

# Social Media Addiction: Applying the DEMATEL Approach

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## Abstract

While there is a growing number of studies investigating the determinants of social media addiction, there is a lack of research on examining the importance of such predictors and their inter-correlations and inter-dependences from psychotherapists' and researchers' point of views. Hence, utilizing the "Decision Making Trial and Evaluation Laboratory (DEMATEL)" technique, the current study investigated the clinical importance of social media addiction from the perspective of researchers and psychotherapists. Accordingly, by reviewing the literature 15 distal predictors of social media addiction were extracted and further classified into three groups of personality factors, comorbid symptoms, and psychosocial factors. From the data collected from 35 respondents, the results highlighted the group of personality factors as the most important dimension increasing the risk for developing social media addiction from the respondents' perspective. Moreover, the DEMATEL results revealed the predictors of openness to experience (personality dimension), loneliness (psychosocial), and depression (comorbid) as the most important predictors of social media addiction within each group. The results and implications of the study are discussed.

**Keywords:** Social media addiction; DEMATEL; Adolescent; Personality; Psychosocial; Comorbidity

## Introduction

While the term “Internet Addiction” was first introduced by Goldberg (1996), the psychiatrist Young (1996) registered this area of research under her name with the first report of Pathological Internet Use (PIU) observed in a forty-three years old householder with more than sixty hours of being online per week. Afterward, several researchers started to contribute to the body of knowledge by investigating various types of Internet Addiction (IA) and PIU disorders (e.g., Griffiths, 2000; Hardie and Tee, 2007; Jun and Choi, 2015; Kuss and Griffiths, 2015; Mitchell, 2000; Pantic *et al.*, 2017; Young, 1998). Regardless of the proliferation of studies in these areas, the status of PIU/IA is still unknown in the *Diagnostic and Statistical Manual of Mental Disorders (DSM)*. However, recently, DSM-5 included Internet Gaming Disorder (IGD) in its appendix under the section of “*conditions for further study*” which reflects the importance gained by experts for such addictive behaviors.

With the proliferation of social media tools in the recent decade, research has emerged assessing the possibility of excessive and addictive social media use (e.g., Blackwell *et al.*, 2017; Kircaburun and Griffiths, 2018; Kuss and Griffiths, 2017; Turel *et al.*, 2018). Furthermore, with the prevalence of mobile devices and the capability of accessing social media tools anytime anywhere, frequent usage has become the norm (Kuss, 2017), with some individuals overusing social media to the extent that addiction symptoms can be the consequence (Dhir *et al.*, 2018; van den Eijnden *et al.*, 2016). In the context of the present paper, social media addiction refers to social media use which causes significant impairment in an individual’s life to the extent that they are unable to control their behavior which in turn interferes significantly with everyday life tasks (Ryan *et al.*, 2014).

Research on social media addiction suggests that adolescents are more at risk of developing addiction symptoms as a consequence of their social media use (Kuss and Griffiths, 2017). Accordingly, a growing number of scholars study the predictors of social media addiction among younger generations to further understand the causes of their excessive use resulting in addiction symptoms (e.g., Dhir *et al.*, 2017; Jia *et al.*, 2017; Oberst *et al.*, 2017). While some scholars investigated the associations between social media addiction and personality traits (e.g., Błachnio *et al.*, 2017; Tang *et al.*, 2016), others assessed social media addiction using various theories and models such as *uses and gratification* motives (e.g., Kircaburun *et al.*, 2018), *fear of missing out* (e.g., Blackwell *et al.*, 2017), *life satisfaction* (e.g., Longstreet and Brooks, 2017), *self-esteem* (e.g., Błachnio *et al.*, 2016b), and *depression* (e.g., Donnelly and Kuss, 2016), among others. Such studies applied empirical analyses from the perspective of social media users, and specifically, young individuals, to understand to what extent these predictors affect addictive behaviors.

### 1.1 Statement of the problem and motivation

The growing volume of research on social media addiction suggests that such addictive behavior is a type of psychosocial disorder characterized by signs of withdrawal, emotional disturbances, and interruptions of social relationships. Therefore, considering the negative effects of Internet addiction, and to be specific social media addiction, on mental health and academic/job performance of individuals, the need for a comprehensive review of the influential factors is imperative and important.

According to the contemporary body of knowledge, there is a scarcity of studies exploring the determinants of social media addiction among adolescents from the perspective of the Internet

and social media addiction therapy experts and researchers. To be more specific, while there is a growing number of studies investigating the determinants of social media addiction, there is a lack of research on examining the importance of such predictors and their correlations and inter-dependences from psychotherapists' and researchers' points of views, as the ones familiar with the field. Kuss and Griffiths (2015) were the only researchers who conducted a qualitative study to explore Internet addiction treatment by interviewing twenty psychotherapists from six countries to further understand their individual experience of treating Internet addicts.

