

**Instagram Use and Depressive Symptoms Among Young Adults: Exploring the
Moderation Effect of Mindfulness**

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Abstract

Social media has become increasingly important and recently the social media platform Instagram took the lead when it comes to the most used social media application among young adults. Not only has Instagram usage increased in the past years but also the number of people with depression or depressive symptoms rises constantly. One concept which was found to positively influence mental health issues such as depression is mindfulness. Since Instagram is a rather novel and therefore vastly understudied social media platform, only little is known about the effects Instagram may have on its users' depressive symptoms with regard to the moderating role of mindfulness. Therefore, this study filled in this gap in the literature by examining the moderating effect of mindfulness on the relationship between time spent on Instagram (IT) and depressive symptoms. The participants ($N = 126$) filled out a survey including the Mindfulness Attention Awareness Scale (MAAS) (Brown & Ryan, 2003), the Patient Health Questionnaire 9 (PHQ-9) (Kroenke et al., 2001), and one item which asked for the respondent's IT. A weak positive significant correlation was found between IT and depressive symptoms. However, no moderating effect of mindfulness on the relationship between IT and depressive symptoms was found. A significant main effect of mindfulness on depressive symptoms was observed, but no significant effect of IT on depressive symptoms was found, which is not in line with the found correlation. A possible explanation is that the relationship between IT and depressive symptoms might be in the reverse as expected, meaning that people who display more depressive symptoms tend to spend more time on Instagram. Additionally, measuring Instagram use solely in terms of time spent on Instagram is not concrete enough and one should distinguish between active and passive use or even several concrete actions such as liking or posting behaviour in future research.

Keywords: Instagram time, social media, depressive symptoms, mindfulness, moderation analysis, young adults.

Instagram Use and Depressive Symptoms Among Young Adults: Exploring the Moderation Effect of Mindfulness

In today's world, social media is becoming increasingly relevant in the daily life of many individuals. It became a popular way of communication and has expanded a lot in the last decades. Social media are web-based communication platforms that provide the option to create personal profiles and content, which makes it possible to interact and connect with users and consume content created by others (Ellison & Boyd, 2013). This includes applications such as Facebook, Snapchat, TikTok, and Instagram. The features allow their users to follow other people online at any time (Lup et al., 2015). The number of social media users is constantly rising with an estimated total number of 3.78 billion users worldwide and an average time spent on social media of 145 minutes daily (Statista, 2022). A further increase to up to 4.41 billion people using social media until 2025 is predicted (Statista, 2022). Studies have shown that particularly young adults use social media platforms frequently (Beyens et al., 2016). In an American sample of 1502 adults, 84% of the respondents aged 18 to 29 indicated that they use at least one social media platform (Auxier & Anderson, 2022). This proportion decreases steadily with increasing age leading to only 45 % of the age group over 65 using social media. Although Facebook and YouTube reach the most users in the whole sample, the user numbers of Instagram, Snapchat and TikTok increased significantly among young adults with Instagram being the most used platform (71%). Additionally, young adults tend to use social media sites also more actively compared to all other age groups (Auxier & Anderson, 2022). Petalas et al. (2021) compared the time spent on social media between young adults and adolescents in a Dutch sample. They found that young adults spent more time on social media than adolescents and stated that young Dutch adults use between three and four different social media platforms with Facebook, Instagram, Snapchat, and YouTube being the most popular ones. On average that sample spent around 99 minutes daily on social media and the users of the sample have on average 220 followers and 123 followees (Petalas et al., 2021). These statistics emphasize the increasing popularity of social media, especially among young adults.

The rapidly increasing numbers of users underline the importance of studying and understanding social media from several points of view such as how it possibly influences well-being and mental health. Although social media is a relatively new concept, the effects it could have on the user's mental health have received a huge amount of attention in research. A literature review by Keles et al. (2020) for example, analysed 13 studies, thereof 12 cross-sectional studies, regarding the association between social media use and several mental health aspects such as depression or anxiety. Many articles found a relationship between these

concepts, however, they pointed out that there are still contradicting findings that need to be further understood in future research. For example, Barry et al. (2017) found a relationship between different social media activities, such as how often people check messages and anxiety or depression, while Banjanin et al. (2015) did not find such a relationship in a similar target group of adolescents. Moreover, several researchers conducted longitudinal studies to understand various associations connected to social media use. Raudsepp and Kais (2019), for example, measured problematic social media use and depressive symptoms in adolescent girls over two years. They found that an increasingly problematic social media use is related to an increase in depressive symptoms. Having heightened problematic social media use implies that users demonstrate greater levels of six previously identified core addiction traits, such as withdrawal feelings when not using social media (Raudsepp & Kais, 2019). Other researchers made use of qualitative methods in form of focus groups to identify how adolescents think about their social media use in relation to mental health (O'Reilly et al., 2018). According to them, adolescents believe that social media use can lead to mood and anxiety disorders, enhance cyberbullying, and can even result in addiction. These are only a few examples of studies that were carried out in the last years, but this demonstrates that the scholarly attention is large and that many researchers try to better understand the relationship between social media use and different aspects of mental health with the use of various methods.

Not only the number of social media users but also the number of people with depression and depressive symptoms has been rising in the last few years. Depression is defined as the constant feeling of sadness and a decrease in pleasure in activities that were previously enjoyable (World Health Organization [WHO], 2022). A study by Mojtabai et al. (2016) found an increase in depression from 8.7% to 11.3% from 2005 until 2014 in young individuals from 12 to 20 years old. Similar studies found the same result of an increasing prevalence of depression also in a US sample of adults (Weinberger et al., 2017). According to the National Institute of Mental Health of the United States, the prevalence of major depressive episodes is currently the highest for people between 18 and 25 at 17% (National Institute of Mental health, 2022). This mental disorder can have a huge impact on daily life and lead to symptoms such as loss of appetite, disturbed sleep, and poor concentration and can even lead to suicide (WHO, 2022). A considerable amount of research has been conducted on the relationship between the ongoing advancement of digitalisation, including social media, and mental health issues such as depressive symptoms in young adults (Shakya & Christakis, 2017). However, the results on how social media impacts different aspects of well-being are inconsistent (Berryman et al.,

2017). Therefore, there is a need to understand the relationship between these two factors to clear this gap in the literature.

Social media use and Instagram

In recent years especially Facebook was studied intensively, which is explainable by its high number of users (Sharma et al., 2020). For example, a study by Marengo et al. (2021) focused on active Facebook use and its association with self-esteem and happiness, while not measuring the respondent's use of other social media platforms such as Instagram or TikTok. Although Facebook still has the most monthly active users among all social media platforms, the popularity of other platforms strongly increased in the last few years (Statista, 2022). The application Instagram was created in 2010 and differs strongly from Facebook, as it mainly focuses on visual-based content (Alhabash & Ma, 2017). According to Auxier and Anderson (2022), 71% of young adults (18-29 years old) in the United States use Instagram and most of them reported doing so several times a day. Thus, the proportion of Instagram users in this age group is slightly higher than the proportion of Facebook users, which currently accounts for 70% (Auxier & Anderson, 2022), underlining the importance of giving Instagram equal attention in research.

Instagram offers its users many functions such as sharing pictures and videos, adding captions, commenting on posts, watching and creating live streams, liking posts, and following public figures or friends (Kim et al., 2017). These new functions set this social media apart from others. Therefore, additional research is needed concerning Instagram to verify previously found effects of studies focusing on other social media platforms like Facebook to understand whether the found effects are similar for Instagram (Baker & Algorta, 2016).

Social media and mental health

The effects social media can have on their users' mental health and well-being have been studied a lot and researchers identified various positive and negative effects. However, the findings are mixed as stated previously and there are contradictory statements about how social media affects individuals (Yang, 2016). Some mentioned positive effects of social media are increased self-esteem (Best et al., 2014), feelings of connectedness, decreased loneliness (Yang, 2016), and perceived social control (Barry et al., 2017). Nevertheless, other studies found opposite results stating that excessive social network use causes lower psychological well-being (Huang, 2017), eating disorders or a worse body image (Holland & Tiggemann, 2016), increased social anxiety, general anxiety, distress, or problematic alcohol use (Ceballos et al., 2018; Curtis et al., 2018; Keles et al., 2020).

Moreover, several studies dealt with the relationship between social media use and depressive symptoms. Depressive symptoms have become increasingly prevalent in recent years (Twenge & Joiner, 2020), and developing depressive symptoms often starts in young adults (Burke, 1991). Although there is a range of factors that can have an impact on becoming depressed, its association with social media use receives increasing attention (Block et al., 2014; Mendelson & Tandon, 2016). Some found that a general screen time (including social media, television, and gaming) leads to a rise in depressive symptoms (Twenge et al., 2018). Others found similar results when focusing solely on the time spent on social media (Yoon et al., 2019). Primack et al. (2017) found that the amount of different social media platforms used increases depression. However, these correlations were often rather weak (Keles et al., 2020) and some did not find any significant relationship (Fardouly et al., 2020). A possible explanation for social media as a risk factor for depression might be the constant exposure to idealized representations of the lives of others the users often encounter on social media (Moreno et al., 2013). Another possible reason for the negative influence of social media on depression might also be the reduction of real-life activities an individual is prone to attend when spending more time on social media (Lin et al., 2016). However, it is important to note that some studies even found that social media use can decrease depression and therefore have a positive impact on the users (Bessièrè et al., 2010), but findings like that are currently in the minority. Conclusively, these contradictory findings and weak correlations show, again, that the association is still ambiguous and further research is needed.

