentially, and the ability to generate solutions. Accordingly, individuals with cognitive flexibility tend to exhibit appropriate attitudes and behaviors when faced with challenges in daily life, whereas those without cognitive flexibility are more likely to give rigid responses to events and situations. The concept of cognitive flexibility is defined Cañas et al.⁴⁸ as “the ability to adapt situations, find alternative ideas, or approach different problems from more than one perspective,” while Silver et al.⁴⁹ define it as “the ability to

generate alternative responses to various situations.” These definitions emphasize the mental process related to cognitive flexibility.

Individuals may encounter unexpected and challenging situations and confront their problems in the normal course of life. When an individual addresses the problems they encounter with a flexible approach or is aware that they have different options for solutions, they can approach the difficulties they face more strongly. Cognitive flexibility is a feature that supports an individual's ability to cope with problems⁵⁰. Some studies have shown that cognitive flexibility has protective effects on mental health^{51–53}. From the perspective of acceptance-commitment theory, cognitive flexibility is considered one of the basic components of psychological flexibility, and it is assumed that a high level of cognitive flexibility supports the individual's acceptance of their internal experiences and acting in accordance with their values instead of fighting them⁵⁴. There are research results in the literature indicating that cognitive flexibility is associated with mindfulness⁵², psychological well-being⁵⁵, and problematic internet use⁵⁶.

Psychological well-being

Psychological well-being is defined as the ability of an individual to manage existential challenges (maintaining meaningful goals, personal development, and establishing quality relationships with others) that they encounter in life⁵⁷. Six sub-dimensions of psychological well-being have been reported: self-acceptance, positive relationships with others, autonomy, environmental control, purpose in life, and personal development⁵⁸. Psychological well-being theory is considered a combination of theories that examine the characteristics of a positively functioning person⁵⁹. Roothman et al.⁶⁰ stated that psychological well-being could be conceptualized in terms of emotional, physical, cognitive, spiritual, personal, and social processes. From this perspective, it is understood that it is a very versatile concept. This can be interpreted as an aspect that is both susceptible to being affected by many factors and may affect many situations. Psychological well-being is an important indicator of mental health. It can be said that the purpose of the acceptance-determination theory is ultimately to contribute to the individual's psychological well-being.

Psychological well-being is not only a concept related to positive emotions. It also encompasses being able to cope with negative or unfavorable emotions, developing social relationships, finding a purpose in life, and being aware of one's own potential⁶¹. For this reason, individuals who are inadequate in their social relationships, are not optimistic, think that they do not have a purposeful life, and are not aware of themselves can escape from these emotions and turn to the Internet and digital games to satisfy these emotions in virtual environments or to feel more adequate⁶². Lack of self-awareness brings to mind mindfulness, and being able to cope with positive and negative emotions brings to mind cognitive flexibility. Individuals' capacity to adapt to changing situations and evaluate different perspectives is effective in the process of coping with stress, and this supports psychological well-being^{63,64}. There are some studies indicating that psychological well-being is associated with mindfulness⁶⁵, cognitive flexibility⁶⁶, and problematic internet use⁶⁷.

Today, the Internet has become an inseparable part of life, with the opportunities it offers in almost every subject. However, its excessive and uncontrolled use can lead to many problems, especially among university students. In this context, investigation of the psychological and cognitive factors underlying PIU is important. Determining the factors that affect problematic internet use will shed light on the design of intervention programs and the studies of experts working in the clinic. Both mindfulness and cognitive flexibility are skills that can be developed. It is thought that the findings on this subject will contribute to the literature. This study aimed to examine the serial mediation effects of cognitive flexibility and psychological well-being in the relationship between mindfulness and problematic internet use in university students. The age range of university students corresponds to the developmental period called emerging adulthood (18–25) and is one of the most at-risk groups in terms of problematic internet use⁶⁸. Gender and age were taken as control variables. It is thought that the findings of this study will contribute to a better understanding of the nature of PIU and the development of prevention and intervention programs. Accordingly, the following hypotheses will be tested in this study.