Utilizing the “*Decision Making Trial and Evaluation Laboratory (DEMATEL)*”, the present study attempts to assess the clinical importance of social media addiction from researchers and psychotherapist' point of views. The DEMATEL technique is useful in analyzing the cause and effect associations between the components of a system. The method investigates the contextual interrelationship between the factors under investigation to further solve the complicated problems in the system under investigation. The DEMATEL method not only reveals the relationships among the factors, but also it highlights the critical ones in the system (Zhang *et al.*, 2019). Capabilities of the DEMATEL method approach have resulted in its vast application in various research disciplines. However, to the best of our knowledge, there is no study in the literature applied this method in the context of social media addiction and its related predictors.

Hence, the present study aims to answer the following questions:

- (1) *What are the predictors of adolescents' social media addiction?*
- (2) *What are the associations between social media addiction and such predictors?*

Answering these questions can help understand and describe social media addiction more accurately through direct and indirect relationships between the determinants and can further help developing insights into the collective understanding of these relationships.

## **2 Literature Review**

### *2.1 Social media addiction*

As a result of the social media revolution, researchers have turned their attention to another type of addictive behavior, known as social media addiction (Kuss and Griffiths, 2011). Taken from the addiction paradigm, Andreassen and Pallesen (2014) defined social media addiction as being too worried about social networking sites, driven by a strong incentive to enter or use social networking sites, and devoting enormous time and effort to social networking sites that interfere with other social activities, studies/work, interpersonal relationships, or mental health and well-being.

This definition reflects the addiction criteria in previous studies (Griffiths, 2005). Researchers argue that addicts to social media often spend a lot of time thinking about such media and how they can spend more time to use these sites and applications (Salience). Often, they spend more time on such media than the initial intention, feeling that there is an urgent need for more and more use to achieve the same level of enjoyment (Tolerance). Usually, they use social media to reduce feelings of guilt, anxiety, restlessness, and depression, as well as to forget personal problems (Mood modifications). If using social media is prohibited, addicts are often distracted, restless, disturbed, or irritable, and feel uncomfortable if they cannot re-engage in social media (Withdrawal). They do not listen to the advice of others to reduce the time spent on social media. However, their action to cut off social networking activities fails. When they decide to use less social media than before, they fail to manage in this direction (Relapse). Social media addicts give

less priority to hobbies, studies/work, recreational activities, and sports, and ignore spouse, family members, and friends for social media activities (Conflict). Social media addicts often use such media excessively that have a negative impact on their health, sleep quality, relationships, and well-being (Problem).

## 2.2 *Background of the study*

In 2001, Davis introduced a cognitive-behavioral model for PIU distinguishing generalized and specific PIUs (Davis, 2001). Generalized PIU refers to the general overuse of the Internet such as spending too much time over the net without a clear objective. However, specific PIU reflects the dependency of an individual to a specific function of the Internet such as online gambling or social networking sites. From then on, several researchers started to investigate the factors influencing generalized PIU (e.g., Ha *et al.*, 2006; Hardie and Tee, 2007; Lam *et al.*, 2009; Song *et al.*, 2004) and specific PIU such as IGD (Hussain *et al.*, 2015; Tian *et al.*, 2018; Wichstrom *et al.*, 2019), gambling (Chóliz *et al.*, 2019; Sirola *et al.*, 2019), social media addiction (Kircaburun *et al.*, 2018; Liu and Ma, 2018; Turel *et al.*, 2018) and cybersex addiction (de Alarcón *et al.*, 2019; Fraumeni-McBride, 2019).

“Uses and Gratifications” theory has been vastly applied to investigate the factors affecting users of social media tools and applications (e.g., Balakrishnan and Shamim, 2013; Gruzd *et al.*, 2016; Kircaburun *et al.*, 2018; Quan-Haase and Young, 2010; Smock *et al.*, 2011). This theory seeks to understand the motives of using different types of media. Williams and Whiting (2013) in their study listed ten gratifications of using social media as “social interaction, information seeking, pass time, entertainment, relaxation, communicatory utility, convenience utility, expression of opinion, information sharing, and surveillance/knowledge about others”. In another study by Zolkepli *et al.* (2018), the authors classified the gratifications of social media utilization into three gratification groups of “personal”, “social” and “tension release”. They have concluded that social gratifications of “social influence” and “social interaction” were explaining the greater portion of utilization variance.

Brand *et al.* (2014) developed theoretical models of generic and specific Internet addiction. In their model of specific Internet addiction, they have highlighted that one’s core characteristics such as personality traits, demographics, needs, and specific predispositions are influencing her specific cognitions of Internet use. The cognitions are consequently leading to the use of a specific Internet application. The authors highlighted that such predispositions and cognitions are further satisfying some certain desires (i.e. gratifications) which would increase the frequent use of such applications, assumed as addictive behavior in general.

In an earlier model of PIU, Davis (2001) developed a theoretical model of PIU based on the diathesis-stress framework. The author argued “[...] psychopathology is a distal necessary cause of symptoms for PIU” (p. 190). To be more specific, symptoms of PIU occur if psychopathology is already present. The more proximal etiologies of PIU were recognized as maladaptive cognitions. Factors such as low self-esteem and low self-efficacy are necessary for the person to show PIU symptoms.