Mindfulness, social media, and depression

Due to the mixed findings regarding the effects of social media on depressive symptoms, the question of which other factors might influence this relationship raises. Therefore, research has started to investigate the mediating or moderating role of several factors more frequently in the last years. However, the majority of studies that tried to identify mediating or moderating variables for the relationship between social media use and mental health mainly focused on for example social comparison, self-esteem, or social support (Appel et al., 2016; Wang et al., 2017). Although these moderating effects seem to play an important role, it is suggested to investigate the moderation effect for further variables which might not receive that much attention in research yet, since the moderation effects currently found were often quite small (Wang et al., 2017).

A concept that gets recently more often related to mental health, including depression, is mindfulness. Mindfulness refers to “the practice of being aware of your body, mind, and feelings in the present moment” (Cambridge University Press, n.d.) and it underlines the skill

of interpreting events in a non-judgmental way (Hülshager et al., 2013). It is considered a personal resource that can help to avoid negative emotions (Yanyu et al., 2020). Studies have shown that the practice of mindfulness can have several health benefits, for example helping to cope with depression and anxiety (Behan, 2020). Huang & Shi (2016) found that being a mindful person decreases negative emotions while increasing positive emotions in cancer patients. Experimental studies have found that mindfulness exercise interventions have a positive effect on symptoms of depression and anxiety (Blanck et al., 2018). These studies underline that there is a positive effect of mindfulness on mental health. However, not a lot is known about whether mindfulness can decrease depressive symptoms related to social media use as most studies focus on the other variables mentioned before like social comparison to understand this relationship.

Nevertheless, some recent studies investigated how these three variables might be related. One study from Pakistan found that social media use during the COVID-19 pandemic has a smaller effect on employee depression when the respondents have a high level of mindfulness (Majeed et al., 2020). Another study also found that mindfulness has a protective role in the negative effects of social media use on psychological distress (Hong et al., 2021). Jones et al. (2022) did not investigate the moderating role of mindfulness but found that mindfulness has a mediating role in the relationship between social media use and depression. These findings underline that mindfulness might be a beneficial personal resource to decrease the negative effects of social media use. However, again, the limited research done in this field is focusing on social media in general, which raises the need to conduct a similar study solely concerning Instagram.

The relationship between social media, mindfulness and depressive symptoms might be explainable through the positive effects mindfulness might have on depressive symptoms. Previous studies concluded that using social media tends to increase the risk of rumination which in turn increases symptoms of depression (Feinstein et al., 2013). People who do not suffer from depression yet, but tend to ruminate, are said to have a higher vulnerability of being diagnosed with depression later in their life (Feinstein et al., 2013). As mindfulness is a personal resource that is found to have a positive effect on the tendency to ruminate, it might have the possibility to minimize this effect. Deyo et al. (2009) for example, found that people who score higher on trait mindfulness, decrease rumination tendencies and in turn improve well-being and also depressive symptoms.

These previous findings on the relationship between mindfulness and depression establish the new notion that people who have a higher level of mindfulness may minimize the

effects of social media use on depressive symptoms. Mindful individuals approach information non-judgmentally which promotes a decrease in depressive symptoms (Behan, 2020). One can argue that when individuals also approach content on social media in a non-judgmental way, they are less negatively impaired by possible outcomes. As not much research is done yet to understand this effect this study investigates the relationship between social media use, depressive symptoms, and mindfulness.

Current study

The previous findings point out gaps in the literature concerning the effects of social media which some are tried to fill through this study. Due to its rising popularity especially among young adults, this study will focus on young adults between 18 and 30 years old. This study will focus solely on the social media platform Instagram as it currently has not been studied as much as other applications such as Facebook. Through its unique image-based features it needs to be studied separately from other social media platforms. Additionally, it is currently the most used social media platform in the studied age group which makes it essential to get a better understanding of how this distinct app influences its user's mental health. Therefore, previously found effects of social media on depressive symptoms need to be studied again to make clarifying statements about this effect.

Moreover, several studies conducted in the last few years suggested the importance of investigating possible intermediate effects. The majority of studies focus on investigating mediating or moderating effects of for example social comparison, self-esteem, or social support (Appel et al., 2016). Only a little research was conducted regarding the moderating role of mindfulness. As explored above, mindfulness tends to have a positive impact on several mental health problems including depressive symptoms. Additionally, it can be hypothesized that mindful people are able to minimize the rumination of social media content which could decrease depressive symptoms. The limited studies that currently exist on the relationship between depression, social media, and mindfulness have always examined the overall concept of social media and have never focused on Instagram as a single medium. That underlines the importance of further investigating how Instagram use, depressive symptoms, and mindfulness are related. Thus, this paper aims at answering the following research questions:

RQ 1: To what extent is there a relationship between time spent on Instagram and depressive symptoms?

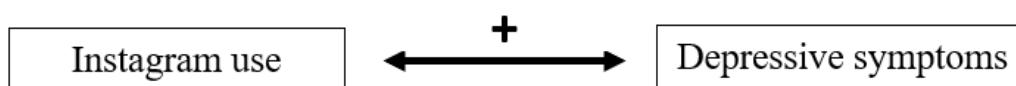
RQ 2: How does mindfulness moderate the relationship between time spent on Instagram and depressive symptoms?

The following hypotheses are going to be tested to get a better understanding of the relationship between Instagram use, depressive symptoms, and mindfulness. Figure 1 visualizes the first hypothesis and figure 2 shows the expected moderating effect.

H1: There is a positive relationship between time spent on Instagram and depressive symptoms.

Figure 1

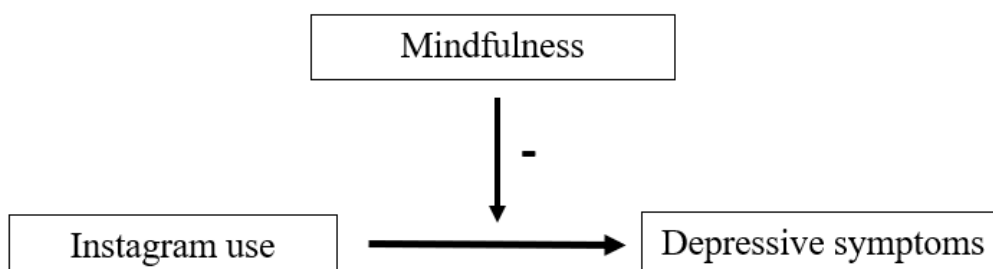
Model of the Hypothesized Relationship between Time Spent on Instagram and Depressive Symptoms (H1)



H2: Mindfulness negatively moderates the relationship between time spent on Instagram and depressive symptoms.

Figure 2

Model of the Hypothesized Effect of Time Spent on Instagram on Depressive Symptoms Negatively Moderated by Mindfulness (H2)



Methods

Design

A quantitative cross-sectional within-subject design was used in the form of an online survey which was created with the website Qualtrics. Conducting an online survey-based design is beneficial as it brings the opportunity to gather data from a large group of a variety of respondents in a short time (Lefever et al., 2007). The relationship of depressive symptoms and Instagram use was aimed to be understood. Moreover, it will be analysed whether the level of mindfulness influences this relationship.

Procedure

Before the data collection, ethical approval was received by the BMS Ethics Committee from the University of Twente (request number 220303). The data collection took place from the 6th of April 2022 until the 7th of May 2022.

The survey took around 10 to 15 minutes for the respondent to complete, which was tested beforehand by the researchers to estimate the average time needed to complete the survey. A link was provided through which the participants could access the survey. The respondents were first asked to read general instructions and information about the survey and give their informed consent to participate in the study. Afterward, the respondents were shown the items concerning demographic factors, social media use and several items related to mental health such as depressive symptoms and mindfulness. In the end, they got informed that they finished the survey and that they could close the website. Moreover, the contact details of the researchers were provided, to allow the respondents to ask questions if they have any. All data were collected anonymously and confidentially.

Participants

It was aimed to gather at least 100 respondents to the survey. This number is above the suggested number of the G*power analysis which recommends having at least $N = 74$ for this study with a significance criterion of $\alpha = .05$, a power = .90, and when expecting an $f^2 = 0.15$ (G*Power Statistical Power Analyses for Mac and Windows, n.d.). It was intended to reach more than these 74 participants to account for possible respondents that needed to be excluded, because of incomplete data or because they do not use Instagram. The inclusion criteria involved that the respondent is between the age of 18 and 30 years old and uses the social media platform Instagram. To recruit enough participants, two non-probabilistic sampling methods were used. Firstly, convenience sampling was used by forwarding the survey to the social environment of each researcher including family, friends, and fellow students. The link for the survey was sent to potential respondents through social media such as WhatsApp or Instagram.