H1: Mindfulness is negatively correlated with problematic internet use.

H2: Cognitive flexibility plays a mediating role in the relationship between mindfulness and problematic internet use.

H3: Psychological well-being plays a mediating role in the relationship between mindfulness and problematic internet use.

H4: Cognitive flexibility and psychological well-being play a sequential mediating role in the relationship between mindfulness and problematic internet use.

Methods

Participants

The sample size of the study was calculated on the *G*Power 3.1* software package. In the analyses, when three predictor variables, a significance level of 0.05 (alpha), a power value of 0.95 (1- β), and a medium effect size⁶⁹ were selected, the minimum number of participants required for the study was calculated to be 119⁷⁰. In this context, it can be said that the sample size of the study, including 405 subjects, provided a fairly strong statistical power. It was observed that the majority of the participants were female (73.1%), their socio-economic level was moderate (70.4%), and their mothers (69.6%) and fathers (52.3%) had secondary school education. The majority of the participants (44.2%) used the Internet for 2–4 h a day. It was also determined that the ages of the participants varied between 18 and 26 (*Mean* = 19.16 and *SD* = 1.52). Demographic data of the participants are presented in Table 1 in detail.

Variable		<i>n</i>	%
Gender	Female	296	73.1
	Male	109	26.9
Education of the mother	Secondary school	282	69.6
	High school	85	21.0
	Undergraduate	33	8.1
	Postgraduate	5	1.2
Education of the father	Secondary school	212	52.2
	High school	118	29.1
	Undergraduate	56	13.8
	Postgraduate	19	4.7
Socio-economic level	Low	32	7.9
	Middle	285	70.4
	High	88	21.7
The level of internet use	Less than 1 h	5	1.2
	1 to 2 h	57	14.1
	2 to 4 h	179	44.2
	4 to 6 h	122	30.1
	More than 6 h	42	10.4

Table 1. Demographic characteristics of the participants.

Instruments

Socio-demographic data form

This form has questions about demographic data, such as participants' gender, age, socio-economic status, and daily time spent on the Internet.

The problematic internet usage scale

The scale, which was developed by Ceyhan et al.⁷¹ to measure individuals' problematic internet usage levels, has 33 five-point Likert-type items. The lowest score that can be obtained from the scale is 33, and the highest is 165. An increase in the score means that the individual's internet usage may negatively affect their life, that there may be uncontrolled or inappropriate usage, and that this usage may carry the risk of evolving into a pathology such as internet addiction. The scale has three sub-dimensions: the "negative consequences of the internet" sub-dimension that evaluates the adversities that may occur as a result of internet usage; the "social benefit/social convenience" sub-dimension that evaluates the effects of the internet on socialization; and the "excessive use" sub-dimension that evaluates the frequency of internet usage. The internal consistency coefficients were calculated as 0.94, 0.85, and 0.75, respectively, for the three factors constituting the scale and 0.95 for the total scale. The total score was used in this study. In the current study, the alpha value was calculated as $\alpha = 0.95$, and the omega value was calculated as $\omega = 0.96$. The results of the factor analysis conducted for the measurement instrument indicated excellent goodness of fit indices ($\chi^2 = 667.912$, $df = 495$, $\chi^2/df = 1.349$, $CFI = 0.994$, $NFI = 0.977$, $SRMR = 0.064$, and $RMSEA = 0.029$).

The mindfulness scale

This scale was developed by Brown and Ryan in³⁹. It was adapted to Turkish by Özyeşil et al.⁷². It has one dimension and 15 six-point Likert-type items, which are scored using options ranging from "almost always = 1" and "almost never = 6." Total scores range from 15 to 90. A high score means that mindfulness is high. According to the results of the reliability study of the scale, the alpha reliability coefficient was calculated as 0.80 for the total scale, and the test-retest correlation was calculated as 0.86. In the current study, the alpha value was calculated as $\alpha = 0.84$, and the omega value was calculated as $\omega = 0.85$. The results of the factor analysis conducted for the measurement instrument indicated excellent goodness of fit indices ($\chi^2 = 97.693$, $df = 90$, $\chi^2/df = 1.085$, $CFI = 0.998$, $NFI = 0.978$, $SRMR = 0.049$, and $RMSEA = 0.015$).