Brand *et al.* (2016) revised the specific Internet addiction model (Brand *et al.*, 2014) called Interaction of Person-Affect-Cognition-Execution (I-PACE) model to elicit more determinant of specific Internet addiction. According to their model, the most distal predictors of specific Internet addiction are person’s personality (e.g., impulsivity and low self-esteem), social cognitions (e.g., loneliness), psychopathology (e.g., depression), and specific motives (e.g., gambling or games).

Moving further through the model, once the situation is perceived subjectively and responded to affections and cognitions, the person would decide to use a specific application which to experience gratifications and pleasures.

From the previous studies, it can be concluded that scholars have investigated both distal and proximal determinants of specific Internet use disorder. However, for the current study, the focus is on more distal predictors, which are considered as root causes of addictive behavior (Brand *et al.*, 2014; Brand *et al.*, 2016; Young and Brand, 2017). In the following section more frequent cited predictors of social media addiction are retrieved from the literature and are further explained.

### 2.3 Predictors of social media addiction

**Fear of missing out (FOMO)** is defined as “a pervasive apprehension that others might be having rewarding experiences from which one is absent” (Przybylski *et al.*, 2013, p. 1841). It was found that there is a direct relationship between FOMO and greater engagement with Facebook (Przybylski *et al.*, 2013), problematic smartphone use (Wolniewicz *et al.*, 2018), social media addiction (Blackwell *et al.*, 2017) and online social media fatigue (Dhir *et al.*, 2018).

**Compulsive use behavior** is highlighted as another predictor of social media addiction and is defined as “an abnormality in controlling behavioral consumptions where an individual is unable to rationally manage his/her routine performances” (Dhir *et al.*, 2018, p. 143). Scholars have reported that compulsive use behavior directly predicts social media fatigue (Dhir *et al.*, 2018), social media addiction (Liu and Ma, 2018), and smartphone addiction (Lin *et al.*, 2017).

**Self-esteem** has been defined as “an evaluation of one’s self-concept, heavily dependent on reflected appraisals, social comparisons, and self-attributions” (Lemmens *et al.*, 2015). It was reported that there is a direct and negative correlation between self-esteem and Internet Gaming Disorder (Lemmens *et al.*, 2015), social media addiction (van den Eijnden *et al.*, 2016), and Internet addiction (Nie *et al.*, 2017). Specifically, people with lower levels of self-esteem appear to be more prone to addictive behaviors.

**Attention deficit** disorder is recognized as another determinant of social media addiction (Shaw and Black, 2008; van den Eijnden *et al.*, 2016) and refers to difficulties in inhibiting behavior, inattention and difficulty of staying focused on a specific task. Problematic online gamers show symptoms of attention deficit disorder in comparison to recreational gamers without gaming-related problems (Gentile *et al.*, 2011). Furthermore, in a study by van den Eijnden *et al.* (2016), the authors reported that there is a direct and positive correlation between attention deficit disorder and addiction to social media.

**Impulsivity**, which is recognized as an important risk factor for various addictive behaviors (Wu *et al.*, 2013), is considered as one of the predictors of social media addiction in the current study. Impulsive individuals tend to act on a whim and without forethought. For example, in a study conducted by Wu *et al.* (2013), the authors reported that impulsive individuals are more prone to visit social media via smartphones and hence experience addiction symptoms.

**Loneliness**, is defined as “an unpleasant experience that derives from important deficiencies in a person’s network of social relationships” (Lemmens *et al.*, 2015), and has been identified as an important factor impacting on one’s addiction to online gaming (Lemmens *et al.*, 2015), Facebook (Błachnio *et al.*, 2016a), Internet (Hardie and Tee, 2007), and social media use (van den Eijnden *et al.*, 2016).

**Personality traits** and their role in social media addiction have been explored vastly by several researchers (e.g., Błachnio *et al.*, 2017; Kuss *et al.*, 2013a; Kuss *et al.*, 2013b; Tang *et al.*,

2016). For example, Kircaburun and Griffiths (2018) reported that the personality traits agreeableness, conscientiousness, and neuroticism were associated with problematic use of social media among adolescents.

**Narcissism** was found to be positively related to the Internet and social media addiction (e.g., Andreassen *et al.*, 2016; Błachnio and Przepiórka, 2018; Pantic *et al.*, 2017). Regarding social media addiction, narcissistic individuals use social media to excess to obtain rewards in the form of “likes” and positive comments from their followers (Andreassen *et al.*, 2016).

**Life satisfaction**, defined as “cognitive assessment of a person’s subjective well-being” (Lemmens *et al.*, 2015, p. 3), and its relationship with social media addiction has seen mixed results depending on the respective age group that has been assessed. In a recent study conducted by Teo and Lee (2016), researchers reported that sharing information on social media is experienced as satisfying for younger adults, while the opposite was true for older adult users. In another study by Longstreet and Brooks (2017), the authors showed that the level of life satisfaction negatively correlated with Internet addiction and social media addiction, in that users with lower levels of life satisfaction tend to experience higher levels of Internet and social media addiction.