The survey got also published on the SONA system platform by the Behavioural, Management, and Social Science (BMS) faculty of the University of Twente as part of the convenience sampling. That made the survey available to a range of students and awarded students from this faculty with 0.25 credits which these students need to graduate from their program. As the second sampling method, the snowball sampling method was used as respondents were asked to send the link of the survey to further people who they think are interested in filling out the survey and are eligible to participate.

Materials

An online questionnaire containing several scales and items was developed on the website Qualitrics.com. The participants needed a working internet connection and any device such as a laptop or smartphone to take part in this survey. The respondents were asked to consent to participate in the survey and fill out demographic questions including age, gender, nationality, education level, and marital status (Appendix A & B). This study was part of a larger study that investigated the relationship between social media and mental health. Other variables in relationship with social media use that were investigated are body image, loneliness, and social comparison. Therefore, the survey contained also pre-existing scales concerning these variables, but as this research focuses on Instagram use, depressive symptoms, and mindfulness, only these scales will be explained further.

Instagram use

To measure Instagram use (IT) one item was formulated which asked the respondent to indicate how much time they spend on that app on average per day in minutes. To make sure that the participants were able to provide their actual time spent on Instagram a short step-by-step description that explained how to look it up directly on Instagram was added (Appendix C).

Mindfulness

To measure the respondents' self-reported level of mindfulness, the Mindfulness Attention Awareness Scale was used (MAAS) was used (Brown & Ryan, 2003). This scale consists of 15 items that quantify the degree to which an individual is mindful. The participants were for example asked to answer the item "I tend to walk quickly to get where I'm going without paying attention to what I experience along the way.". The response was assessed with a 6-Point Likert scale, ranging from almost always (1) to almost never (6), with higher scores implying a higher level of mindfulness. A previous study found that this scale has a good test-retest reliability of .81 and internal consistency with an alpha of .82 in a sample of U.S. students with a mean age of 19 (Brown & Ryan, 2003). The Cronbach's alpha in the present study was

found to be .88 and therefore this scale showed again excellent reliability. Moreover, the validity was found to be good, meaning that the MAAS is able to assess the distinct construct mindfulness (Brown & Ryan, 2003).

Depressive symptoms

In order to measure a respondent's level of depressive symptoms, the Patient Health Questionnaire 9 (PHQ-9) was used (Kroenke et al., 2001). This scale consists of nine items of which each is concerned with one of the diagnostic criteria of Major Depression in the DSM-IV (Kroenke et al., 2001). The respondents were asked how often they felt bothered by several criteria such as little interest or pleasure in doing things during the last two weeks. The depressive symptoms of the respondents get assessed on a 4-Point Likert scale ranging from 1 (Not at all) to 4 (Nearly every day). Kroenke et al. (2001) found excellent internal reliability with a Cronbach's alpha of .89 and test-retest reliability of .84 in a U.S. sample of 3000 primary care patients aged 18 or older. In this study, Cronbach's alpha was found to be good as well with $\alpha = .82$. Additionally, the criterion, construct, and external validity of the PHQ-9 were found to be good (Kroenke et al., 2001).

Data analysis

Data analysis was carried out using IBM SPSS Statistics 27. Before starting the analysis, the data was checked for the predefined exclusion criteria, meaning that participants above the age of 30 or under the age of 18 were excluded. Additionally, all respondents who indicated that they did not use Instagram got excluded as they were not relevant for further analysis. Also, incomplete responses or respondents who did not give consent to participate beforehand were deleted. Additionally, the data was checked for unrealistic data such as a social media use of more than 24 hours per day. To check the reliability of the scales in this research Cronbach's alpha is calculated to test the internal consistency.

First, descriptive analysis was performed, to summarize data for the several scales. This included the mean and standard deviation of the age and the frequency and the respective percentage of the whole sample for the demographic factors of gender, nationality, education, and marital status was calculated. Additionally, the mean and standard deviation of IT was calculated. Before starting with the correlational and moderation analysis, the assumptions of normality, normality of residuals, multicollinearity, and homoscedasticity were tested. Normality was tested by looking at the skewness and kurtosis values as well as the Shapiro-Wilk test, histograms, and Q-Q plots for each variable. For not normally distributed variables, a logarithmic transformation was performed. Additionally, the normality for the residuals of the regression analysis was tested. To check for multicollinearity, the variance inflation factor

(VIF) was calculated, and the variables were mean-centred to ensure collinearity. For testing homoscedasticity, the Breusch-Pagan test was used.

To answer the first hypothesis a correlational analysis was conducted with the independent variable IT and the dependent variable depressive symptoms. Pearson's R was calculated, and it was checked for a significant value of $p < .05$ to decide whether the correlation is significant. Additionally, moderation analysis was performed to answer the second hypothesis. For this, the SPSS extension PROCESS macro by Hayes (n.d.) got used while testing the moderation effect. The significance of the overall model as well as the significance of the individual variables and especially the interaction effect was tested for a significant value of $p < .05$.

Results

Descriptive statistics

Initially, 167 respondents were recruited and filled in the questionnaire on Qualitrics.com. However, a total of 41 respondents needed to be excluded from further analysis for several reasons. One person did not answer the consent question and two people were younger than the predefined inclusion criterion for the age. Moreover, 15 respondents indicated that they do not use Instagram or did not fill in their time spent on the App and are therefore not relevant for this research. Lastly, 23 participants were excluded as they did not fill out every relevant scale. After excluding these respondents, a final sample of $N = 126$ was used for further analysis. The majority of the sample was from Germany and female and most of the respondent's highest education achieved was a high school diploma. For a detailed overview of the demographics of this sample, see Table 1.

Table 1*Demographic Characteristics of Participants*

Characteristic	Sample	
	<i>N</i> (%)	<i>M</i> (<i>SD</i>)
Age	126 (100)	21.19 (1.99)
Gender	Female	105 (83.3)
	Male	20 (15.9)
	Prefer not to say	1 (0.8)
Nationality	German	97 (77)
	Dutch	16 (12.7)
	Others	13 (10.3)
Education level	High School	110 (87.3)
	Bachelor	12 (9.5)
	Master	4 (3.2)
Marital status	Single	76 (60.3)
	Relationship	46 (36.5)
	Married	3 (2.4)

Note. *N* = sample size; *M* = Mean; *SD* = Standard Deviation.

The IT of this sample had a wide range. The respondent who used Instagram the least was only two minutes daily on Instagram while the respondent who used it the most, spent 464 minutes (7 hours 44 minutes) daily on it. The depressive symptoms items were assessed on a scale between 1, indicating no depressive symptoms, and 4, indicating a high number of depressive symptoms. For this sample, the average score of depressive symptoms was relatively low ($M = 1.82$, $SD = .54$). Thus, there were rather few depressive symptoms experienced by this sample. Lastly, the level of mindfulness was assessed on items with values between 1 and 6 where a higher score means that the individual has a higher level of mindfulness. In this sample, the scores ranged from 2.13 to 5.67 ($M = 3.98$, $SD = .83$). This means that the given

sample displayed slightly above a medium amount of mindfulness. For a summary of the descriptive statistics, see Table 2.

Table 2

Descriptive Statistics of Depressive Symptoms, IT & Level of Mindfulness

	<i>M</i>	<i>SD</i>	Minimum	Maximum
IT	60.89	59.12	2	464
Depression	1.82	.54	1	3.78
Mindfulness	3.98	.83	2.13	5.67

Note. *M* = Mean; *SD* = Standard Deviation; *N* = 126.

Assumptions

Assumption of normality

To test the assumption of normality, the skewness and kurtosis values for the different variables were interpreted as well as the Shapiro-Wilk test. The results of these tests can be found in Appendix D. Additionally, the histogram and the Q-Q plot were checked for each variable (Appendix E). For the mindfulness level, the normality assumption was met. However, when looking at the results for the depressive symptoms one can conclude that this variable was not normally distributed according to the Shapiro-Wilk test. A Logarithmic transformation was performed for depressive symptoms. The Shapiro-Wilk test still indicated significance, meaning that the data was not normally distributed ($W(126) = .97, p = .008$). However, the values for skewness and kurtosis were now between -1 and 1 which made it possible to conclude that this variable was now also approximately normally distributed (Mishra et al., 2019). The histogram and Q-Q plot of the transformed variable further confirmed this (Appendix F). Also, for IT, the assumption of normality was not met, according to all tests. After a logarithmic transformation was performed, the Shapiro-Wilk test indicated that the data was still not normally distributed ($W(126) = .70, p < .001$). Therefore, the data and results need to be interpreted carefully. However, according to Field (2013), the results of the statistical normality tests get more sensitive for an increasing sample, meaning that even a few outliers could influence the significance of these tests. Therefore, it is suggested to mainly take the visual tests including the Q-Q plots and the histogram into account (Field, 2013). So, after transforming the

data and looking at the new Q-Q plot and histogram (Appendix H), one could conclude that IT was approximately normally distributed.