The cognitive flexibility inventory

This inventory was developed by Dennis and Vander Wall⁴⁵ and was adapted to Turkish by Gülüm and Dağ⁷³. It is a self-report assessment tool consisting of 20 five-point Likert-type items and "alternatives" and "control" sub-dimensions. A total score for each sub-scale can be calculated, as well as a general 'cognitive flexibility' score. In this study, the general cognitive flexibility score was used. As the score on the scale increases, cognitive flexibility increases, too. In this study, the alpha coefficient of the total scale was calculated as $\alpha = 0.89$, and the omega value was calculated as $\omega = 0.90$. The results of the factor analysis conducted for the measurement instrument indicated excellent goodness of fit indices ($\chi^2 = 325.970$, $df = 170$, $\chi^2/df = 1.917$, $CFI = 0.982$, $NFI = 0.963$, $SRMR = 0.072$, and $RMSEA = 0.048$).

The psychological Well-Being scale

The scale was developed by Diener et al.⁷⁴ and was later revised by Diener et al.⁷⁵. It was adapted to Turkish by Telef⁷⁶. The scale has eight seven-point Likert-type items. The scores that can be obtained from the scale, which does not have a reverse-scored item, are between 8 and 54, and high scores indicate high psychological well-being and the availability of many psychological resources and strengths. According to the results of the validity study conducted on university students, it was determined that the scale consisted of a single factor. Cronbach's alpha value of the scale was found to be 0.87⁷⁵. The alpha value calculated in the adaptation study of the scale was found to be 0.80⁷⁶. In the current study, the alpha value was calculated as $\alpha=0.86$, and the omega value was calculated as $\omega=0.87$. The results of the factor analysis conducted for the measurement instrument indicated excellent goodness of fit indices ($\chi^2=12.897$, $df=20$, $\chi^2/df=0.064$, $CFI=0.999$, $NFI=0.999$, $SRMR=0.041$, and $RMSEA=0.005$).

Data collection

To conduct the research, first, the approval of the ethics committee of the university was obtained (14.05.2025, E.88656144-000-2500158876). Then, the scales were converted into an online form. Students at Trabzon University, Atatürk University, Karadeniz Technical University, Erzurum Technical University, Bayburt University, Uşak University, Kırıkkale University, Ordu University, Gümüşhane University, Ağrı İbrahim Çeçen University, and Iğdır University were informed about the research within the framework of an informed consent form. Students who agreed to participate in the research voluntarily filled out the forms. It took approximately 15 min for each student to fill them out. Study data were collected between April 2025 and May 2025. Being aged ≥ 18 years and not having a psychological problem were determined as inclusion criteria of the study. Exclusion criteria were not being an internet user and not wanting to be a voluntary participant in the study.

Analysis of data

The data set was examined before performing advanced analyses. Given that the hypotheses to be tested in the research would be evaluated using regression-based mediation methods, the assumptions of regression analysis were tested. Accordingly, assumptions such as outliers, normal distribution, and linearity in the data set were assessed⁷⁷. To test these assumptions, the data were first converted to z scores and analyzed for outliers. It was observed that the z statistics ranged between -3 and $+3$, leading to the conclusion that the data set did not contain outliers⁷⁸. In the subsequent process, the skewness and kurtosis values of the variables were reviewed, which revealed that these values fell between -2 and $+2$. Based on these findings, it was concluded that the data were normally distributed⁷⁹. Next, the assumption of independence of errors was evaluated by examining the Durbin-Watson coefficient. This coefficient was found to be 1.856 in the study. According to Durbin and Watson⁸⁰, this value is expected to be between 1 and 3. Since the value obtained in the study was within this range, the error terms were assumed to be independent.