Several studies reported **depression** as one of the consequences of social media addiction. For example, Donnelly and Kuss (2016) showed that Instagram use and social media addiction were significant determinants of depression. However, other studies highlighted depression as an important predictor of social media addiction (e.g., Hong *et al.*, 2014; Koc and Gulyagci, 2013).

**Table 1:** Predictors of social media addiction

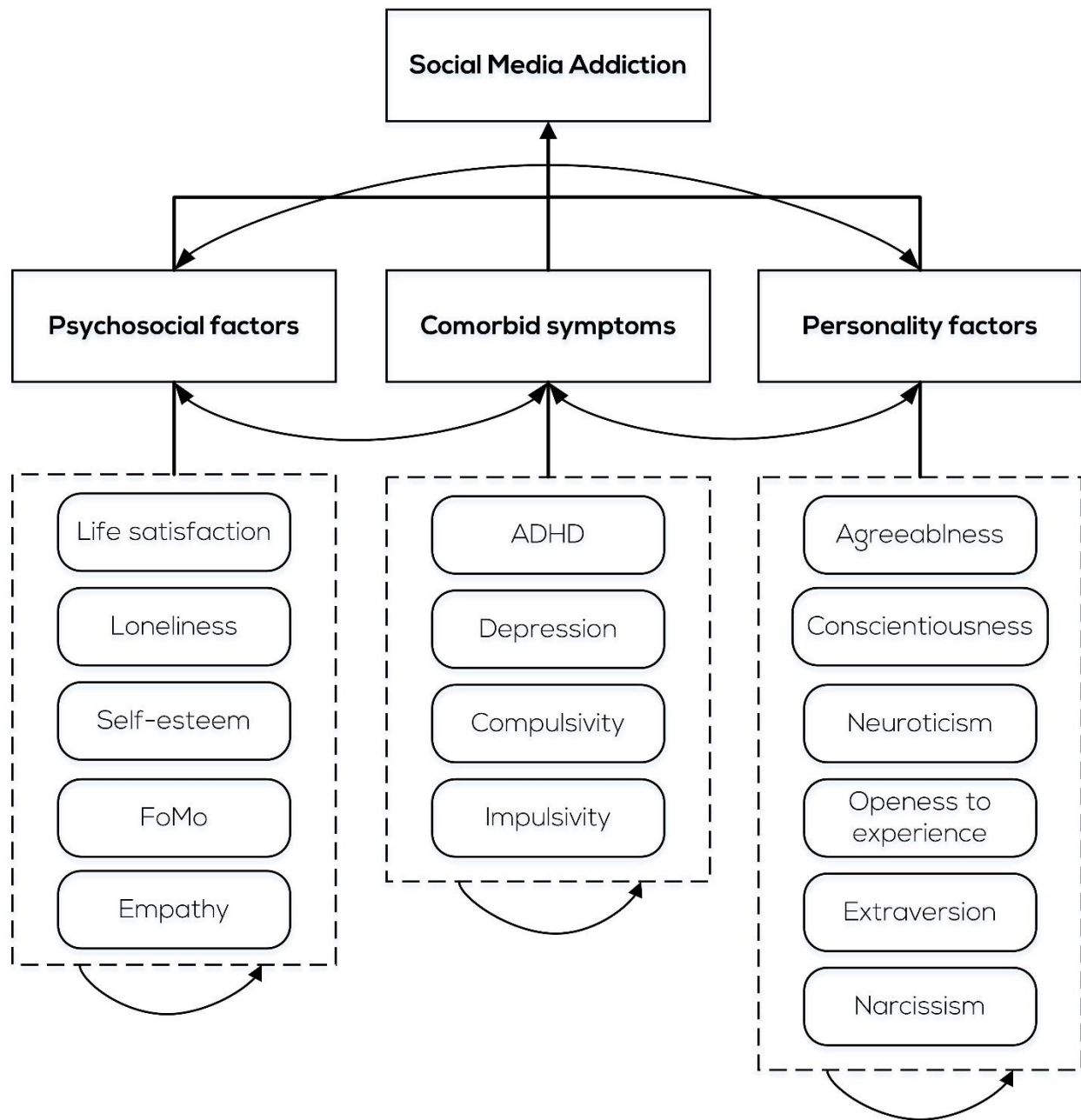
<b>Predictor</b>	<b>Addiction context</b>	<b>Source(s)</b>
Fear of missing out	Facebook, social media	Błachnio and Przepiórka (2018), Blackwell <i>et al.</i> (2017), Dhir <i>et al.</i> (2018)
Compulsive use	Social media	van den Eijnden <i>et al.</i> (2016), Dhir <i>et al.</i> (2018)
Self-esteem	Internet, Facebook, Social media	Pantic <i>et al.</i> (2017), Błachnio <i>et al.</i> (2016b), Błachnio and Przepiórka (2016), Andreassen <i>et al.</i> (2016)
Attention deficit	Social media	van den Eijnden <i>et al.</i> (2016)
Impulsivity	Social media	van den Eijnden <i>et al.</i> (2016)
Loneliness	Facebook, Social media	Błachnio <i>et al.</i> (2016a), Yu <i>et al.</i> (2016)
Personality traits	Internet, Facebook	Zhou <i>et al.</i> (2017), Jiang <i>et al.</i> (2017), Grammenos <i>et al.</i> (2017), Błachnio <i>et al.</i> (2017), Tang <i>et al.</i> (2016), Kayış <i>et al.</i> (2016), Błachnio and Przepiórka (2016), Sariyska <i>et al.</i> (2014)
Narcissism	Facebook, Internet, Social media	Błachnio and Przepiórka (2018), Pantic <i>et al.</i> (2017), Andreassen <i>et al.</i> (2016)
Life satisfaction	Facebook	Błachnio and Przepiórka (2018), Błachnio <i>et al.</i> (2016b), Błachnio and Przepiórka (2016), Satıcı and Uysal (2015)
Depression	Facebook	Błachnio <i>et al.</i> (2015)
Empathy	Internet, Smartphone	Jiaojiao <i>et al.</i> (2017), Lachmann <i>et al.</i> (2018)