Multicollinearity

The next assumption for linear regression states that the independent variables should not be correlated to be fulfilled. Both independent variables as well as the interaction effect displayed high values. For IT, the variance inflation factor was equal to $VIF = 25.68$, for mindfulness, the VIF was 15.81 and the interaction effect showed a $VIF = 36.17$. These values suggested that multicollinearity could be a problem. Therefore, the independent variables were mean-centred. After centring the variables, the variance inflation factor for the IT was $VIF = 1.04$, for mindfulness $VIF = 1.05$, and for the interaction effect, $VIF = 1.07$. These values demonstrated that collinearity was given after centring the variables, and the assumption was met.

Homoscedasticity

The Breusch-Pagan test was performed and showed that the assumption of homoscedasticity was met, with a $p = .07$. That means that the variance of the errors did not depend on the values of the independent variables. To further underline these findings, the according scatterplot can be found in Appendix I.

Normality of residuals

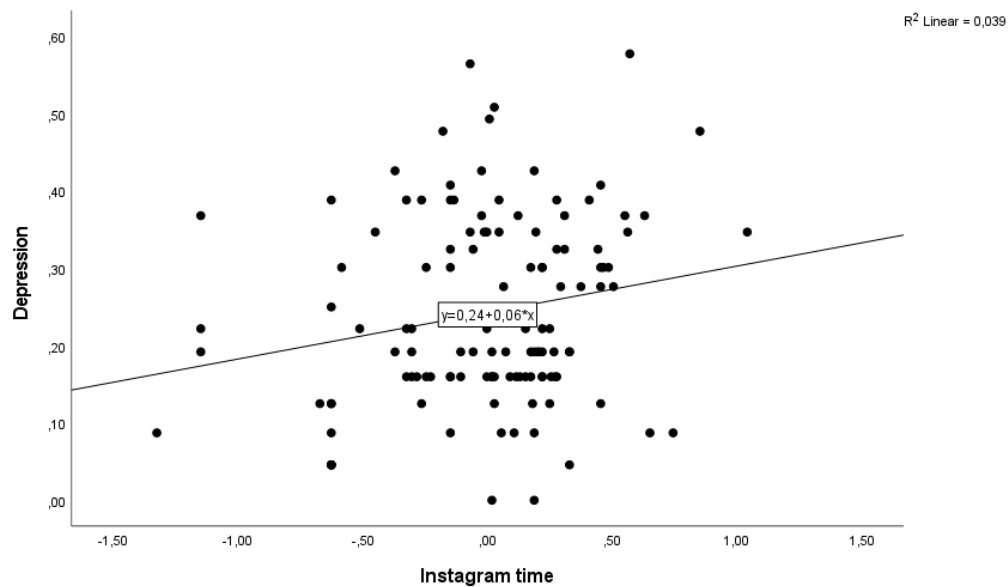
After each individual variable was checked for normality, also the residuals were checked to meet the assumption of normal distribution. The Shapiro-Wilk test ($W(126) = .98$, $p = .15$) showed that the residuals were approximately normally distributed. This can also be seen visually in the Q-Q plot and the histogram (Appendix J).

Correlational analysis

To test the first hypothesis, stating that *there is a positive relationship between IT and depressive symptoms*, a Pearson correlation between the independent variable IT and the dependent variable depressive symptoms was computed. A small significant positive correlation was found ($r = .20$, $p = .03$). This indicates that an increase in IT was correlated with an increase in depressive symptoms. Therefore, the first hypothesis can be accepted. The correlation is displayed in Figure 3.

Figure 3

Scatterplot Visualizing the Correlation Between IT and Depressive Systems



Moderation analysis

In order to test the second hypothesis which states that *Mindfulness negatively moderates the relationship between Instagram use and depressive symptoms*, moderation analysis was done with the PROCESS macro for SPSS by Hayes (n.d.). The overall model was found to be significant ($F(3,122) = 22.00$, $p < .001$, $R^2 = .35$). Hence, it was overall suitable for explaining the effect of mindfulness on the relationship between IT and depressive symptoms. However, the effect of IT on depressive symptoms was found to not be significant ($b = .04$, $p = .08$). Therefore, an individual's IT cannot predict depressive symptoms. Nevertheless, for the relationship between mindfulness and depressive symptoms, a significant result was found ($b = -.08$, $p < .001$), meaning that mindfulness can predict the level of depressive symptoms. Lastly, the moderation effect was analysed, revealing that no significant effect was found ($b = -.01$, $p = .82$). This suggests that there was no moderation effect of mindfulness on the relationship between IT and depressive symptoms (Table 3). Therefore, the second hypothesis is to be rejected.

Table 3

Moderation analysis with the interaction effect of mindfulness on the relationship between Instagram use and depressive symptoms

	<i>b</i>	<i>SE</i>	<i>t</i>	<i>p</i>
Constant	.24	.01	27.37	.001
Instagram use	.04	.02	1.78	.08
Mindfulness	-.08	.01	-7,47	.001
Interaction	.01	.03	.22	.82

Note. *SE* = Standard error; Confidence interval = 95%; *N*= 126.

Discussion

Summary of findings

This study was aimed at investigating the research questions: *Is there a relationship between Instagram use and depressive symptoms?* and *How does mindfulness moderate the relationship between Instagram use and depressive symptoms?* Based on a thorough analysis of the data, it can be concluded that there is a relationship between time spent on Instagram and depressive symptoms. Yet mindfulness does not have a moderating effect on this relationship.

The first hypothesis regarding the first research question was that *there is a positive relationship between time spent on Instagram and depressive symptoms*, which was accepted. This means that an increase in IT corresponds with an increase in depressive symptoms. These findings are in line with similar studies which found that social media time in general and depressive symptoms are indeed connected. For example, Jeri-Yabar et al. (2018) found an association between depressive symptoms and social media use in a sample of students which is similar to the sample in this study. Hence, this study was able to confirm this effect also when focusing on only Instagram use. However, the findings of this study contradict the findings of several other studies such as the longitudinal study of Heffer et al. (2019) who found that there is no relationship between general social media use and depressive symptoms. A possible explanation for these contradictory findings is the different conceptualization of the independent variable IT. Prior studies investigated an individual's entire social media use or focused on the social media platform Facebook, while the present study focused on Instagram. One study that likewise focused on only Instagram as a social media platform, found a similar

weak positive correlation between the two variables (Lup et al., 2015). That could mean that whether social media is correlated with depressive symptoms is dependent on the used social media platforms. Instagram use might be related to depressive symptoms, while other social media platforms such as Facebook might not correlate with it.

Next, the second hypothesis stated that *Mindfulness negatively moderates the relationship between Instagram use and depressive symptoms*. The hypothesis was rejected as no interaction effect was found. This is not in line with similar studies that found such an effect. Majeed et al. (2020) found that mindfulness moderated the effect of social media use on employee depression. However, the sample of that study was employees, who were on average older than the respondents of the current study which might account for the different results. Additionally, the fact that this study focused on solely Instagram might be an explanation for the different results.

Although no interaction effect, and therefore no moderating role of mindfulness was identified, a significant negative main effect of mindfulness was found. That means that the level of mindfulness can predict the number of depressive symptoms. The more mindful a person is, the lower are the depressive symptoms. This is in line with previous research which also found that being mindful can decrease anxiety and depression (Behan, 2020).

Interestingly, the main effect of IT did not show a significant result. Therefore, the time on Instagram is not able to predict an individual's depressive symptoms. When taking the significant results regarding the relationship between these two variables into account, the question arises of how the positive relationship might be explainable. The nonsignificant main effect could mean that Instagram use does not cause depression, but the effect happens the other way around. An explanation for this might be that people who already experience a high number of depressive symptoms, turn to social media more often. As stated by the theory of compensatory internet use, individuals might use social media as a tool to relieve negative emotions (Kardefelt-Winther, 2014). Likes, comments, or the general attention generated by other users worldwide could give the individuals with depressive symptoms positive feelings and possibly increase their self-esteem. Moreover, the assumption that depressive symptoms precede heightened social media use can be explained from an evolutionary point of view. Humans are social creatures who strive for social confirmation and fear social rejection (Leary & Baumeister, 2000). As individuals with depressive symptoms tend to feel insecure and have low self-worth, they might be more vulnerable to spending more time on social media as the social cues in the form of likes, comments and followers can be perceived as rewarding and satisfy psychosocial needs that may not be met in real life (Lim & Yong, 2019; Stiles & Kaplan,

2004). This would again underline why the findings of this study, which focus on the image-based platform Instagram, are contradictory to a range of studies that did not find any relationship when focusing on other social media as Instagram might be able to fulfil these needs more than other platforms can.

In conclusion, there is a weak positive relationship between IT and depressive symptoms, but no moderating effect of mindfulness. These findings are in line with some previous studies, but contradictory to others. This points out that the effect social media including Instagram can have on the mental health of their users is complex and might have more facets to analyse than is currently done. Still, these results have a noteworthy academic relevance. The finding of a significant correlation between IT and depressive symptoms, but no main effect, highlights that the relationship between these two constructs might be the other way around as expected by the majority of current studies. This offers new insight into how the constructs might be related and can serve as a basis for further studies.