The multicollinearity, another assumption, was tested by examining the relationships between predictor variables. The variance inflation factor (VIF) and tolerance values were studied in this context. According to this assumption, the correlation between predictor variables should not exceed 0.90, the VIF value should be below 5, and the tolerance value should be above 0.20^{77,81,82}. The VIF values for cognitive flexibility, mindfulness, and psychological well-being variables were 1.327, 1.212, and 1.412, respectively. Similarly, the tolerance values of these variables were calculated as 0.754, 0.825, and 0.708, respectively. These values showed that the multicollinearity assumption was met. The absence of multivariate outliers is another assumption of multiple regression analysis. Cook's D value was examined to test this assumption. If Cook's D is greater than 1, this value is considered an outlier^{83,84}. No value greater than 1 was found in the analyses conducted within the scope of the research.

After the assumptions were met, SPSS version 21 and PROCESS Macro Model 6 were employed to test the mediation analysis⁸⁵. The Bootstrap method was used to determine the significance of the indirect effects in the model to be tested in the research. In the bootstrap procedure, the significance of the indirect effect is evaluated by looking at the confidence interval results obtained by increasing the representativeness of the sample^{86,87}. In the analysis, bootstrap values and confidence intervals are created, and if there is no zero between the lower and upper limits of the confidence interval, the indirect effect is considered significant^{87,88}. In order to test the reliability of the measurement instruments, both Cronbach's alpha (α) and McDonald's omega (ω) reliabilities were calculated. In addition, the factor structure of the measurement instruments was tested using confirmatory factor analysis. JASP 0.19.3 was used for these procedures.

Results

The results of the correlation analysis

Before the research hypotheses were tested, complementary statistical values were examined. First, Pearson correlation analysis was performed to determine the relationships between the variables. The findings revealed positive significant relationships between mindfulness and cognitive flexibility ($r=.315$, $p<.001$) and psychological well-being ($r=.418$, $p<.001$). Similarly, a positive relationship was observed between cognitive flexibility and psychological well-being ($r=.476$, $p<.001$). On the other hand, negative and statistically significant relationships were detected between problematic Internet use and mindfulness ($r=-.518$, $p<.001$), cognitive flexibility ($r=-.392$, $p<.001$), and psychological well-being ($r=-.417$, $p<.001$). The results of these analyses are presented in detail in Table 2.

Testing of the mediation hypotheses

The nonparametric Bootstrap method was utilized to test the mediation hypotheses of the study. With this method, it was aimed to produce data sets larger than the current sample size ($n=405$). The Bootstrap method

Variables	1	2	3	4
Cognitive flexibility	1			
Mindfulness	0.315***	1		
Psychological well-being	0.476***	0.418***	1	
Problematic internet use	-0.392***	-0.518***	-0.417***	1
Mean	73.539	56.494	41.627	69.703
SD	11.173	13.315	9.223	23.943
Skewness	-0.010	-0.121	-1.139	0.884
Kurtosis	-0.084	0.180	1.429	0.249

Table 2. Descriptive values and relationships for measurement tools. Note:*** $p < .001$.

Direct effects	B	SE	β	t	p
Mindfulness Δ cognitive flexibility	0.270	0.041	0.315	6.655	<0.001
Mindfulness Δ psychological well-being	0.186	0.031	0.269	6.066	<0.001
Cognitive flexibility Δ psychological well-being	0.317	0.036	0.392	8.843	<0.001
Cognitive flexibility Δ problematic internet use	-0.397	0.099	-0.185	-3.989	<0.001
Psychological well-being Δ problematic internet use	-0.466	0.127	-0.176	-3.667	0.001
Total effect of mindfulness	-0.951	0.078	-0.518	-12.338	<0.001
Direct effect of mindfulness	-0.717	0.082	-0.391	-8.789	<0.001
Bootstrap results for indirect effects	Effect	SE	Lower CI	Upper CI	
Mindfulness Δ cognitive flexibility Δ problematic internet use	-0.058	0.019	-0.098	-0.024	
Mindfulness Δ psychological well-being Δ problematic internet use	-0.047	0.017	-0.083	-0.017	
Mindfulness Δ cognitive flexibility Δ psychological well-being Δ problematic internet use	-0.022	0.009	-0.042	-0.007	