Hong and Chiu (2014) reported that depression significantly determines Facebook usage patterns of university students and increases their addictive behavior.

**Empathy** has been recognized as an important factor in explaining one's psychological states (Jeong *et al.*, 2015). Few studies investigated the association between empathy and various technology addiction behaviors. For example, researchers reported that a lower level of empathy is positively associated with Internet and smartphone use disorders (Jiaojiao *et al.*, 2017; Lachmann *et al.*, 2018). Hence, in the current study, empathy is considered as an important determinant of social media addiction. Table 1 summarizes the predictors of social media addiction.

### **3 Research model using the DEMATEL format**

Following the study by Kuss *et al.* (2014), extracted determinants are grouped into three categories of “*psychosocial factors*”, “*comorbid symptoms*”, and “*personality factors*”. Internal characteristics of social media addiction, such as low life satisfaction, loneliness, low self-esteem, FoMo, and empathy, form the dimension of psychosocial factors. Psychopathological symptoms associated with social media addiction, such as attention deficit, depression, compulsivity, and impulsivity, were grouped under the dimension of comorbid symptoms. Finally, the dimension of personality factors are included in the personality traits of social media addicted persons, including as agreeableness, conscientiousness, neuroticism, openness to experience, extraversion, and



**Figure 1:** Research model in DEMATEL format

narcissism. According to the groups discussed, the research model of the study in the DEMATEL format is depicted in Figure 1.

## 4 Methodology

### 4.1 DEMATEL

In the early 1970s, Duval et al. (1974) developed a method called the “Decision Making Trial and Evaluation Laboratory (DEMATEL)” at the Battelle Memorial Institute of Geneva Research Centre. This method was initially developed to solve real-world complex problems by considering and analyzing several dimensions and several factors involving many stakeholders.



As a type of structural modeling method, DEMATEL is used to analyze and reveal the cause and effect association between the components of a system. The DEMATEL method is applied to analyze variables impacting a specific system and utilize experts' knowledge to better understand interrelations and inter-dependences between factors. The method not only converts the interdependencies of factors into cause-and-effect relationships but also determines the critical components of a system aided by impact relation diagrams.

To use the DEMATEL method, first the complex system should be defined, then factors (variables in the DEMATEL method) influencing the system should be identified. It is achieved by reviewing the literature or by using experts' opinions. In addition, a measurement scale should be developed to express the relationships and relationship strengths between these factors (Shen et al., 2011). A typical range of scales for this purpose is 0 to 4 denoting "no influence", "low influence", "medium influence", "high influence", and "very high influence", respectively. Respondents were asked to determine the impact of each predictor on the other each predictor of social media addiction.

According to Sumrit and Anuntavoranich (2013), researchers are advised to perform the following steps to apply the DEMATEL method:

**Step 1:** Gathering experts' opinions

The first step of the DEMATEL approach focuses on collating opinions of  $l$  experts  $E = \{E_1, E_2, \dots, E_l\}$  regarding the influence of factors  $F = \{F_1, F_2, \dots, F_n\}$  on each other using the aforementioned scaling system by creating a pair-wise comparison matrix. The  $k$ th expert provides an individual direct influence matrix  $Z_k = [z_{ij}^k]_{n \times n}$  with the zero-value of all principal diagonal elements,  $z_{ij}^k$  represents the opinion of an expert  $E_k$  regarding the degree to which the determinant  $F_i$  influences the determinant  $F_j$ .