Strength and Limitations

The current research reveals both several strengths, but also certain limitations, which need to be taken into account when interpreting the data. What is particularly positive is that enough participants have been recruited in accordance with the power analysis to be able to draw any meaningful conclusions. Besides, pre-established scales were used which offered good reliability and validity. However, despite several advantages of an online survey such as the opportunity to gather data from a large group of respondents in a short time (Lefever et al., 2007), using a survey might also be a limitation. Studies have shown that self-reported measurements tend to not be completely accurate (Lambert, 2013). Additionally, people tend to give answers that are seen as socially desirable, which possibly also happened in this survey (Krumpal, 2013).

Moreover, the assessment of Instagram use might be a limitation. As some of the participants indicated that they use Instagram but did not fill out their time spent on the App, one could assume that they had trouble finding that time. Even though an explanation on how to find that number was given, it was possibly not clear for everybody. Additionally, some participants might not check their time and just estimate a number, because they did not want to take the time to actually look it up or did not want to be honest about it. This could again be the case since people often give socially desirable answers in online surveys, which in this situation could result in the respondents stating a lower IT because they are ashamed of their actual IT and think that it might not be socially accepted. However, this effect might be compensated through the anonymity of an online survey offers. Studies found that people tend

to be more willing to state possibly socially undesirable statements about themselves in the context of an anonymous survey (Rance et al., 2010; Wiederman, 1997). But as the survey was online, it is not possible to check whether the respondent's indicated time on Instagram is equal to their actual time.

Furthermore, measuring Instagram use by only asking for the respondent's time on the App might be too general and is therefore another limitation. One could argue that not only IT is relevant when investigating its relationship with depressive symptoms, but rather how exactly people make use of Instagram. Some research has found that one can distinguish different types of using social media. According to Yang (2016) for example, there are three types of using Instagram. Firstly, using it as a form of interaction including communicating, commenting, or replying to the content of other users. Secondly, browsing, refers to a rather passive use, meaning to look at the content of others but not actively respond to it. Lastly, broadcasting can be understood as actively sharing content on Instagram, but without targeting it to specific individuals (Yang, 2016). Others only distinguish between active and passive use (e.g., Escobar-Viera et al., 2018). Active use includes actions such as liking, favouring content, sharing, commenting, responding to other users' content, or creating and posting your content. Whereas passive use is identified as reading or looking at content created by others without interacting with it (Gerson et al., 2017). Studies found that especially passive social media users tend to have adverse effects on well-being, while active users might have rather positive effects (Lup et al., 2015), which is called the passive social media use hypothesis (Hall et al., 2019). Davila et al. (2012) found depressive symptoms are only related to the quality of social media behaviour, while the quantity was not found to have any effect on it. This emphasized that measuring Instagram use just in terms of time spent on the app might not be completely accurate.

Lastly, the sample of this study was quite limited. Most of the participants were female, German, and individuals with higher education. This needs to be considered when interpreting the results and makes it infeasible to generalize the results to a wider population. To be able to generalize the results and get a better understanding of the impact of the demographic factors on the given relationships, one should account for these in future research or replicate the study with a sample with different demographic characteristics.

Implications and future research

After considering the results and limitations of the current study, several recommendations regarding future research can be made. As this study found a significant correlation between Instagram time and depressive symptoms as well as a main effect of

mindfulness on depressive symptoms, one can conclude that there is some kind of relationship between these concepts. However, both effects are rather weak and should be further studied to better understand these relationships. Therefore, future research should focus on understanding the direction of the correlation between depressive symptoms and time spent on Instagram, to find out whether individuals, who display depressive symptoms, are indeed spending more time on Instagram.

To overcome some of the limitations of a survey method, future research should investigate the given research questions using the experience sampling method or a qualitative method such as interviewing or developing an experiment to possibly get a better picture of the Instagram usage of the target group. Experience sampling can determine thoughts, feelings, and specific behaviours more concretely several times a day or week, which can help to account for fluctuations in the assessed factors (Stone et al., 2007). In addition, further studies should attempt to analyse the relationship between the concepts from a smaller perspective, by not only focusing on IT. As Instagram offers a range of various functions, there are several ways to make use of the app. Therefore, one should distinguish between for example active and passive users or even more concrete by investigating how several actions such as following public figures impact the number of depressive symptoms in the individuals. Lub et al. (2015) found for example that passive use has more negative effects on the user than on active users. This additional knowledge would allow the researchers to more accurately determine what behaviour on Instagram might be affecting mental health. This would make it possible to formulate specific recommendations for the target group and, if necessary, even long-term changes to be made to the app itself to create a more positive user experience.

Although the found effects in this research are weak and not completely understood yet, nonetheless practical implications can be derived from it. Even though the direction of the relationship between Instagram time and depressive symptoms is not entirely clear at this point in time, one could say that it might still be important to observe the Instagram time of people prone to developing depression. Additionally, it would be good to keep young adults informed about possible mental health consequences when using Instagram, to increase their awareness. Moreover, the found effect of mindfulness on depressive symptoms could be used in the prevention of developing depressive symptoms. This can be achieved in a variety of ways. First, educating people about the positive effects that mindfulness can have on depressive symptoms would be helpful. Furthermore, mindfulness-based applications could be further developed and then made available to young adults free of charge.

Conclusion

In conclusion, this study was aimed at investigating whether there is a moderating effect of mindfulness on the relationship between Instagram use and depressive symptoms. After the quantitative analysis, it can be concluded that no such moderating effect plays a role in the relationship. However, mindfulness was able to predict an individual's depressive symptoms. Instagram use was not able to predict depressive symptoms, although the analysis revealed a correlation between these two concepts. These findings underline that the effect Instagram has on its users is complicated and has probably even more facets than expected. This study was able to prove that mindfulness does not play a moderating role when only measuring the IT in a sample of young adults. However, countless other variables can possibly interfere with the relationship between Instagram use and depressive symptoms. In future research, there should be made a small adjustment to this study, such as conceptualizing Instagram use in terms of active and passive use, to either verify the results of this study or get a better picture of under which circumstances mindfulness might still have an impact. Additionally, further variables should be checked for moderating effects on that relationship to fully understand which factors play a role and in the long-term optimize the use of this app in terms of mental health.

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Appendix A

Informed consent

Dear participant,

Social media has gotten increasingly popular in the last few years. Research between social media and well-being showed very mixed findings. Therefore, it is not clear if social media has a positive or negative impact on mental health. The results of this study might contribute to a better understanding of the relationship between social media use and mental health.

This survey assesses your social media use, body image, depressive symptoms, loneliness, mindfulness and social comparison.

For participation in this study, participants are required to be between the ages of 18 and 30 and have proficiency in the English language and access to the Internet.

Filling in the survey will take about 15 minutes.

Please note that this survey will be best displayed on a laptop or computer. Some features may be less compatible for use on a mobile device.

The collected data will be handled confidentially and will only be used for analysis purposes and only for this study. All participation is anonymous.

By clicking the first 'I consent' button below, you confirm that you are fully informed about this study and do not have any further questions.

By clicking the second 'I consent' button, you acknowledge that your participation in the study is voluntary and that you can cancel your participation in this study at any time without needing to provide an explanation.

For any further questions about this study or the way the data is being handled, please contact Viktoria Tiltmann (v.tiltmann@student.utwente.nl).

Thank you in advance!

Kindest regards,

Nina Nordmann

Viktorija Tiltmann

Yannick Gerhards

I am fully informed and do not have any further questions. I give permission that my answers will be handled anonymously and confidentially in the context of this study.

I consent

I am fully informed and do not have any further questions. I give permission that my answers will be handled anonymously and confidentially in the context of this study.

I consent

Appendix B

Demographic questions

Please enter your age.

Please select your nationality.

- Dutch
- German
- Other

What gender do you identify with?

- Female
- Male
- Non-binary
- Prefer not to answer

Please select the highest level of education you achieved.

- Highschool
- Bachelor's degree
- Master's degree
- PhD

Please select your marital status.

- Single
 - In a partnership
 - Married
 - Divorced
 - Prefer not to answer
-

Appendix C

Questions about social media use

Please select which social media platforms you are using.

- Instagram
- Facebook
- Twitter
- TikTok
- Snapchat
- Pinterest
- Youtube
- Others (Please specify)

How much time do you spend on Instagram on average per day (in minutes)?

This is one possibility to check it:

1. Click on Instagram
2. Go to your own profile.
3. Click on the three lines in the top right corner.
4. Click on "Your activity".
5. Click on "Time spent".
6. Write down your daily average minutes (e.g.: when you spend 1 hour and 12 minutes, write 72)

How many times do you open Instagram daily?

You can check this in the settings of your phone.

How many influencers do you follow on Instagram?

(You can either look it up, or estimate)

What is the content of the influencers you follow mostly about?