Table 3. Direct and indirect effects of mindfulness on problematic internet use with cognitive flexibility and psychological well-being as mediators. Statistical significance indicated in **bold**. CI = 95% percentile bootstrap confidence interval. Bootstrapping process was confirmed with 10,000 bootstrap samples.

allowed for resampling and performing the analysis on a 10,000 bootstrap samples within a confidence interval of 95%, and achieving more reliable results. The results are presented in Table 3.

The result of the analyses indicated that the total effect of mindfulness on problematic internet use was negative and statistically significant (total effect; $\beta = -0.518, p < .001$). This result supported hypothesis 1. Mindfulness had a significant and positive effect on cognitive flexibility ($\beta = 0.315, p < .001$) and psychological well-being ($\beta = 0.269, p < .001$). Cognitive flexibility positively affected psychological well-being ($\beta = 0.392, p < .001$). On the other hand, psychological well-being ($\beta = -0.176, p < .001$) and cognitive flexibility ($\beta = -0.185, p < .001$) predicted problematic internet use negatively and significantly.

When the indirect effects of the study were examined, the mediating effect of cognitive flexibility in the relationship between mindfulness and problematic Internet use was found to be significant ($\beta = -0.058, SE = 0.019, 95\% CI = [-0.098, -0.024]$), which supported hypothesis 2. Likewise, the mediating effect of psychological well-being was also significant ($\beta = -0.047, SE = 0.017, 95\% CI = [-0.083, -0.017]$), which supported hypothesis 3. Finally, it was found that the effect of mindfulness on problematic internet use was indirectly mediated through cognitive flexibility and psychological well-being ($\beta = -0.022, SE = 0.009, 95\% CI = [-0.042, -0.007]$). This finding supported hypothesis 4. The results of the serial mediation analyses can be seen in Fig. 1.

Discussion
Relationships between mindfulness and problematic internet use

The results of this study showed that there was a negative relationship between mindfulness and problematic internet use and that mindfulness was a negative predictor of problematic internet use. In other words, as individuals' mindfulness levels increased, their level of problematic internet use decreased. A high level of mindfulness indicates that an individual is aware of the moment. However, when using the Internet, an individual can drift from one site to another, with no control. It is expected that attention and awareness cannot be managed while surfing randomly. Individuals with high levels of mindfulness have more insights into their cognitive and behavioral processes, and instead of reacting automatically, they learn to react more consciously and thoughtfully⁸⁹. Constantly switching from one page to another, from one game to another, and repeating this uncontrollably can be thought of as a type of rumination. Recent studies have shown that high mindfulness reduces the likelihood of engaging in rumination⁹⁰. Mindfulness helps individuals break their habitual ruminative cycles by teaching them to notice their feelings and thoughts without judging or getting involved in them⁹¹.

Many study findings have supported this study. For example, a study conducted with adolescents revealed a relationship between high levels of mindfulness and low levels of problematic internet use. The results of the