**Step 2:** Compute Z: average matrix

The average matrix  $Z = [Z_{ij}]_{n \times n}$  is computed in order to integrate the opinions of  $l$  experts as follows:

$$z_{ij} = \frac{1}{l} \sum_{k=1}^l z_{ij}^k, \quad i, j = 1, 2, \dots, n \quad (1)$$

**Step 3:** Computing normalized influence matrix X

Upon the calculation of average matrix  $Z$ , the normalized matrix  $X = [x_{ij}]_{n \times n}$  is obtained using

$$X = \frac{Z}{s} \quad (2)$$

where,

$$s = \max \left( \max_{1 \leq i \leq n} \sum_{j=1}^n z_{ij}, \max_{1 \leq i \leq n} \sum_{i=1}^n z_{ij} \right) \quad (3)$$

**Step 4:** Computing total influence matrix T

Experts only estimated the direct influence of factors on each other. Hence, the total influence matrix  $T = [t_{ij}]_{n \times n}$  is obtained from matrix  $X$  by applying the transition theory and summing up all direct and indirect effects.

$$T = X + X^2 + X^3 + \dots + X^h = X(I - X)^{-1}, \quad \text{when } h \rightarrow \infty \quad (4)$$

where  $I$  denote the identity matrix.

**Step 5:** Obtaining the influence relation map (IRM)

At this step, vectors  $R$  and  $C$  are achieved by summing up the rows and columns of total relation matrix  $T$ .

$$\begin{aligned} R &= [r_i]_{n \times 1} = \left( \sum_{j=1}^n t_{ij} \right)_{n \times 1} \\ C &= [c_j]_{1 \times n} = \left( \sum_{i=1}^n t_{ij} \right)_{1 \times n} \end{aligned} \quad (5)$$

where  $r_i$  is the sum of the  $i$ th row of matrix  $T$  and represents all the direct and indirect effects which are dispatched from the determinant  $F_i$  to other determinants. Likewise,  $c_j$  is the sum of the  $j$ th column of matrix  $T$  and represents all the direct and indirect effects that the determinant  $F_j$  receives from the other determinants.

The roles played by the factors in the system are illustrated by a diagram with the horizontal axis ( $R + C$ ) and the vertical axis ( $R - C$ ). The degree of the central role (importance) played by the factor  $i$  in a system is represented by  $(r_i + c_i)$ , where  $(r_i - c_i)$  stands for the net effect (i.e. the degree of importance) of the factor  $i$  contributed to the system. The factors are categorized into two groups of cause (driver) and effect (receiver) factors. If the value of  $(r_i - c_i)$  is positive the factor  $F_i$  is grouped under the category of driver factors which has an influence on other factors; if the value of  $(r_i - c_i)$  is negative the factor  $F_j$  is grouped under the category of receiver factors which receives influence from other factors.

Finally, the IRM diagram, which provides valuable insights for decision-making, can be obtained by dataset mapping ( $R + C, R - C$ ). To refine insignificant effects, decision-makers should define a threshold value for the influence values. The IRM diagram becomes too complicated if the threshold value is too low, and if the value is too high many predictors remain independent without showing their relationship with other predictors. The predictors with influence levels higher than the threshold value in the matrix  $T$  are chosen to construct the IRM diagram.

#### 4.2 Sample and data collection

Data were collected from 35 individuals including researchers and psychotherapists who were familiar with the issues of Internet and social media addiction and were identified and selected according to their research and job profiles. In order to collect the required data, an appropriate questionnaire was developed fitting the requirements of the DEMATEL method. After validating the content of the developed questionnaire by three DEMATEL experts, the developed questionnaire together with a cover letter introducing the purpose of the study were emailed to the target respondents. They were asked to determine the degree to which a predictor influence (or is influenced by) other predictors. Figure 2 depicts a sample of the designed DEMATEL questionnaire.

Figure 2 shows that if FOMO has a strong direct influence on life satisfaction, as the predictors of social media addiction, then the score “3” is assigned to the related cell in the

	Life satisfaction	Loneliness	Self-esteem	FoMo	Empathy
Life satisfaction					
Loneliness					
Self-esteem					
FoMo					
Empathy					

Notes: 0: no influence; 1: weak direct influence; 2: moderate direct influence; 3: strong direct influence; 4: very strong direct influence

**Figure 2:** Example of the DEMATEL questionnaire

**Table 2:** Respondents' profile

	Frequency	Percent (%)
<b>Gender</b>		
Male	14	40
Female	21	60
<b>Expertise</b>		
Researcher	29	83
Psychotherapist	6	17
<b>Experience (year)</b>		
Less than 3	4	11
3 – 5	23	66
More than 5	8	23

**Table 3:** Reliability assessment of the DEMATEL questionnaires

Test	Cronbach's $\alpha$ ( $> 0.7$ )	Result
Dimensions' questionnaire	0.877	Reliable
Psychosocial factors questionnaire	0.901	Reliable
Comorbid symptoms questionnaire	0.922	Reliable
Personality factors questionnaire	0.898	Reliable

questionnaire. Conversely, if self-esteem moderately influences empathy, then the score “2” is given to represent this moderate direct relationship.

From the 35 respondents who participated in the current study, six (17 percent) were Internet and social media addiction therapists, and 29 (83 percent) were researchers in the fields of Internet addiction and social media addiction. Table 2 exhibits the profiles of respondents. To assess the reliability of the collected data, the Cronbach's  $\alpha$  criteria were applied and the results revealed that the questionnaire utilized to collect data for the DEMATEL method was reliable. Table 3 exhibits the reliability assessment of the designed questionnaire.