- Lifestyle
- Fitness
- Travel
- Food
- Family
- Animals
- Fashion
- Others (Please specify)

Appendix D

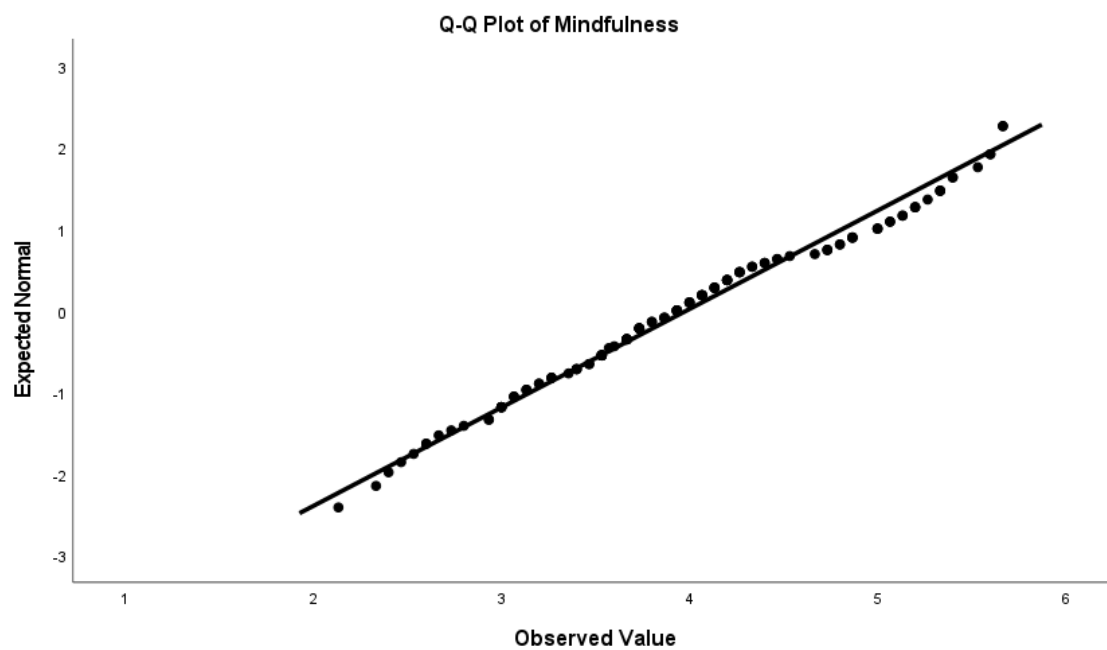
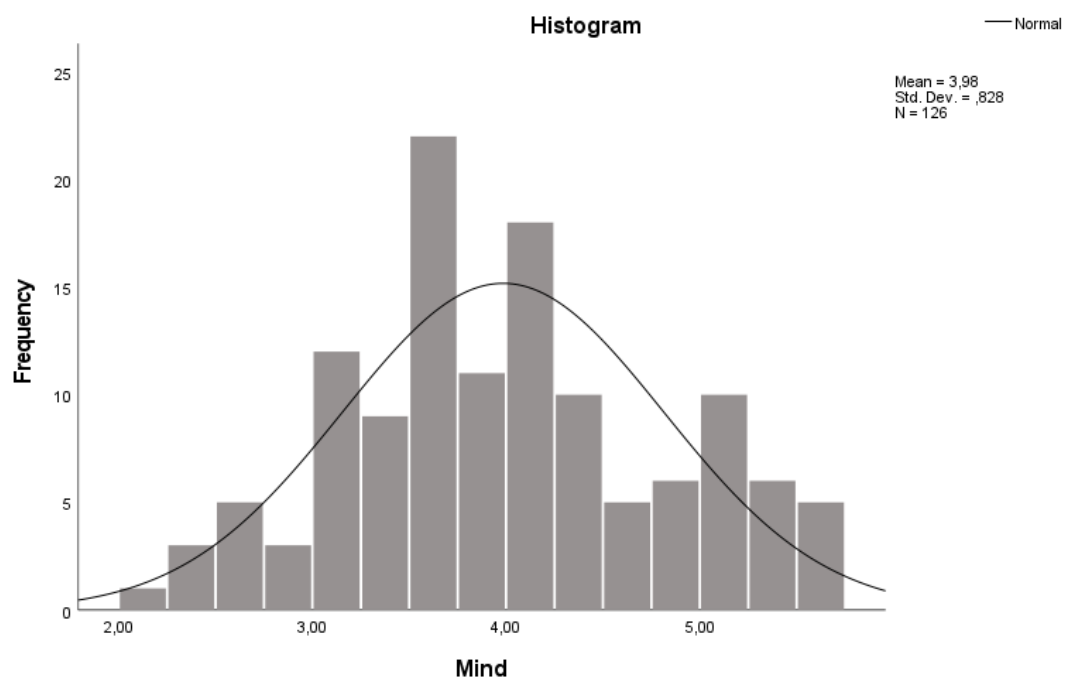
Shapiro-Wilk test, Skewness and Kurtosis for the variables Depression, Mindfulness, and Instagram time

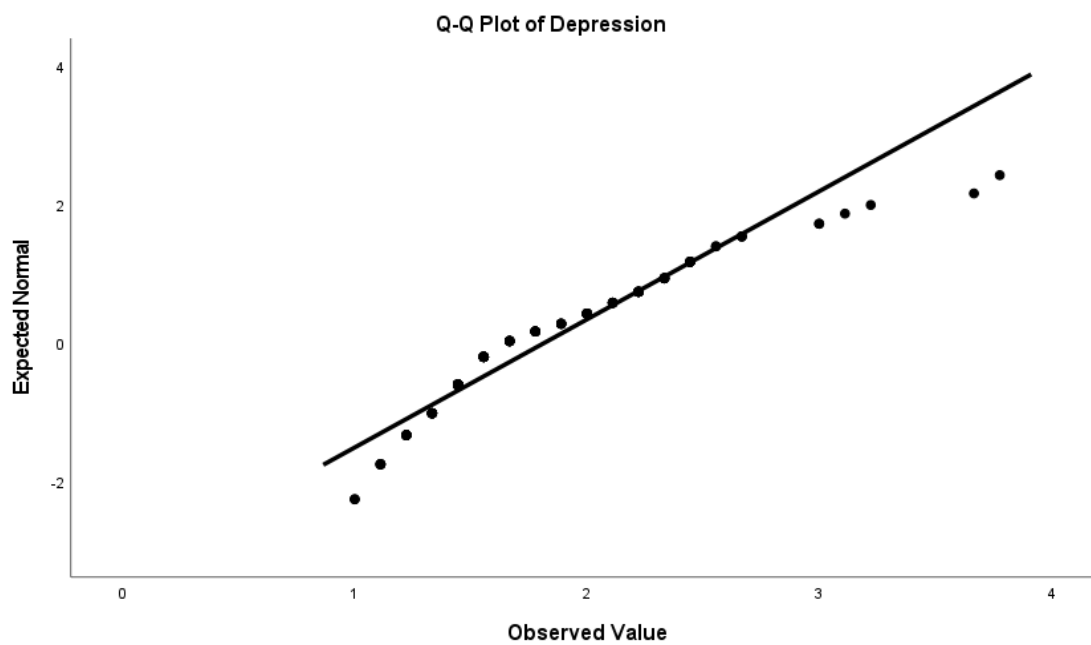
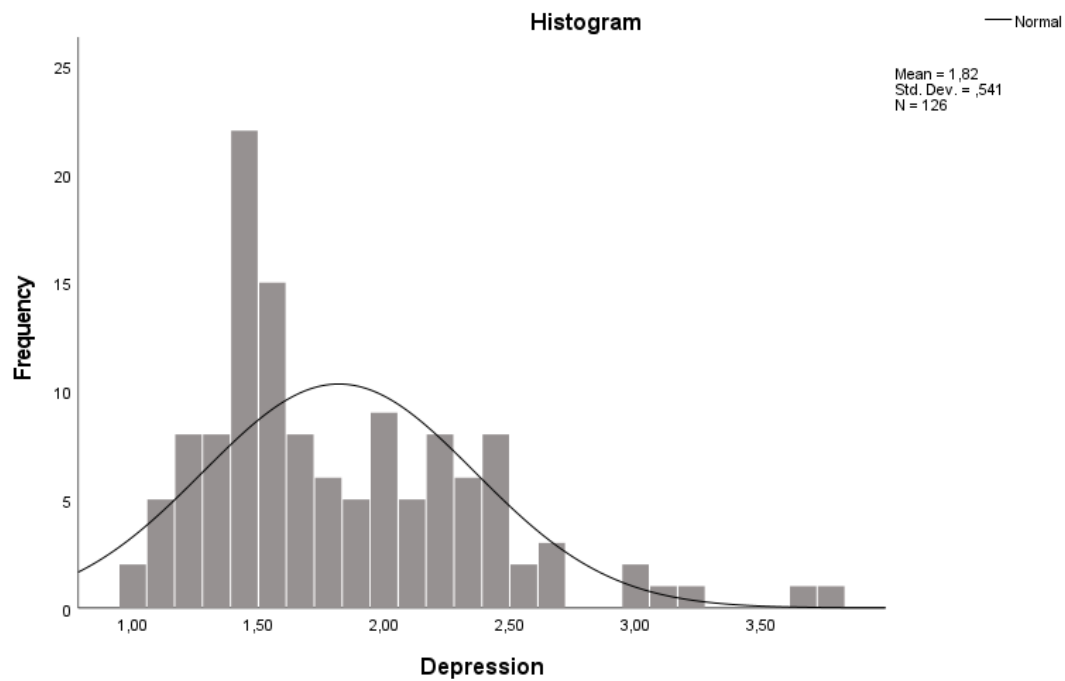
	Shapiro-Wilk			Skewness		Kurtosis	
	Statistic	df	Sig.	Statistics	SE	Statistics	SE
Depression	.917	126	.000	1.082	.216	1.335	.428
Mindfulness	.981	126	.077	.138	.216	-.582	.428
Instagram time	.702	126	.000	3.503	.216	18.632	.428