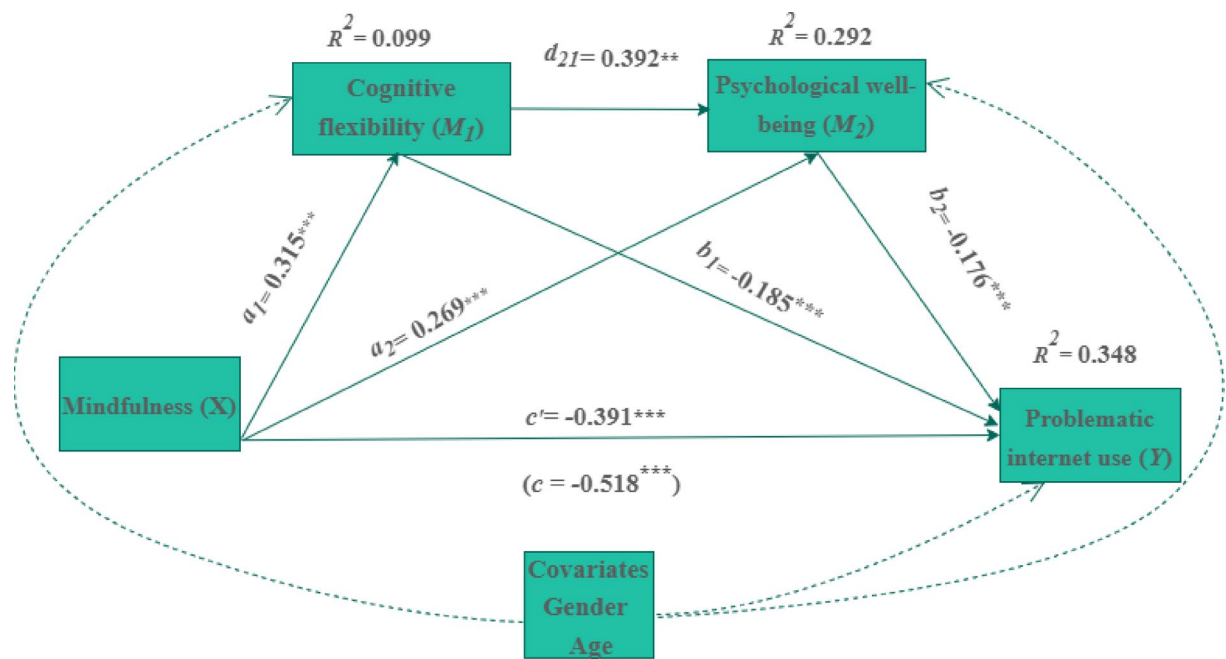


Fig. 1. Serial mediation using the mediating effects of cognitive flexibility and psychological well-being in the relationship between mindfulness and problematic internet use.

study suggest that mindfulness may serve as a protective factor in the development of problematic internet use⁹². There were some other studies showing negative and significant relationships between mindfulness and problematic internet use^{93,94}. According to recent research, adolescents who engage in mindfulness practices are better able to manage problematic internet use, resist impulsive urges, and spend less time online. Additionally, mindfulness techniques such as breathing exercises, body scans, and meditation can help reduce stress, anxiety, and depression, which are common comorbidities associated with problematic internet behavior⁹⁵.

In addition, some experimental studies indicated that mindfulness-based therapies had healing effects on problematic internet use⁹⁶. For example, Fendel et al.⁹⁷ conducted a meta-analysis study and revealed that mindfulness-focused programs had healing effects on problematic internet use and time spent on the Internet. Many researchers suggest that mindfulness programs have promising effects on behavioral addictions^{98,99}. Problematic internet use is also thought to be a type of behavioral addiction. Commitment-based therapies (one of the important components of which is mindfulness), on which this study was based, also lead to a significant decrease in the level of internet addiction¹⁰⁰. There are research findings showing that increased self-awareness will contribute to the prevention of internet addiction⁹², that mindfulness will have a protective effect on behavioral addictions such as problematic internet use¹⁰¹, and that high mindfulness is associated with less problematic internet use¹⁰². Some studies reaching similar results suggest that as mindfulness increases, problematic smartphone use decreases^{94,103}, and that individuals with low mindfulness are less able to control their internet use and are more likely to develop addiction¹⁰⁴.