## 5 Data analysis and results

In the first stage of the analysis, we used the DEMATEL method following the described approach in Section 4 to find the interdependencies between the predictors of social media addiction. In fact, the DEMATEL technique was used to reveal the cause and effect groups and predictors in the proposed research framework. This stage of identifying the relationships was important as it may help reveal the relative importance of the predictors in each dimension (i.e., psychosocial factors, comorbid symptoms, personality factors).

Utilizing the specifically designed questionnaire (see Figure 2), data were collected and kept in the initial matrices with all dimensions and their indicators. Accordingly, the DEMATEL research method was used, firstly, to determine the level of importance of identified dimensions

**Table 4:** Normalized primary direct matrix for psychosocial factors, comorbid symptom, and personality factors

	Psychosocial factors	Comorbid symptom	Personality factors
Psychosocial factors	0	0.46	0.49
Comorbid symptom	0.36	0	0.51
Personality factors	0.44	0.36	0

**Table 5:** Total relation matrix for the dimensions of psychosocial factors, comorbid symptom, and personality factors

	Psychosocial factors	Comorbid symptom	Personality factors
Psychosocial factors	2.00	2.34	2.66
Comorbid symptom	2.14	1.90	2.53
Personality factors	2.08	2.06	2.07

**Table 6:** Net causer and net receiver dimensions

Factors	D	R	D+R	D-R
Psychosocial factors	7.00	6.22	13.22	0.78
Comorbid symptom	6.57	6.30	12.87	0.27
Personality factors	6.21	7.30	13.51	-1.09

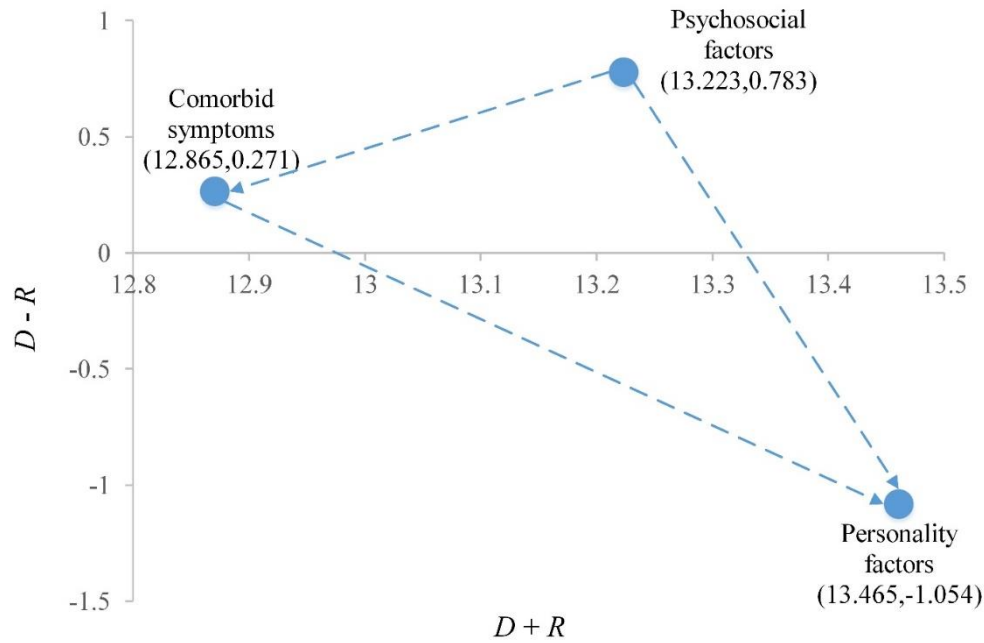
(i.e., psychosocial, comorbid symptoms, and personality factors), then, to prioritize the predictors of each dimension according to their level of importance level explaining social media addiction.

As described in Section 4 (steps 1 and 2), the average of the responses was calculated to form the initial average matrix  $Z = [Z_{ij}]_{n \times n}$ . Subsequently, the normalized primary direct matrix  $X = [x_{ij}]_{n \times n}$  was calculated (see Section 4, step 3). Table 4 presents the normalized direct matrix for the dimensions of psychosocial factors, comorbid symptoms, and personality factors.

Following the steps 4 and 5 described above (see Section 4), by calculating the normalized primary direct matrix, the total relation matrix  $T = [t_{ij}]_{n \times n}$  was obtained, which can provide the influence rate of each dimension (see Table 5). In addition, the DEMATEL method also identified the relative importance of the factors by calculating the vectors  $R$  and  $C$  (see Table 6). This table reveals that psychosocial factors and comorbid symptom are net causer dimensions ( $D - R > 0$ ) and the dimension of personality factors is a net receiver ( $D - R < 0$ ). Furthermore, the results revealed that, with respect to social media addiction, the most important dimension is the personality factors dimension ( $R + D = 13.47$ ) followed by the dimensions of psychosocial factors and comorbid symptom.