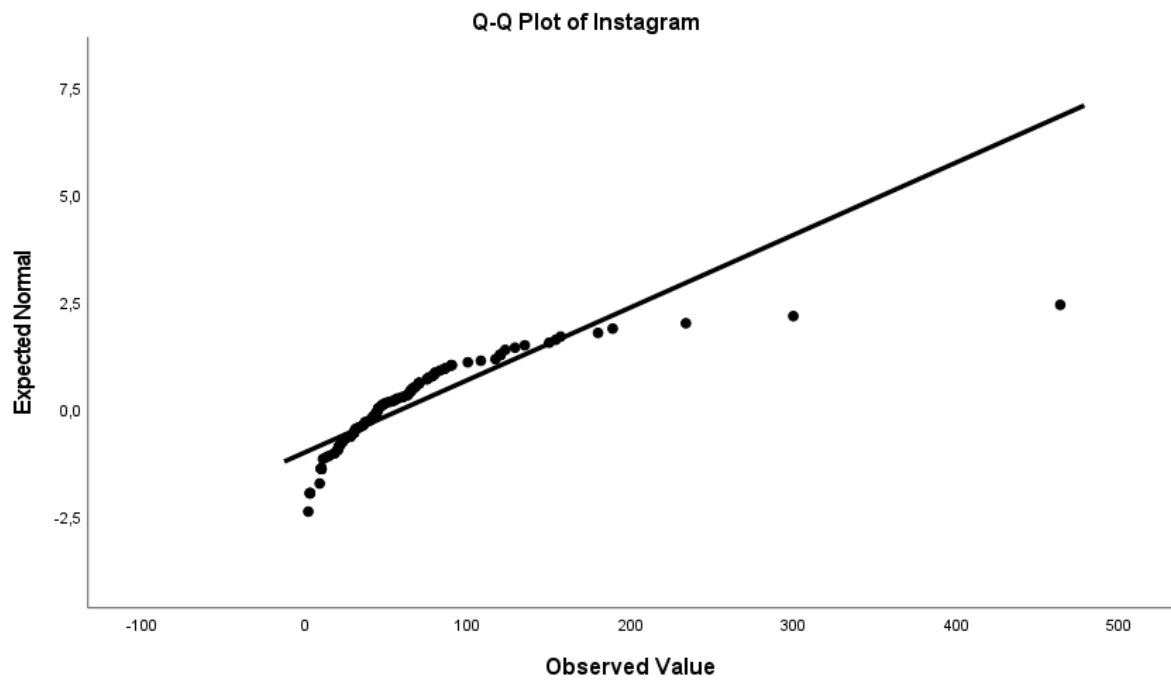
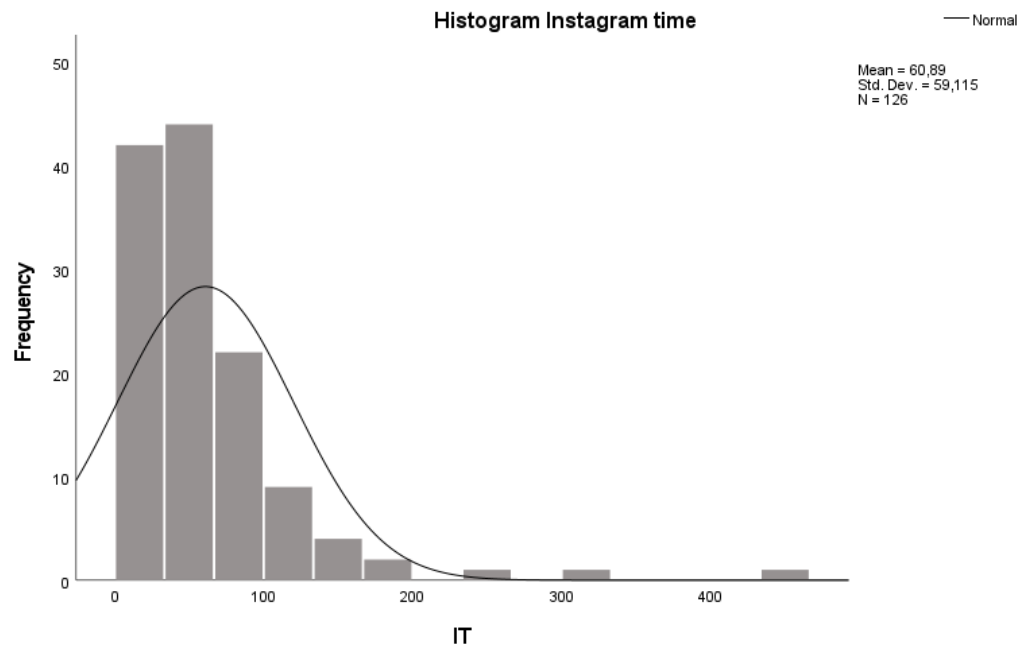
Note. SE = Standard Error.

Appendix E

Histogram and Q-Q plot for the variables mindfulness, depression and Instagram time

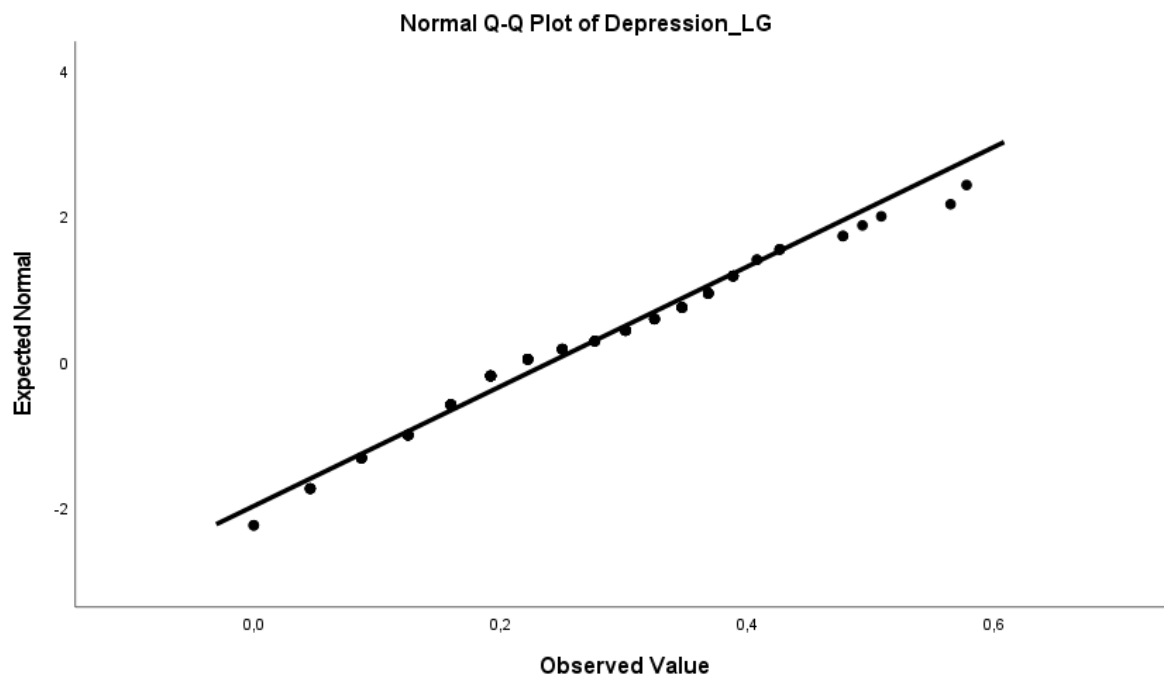
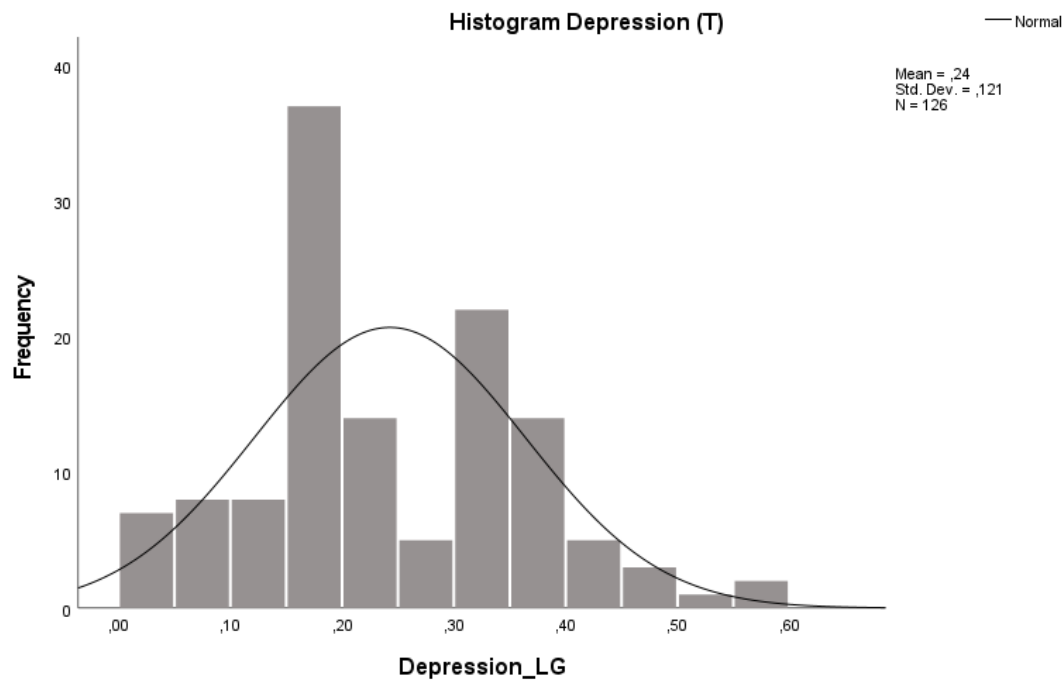