Relationships between mindfulness and cognitive flexibility

The results obtained from this study revealed a positive and significant relationship between mindfulness and cognitive flexibility. It can also be said that a high level of mindfulness supports the individual's cognitive flexibility. Cognitive flexibility is the ability of an individual to be aware of alternative options in areas of knowledge that they cannot fully structure¹⁰⁵ and to be flexible enough to implement these options. There are findings that the concept of cognitive flexibility, which is associated with learning processes and many psychological structures, is related to the concept of mindfulness⁴⁵. Many studies in the literature supported these findings. Peker Akman and Demir¹⁰⁶ concluded that there was a significant relationship between mindfulness and cognitive flexibility in their study. In addition, there were many studies showing a significant and positive relationship between the two variables^{52,107–109}. As the individual's mindfulness develops, the level of cognitive flexibility can be expected to improve. Zou et al.¹¹⁰ claimed that a mindfulness based stress reduction program positively affected cognitive flexibility. Generally, while a positive relationship is observed between mindfulness and cognitive flexibility, it has also been reported that this relationship is influenced by mediating variables such as self-control¹¹¹.

Relationships between mindfulness and psychological Well-being

The results obtained from the research demonstrated a significant positive relationship between mindfulness and psychological well-being. Living in the moment and a mindful approach to events will help the individual experience all kinds of emotions without suppressing or trying to prevent them¹¹², and this will support well-being³⁵. The research conducted by Jimenez et al.¹¹³ revealed that individuals with high mindfulness had higher levels of positive emotions. The positive relationship between mindfulness and positive emotions is

also supported by studies in the literature, with statements that mindfulness enables the formation of positive emotions^{114,115}. There were many research findings in the literature consistent with the findings of this research, demonstrating that mindfulness was positively correlated with well-being^{38,116,117}, that psychological well-being increased as a result of experimental studies on raising mindfulness^{65,118,119}, and that mindfulness interventions were generally effective in increasing well-being^{120–122}. In addition to these, there were research results with claims that mindfulness was a significant predictor of psychological well-being^{116,123–125} and that mindfulness was an effective variable on well-being^{126,127}. Moreover, some studies showed that life satisfaction, too, a concept closely related to well-being, was related to mindfulness^{35,128,129}.

Relationships between cognitive flexibility and psychological Well-being

The results obtained from the research indicated significant relationships between cognitive flexibility and psychological well-being. The ability to view events from different perspectives and the idea that there may be alternative solutions to problems will support individuals' well-being. Similar to this research, Kiye and Çiçek Habeş⁶⁶ concluded that there was a positive relationship between cognitive flexibility and psychological well-being. The findings of the present research were consistent with many research results in the literature. Many studies indicated that there was a positive and significant relationship between cognitive flexibility and psychological well-being^{55,130}. In addition to these, it was reported that cognitive flexibility predicted psychological well-being^{131–134}. Apart from routines in human life, unexpected situations, for which existing solutions do not work, can sometimes develop. It can be said that people with high levels of cognitive flexibility view events from different perspectives and are open to alternative ways, which contributes to more effective coping with problems and thus supports their well-being.

Relationships between problematic internet use and mediating variables

The results of the research revealed that the mediating effects of cognitive flexibility and psychological well-being between mindfulness and problematic internet use were significant. All three variables were negative predictors of problematic internet use. In other words, as the levels of mindfulness, cognitive flexibility, and well-being increased, the level of problematic internet use decreased. In addition, as cognitive awareness increased, cognitive flexibility increased, and as cognitive flexibility increased, well-being increased, as well. There was no study in the literature where all of these variables were addressed together. The results of the studies where the variables were handled separately were consistent with the findings of this research.

The results of this study showed a significant negative relationship between psychological well-being and problematic internet use. It was seen that there were many studies in the literature with similar results^{62,67,135–140}. In addition to these, there were also research findings indicating that psychological well-being was a predictor of problematic internet use^{141–143}. The concept of internet addiction was also used instead of problematic internet use in the literature^{4,12}. Many studies using the concept of internet addiction also pointed to a negative relationship between internet addiction and psychological well-being, similar to this study^{18,144–148}. Young¹⁹ reported that individuals with low psychological well-being would have difficulties in social relationships and therefore show a greater tendency to the online world.

The results of the research indicate a negative correlation between cognitive flexibility and problematic internet use. Several studies in the literature have shown similar results^{56,149}. Based on these findings, it can be concluded that individuals with high cognitive flexibility experience less problematic internet use. The internet often serves as a means for people to escape from their problems temporarily and shift their agendas. Individuals who can effectively cope with their problems due to their cognitive flexibility do not feel the need for this tendency. Those with low cognitive flexibility often harbor irrational beliefs or cognitive distortions and engage in unhealthy cognitive coping methods^{150,151}. From this viewpoint, problematic internet use may serve as a form of escape. An individual with low cognitive flexibility and high social anxiety might resort to this means of fulfilling their socialization needs, while those who are dissatisfied with themselves may create a reality that aligns with their desires. In such cases, it can trigger a cycle of problematic internet use.

Similar to other results of this research, Kaymaz and Şakiroğlu¹¹¹ concluded that there was a negative relationship between mindfulness, cognitive flexibility, and problematic smartphone use, and according to the research result, mindfulness and cognitive flexibility were significant predictors of problematic smartphone use. Davis¹⁵² reported that low cognitive flexibility and low psychological well-being might cause individuals to use the Internet as a means of escape. Wallace and Shapiro¹⁵³ stated that individuals could increase their well-being by developing their mindfulness and cognitive flexibility. Dennis and Vander Wal⁴⁵, who stated that individuals with cognitive flexibility were open to change and concentrated well on events, stated that those with low cognitive flexibility were cognitively weaker and were more likely to experience various psychological disorders. Considering problematic internet use a type of behavioral addiction, it can be said that it was consistent with the findings of the present study.

Limitations

The cross-sectional nature of the data limited the establishment of a causal relationship between variables. This limitation can be overcome with longitudinal studies on this subject. Another limitation was that the study was based on self-reporting. In particular, conducting in-depth interviews rather than assessing mindfulness in this way can provide more detailed data. Since the research data were limited to university students studying in Türkiye, it can be said that caution should be exercised in generalizing the results to other cultures.

Recommendations

The results of the research showed that mindfulness could serve as a protective factor in problematic internet use. Accordingly, it can be said that awareness-based intervention programs will be useful for solving the problems of

problematic internet users. Cognitive flexibility can be considered a variable that can serve a similar protective function, intervention programs can be developed on this subject, and existing programs can be used for this purpose. Clinical psychologists and psychological counselors can use therapy techniques that target mindfulness and cognitive flexibility in their interventions for clients who present with internet addiction or problematic internet use complaints. Short-term technology detox programs can be supported by informing students about what digital detox is, how it can be done, and what kind of contributions it will provide. Experimental studies can be conducted to test the effects of digital detox and screen time restrictions on different mental health disorders. This research can be repeated in different age groups (e.g., primary school children or university students) and generalized. Moreover, a more holistic understanding can be developed by examining individuals' experiences with internet use in depth with qualitative studies.

Data availability

The data analysed in this study are available from the corresponding author if requested. The corresponding author takes responsibility for the precision of the data analysis.

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Author contributions

G.Y.Ç., S.G. and F.K. conducted the analyses and wrote the manuscript. G.Y.Ç., S.G. and F. K. coordinated data collection, participated in survey design, and supervised the development of the analytic code. G.Y.Ç., S.G. and F. K. contributed to the review and editing of the manuscript.

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Declarations

Conflicts of interest

There is no conflict of interest between the authors.

Ethics approval

This study was conducted in accordance with the 1975 Helsinki Declaration. Ethical approval was first obtained from the Social Sciences Ethics Committee at Ataturk University for the study. Ethics committee approval for the research was obtained with document number E.88656144-000-2500158876 from the meeting held on 14.05.2025.

Consent for publication

Not applicable.

Consent to participate

The students participating in the study signed the consent form. In the study, the authors obtained both ethical committee approval and informed consent for participation from the participants.

Additional information

Correspondence and requests for materials should be addressed to F.K.

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