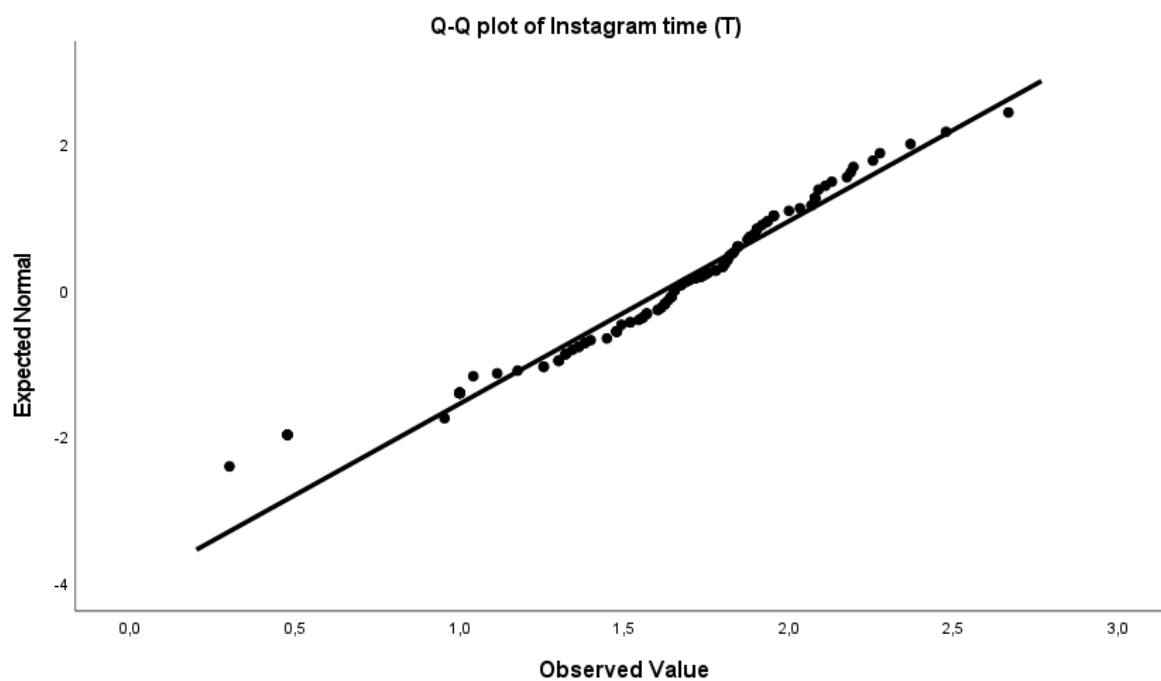
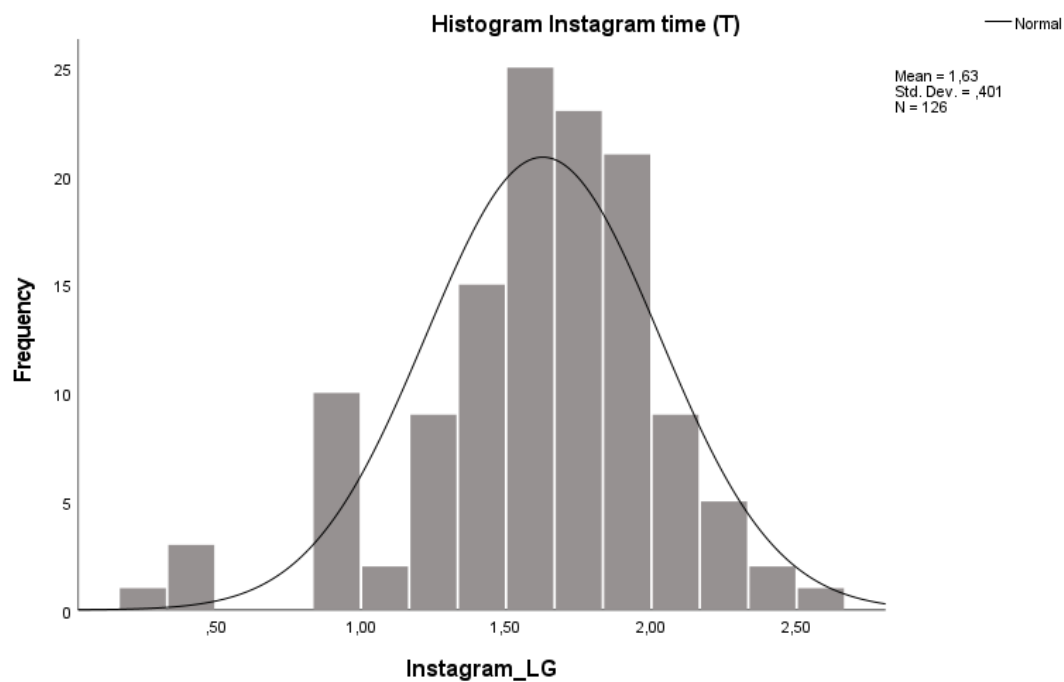
Appendix F

Histogram and Q-Q plot for transformed variable of Depression



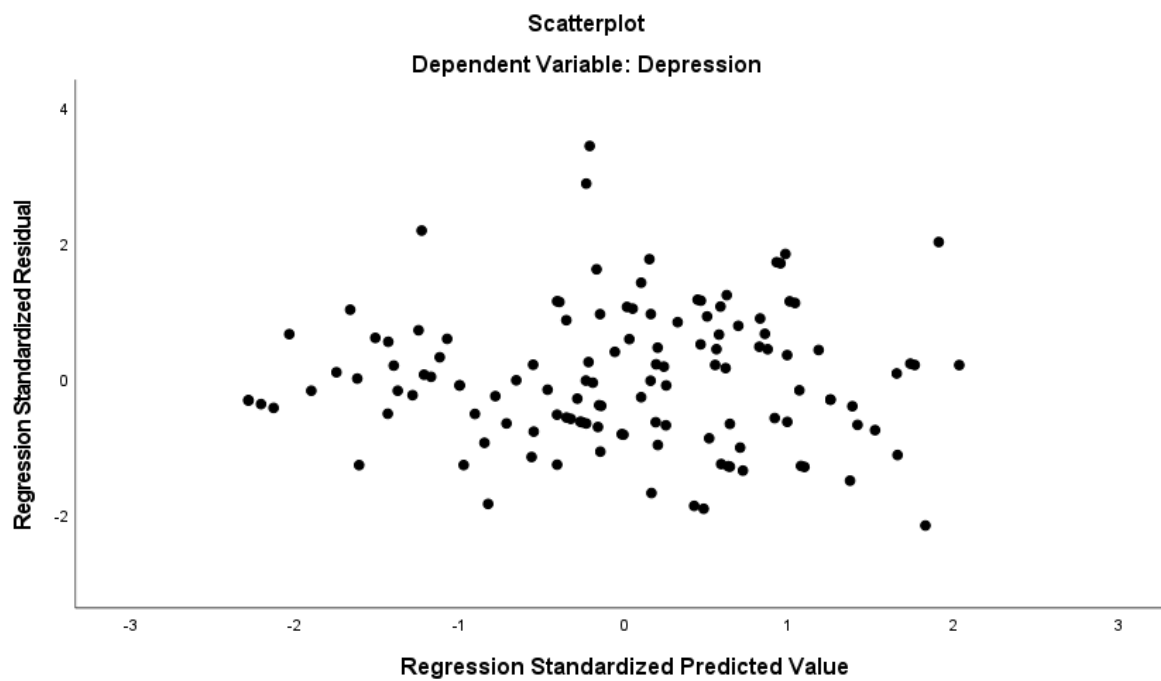
Appendix H

Histogram and Q-Q plot for the transformed variable of Instagram time



Appendix I

Assumption of homoscedasticity



Appendix J

Histogram and Q-Q plot of the normality of residuals