To define the threshold value we applied the approach suggested by Tamura *et al.* (2002) and use the value of 2.197 which is the average value of the elements of matrix  $T$ . Considering the defined threshold value, the significant relationships are depicted in Figure 3. The results clearly show that the dimension of psychosocial factors has significantly influenced the dimensions of comorbid symptoms and personality factors. In addition, it can be seen that the dimension of personality factors has received significant impacts from the dimensions of psychosocial factors and comorbid symptoms.

This procedure is also applied to the predictors of each dimension. The DEMATEL technique was applied to find the cause and effect factors and their relative importance according

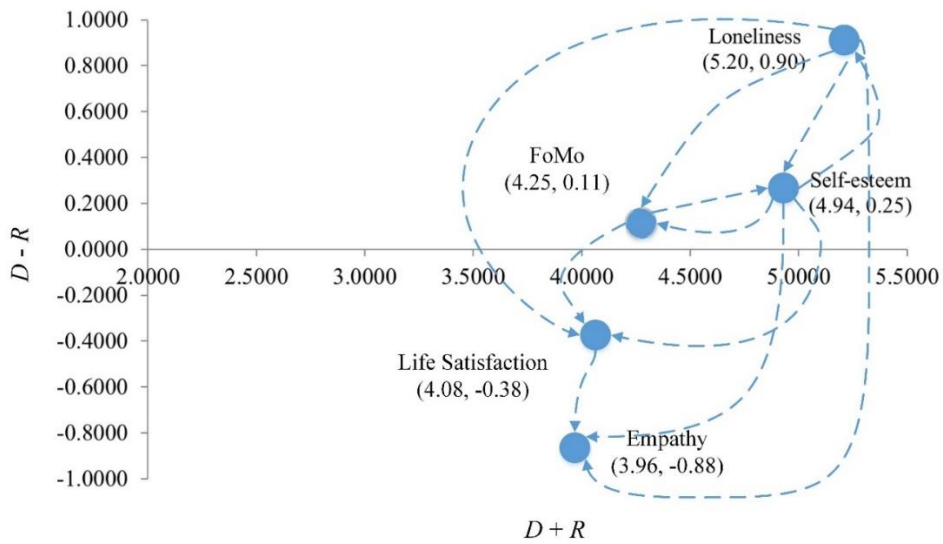


**Figure 3:** IRM diagram of the dimensions of psychosocial factors, comorbid symptom and personality factors with respect to social media addiction

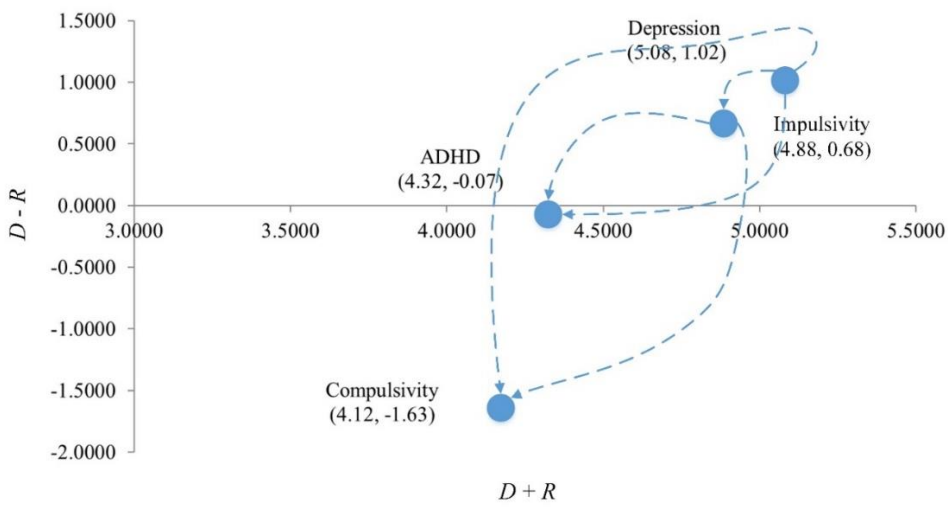
**Table 7:** Net causer and net receiver factors in psychosocial factors, comorbid symptom, and personality dimensions

Dimensions	Indicators	D	R	D+R	D-R
<b>Psychosocial factors</b>	FoMo	2.18	2.07	4.25	0.11
	Loneliness	3.05	2.15	5.20	0.90
	Self-esteem	2.60	2.35	4.94	0.25
	Empathy	1.54	2.42	3.96	-0.88
	Life Satisfaction	1.85	2.23	4.08	-0.38
<b>Comorbid symptoms</b>	ADHD	2.12	2.20	4.32	-0.07
	Depression	3.05	2.03	5.08	1.02
	Compulsivity	1.27	2.90	4.17	-1.63
	Impulsivity	2.78	2.10	4.88	0.68
<b>Personality factors</b>	Agreeableness	0.45	0.36	0.81	0.09
	Conscientiousness	0.19	0.46	0.65	-0.26
	Neuroticism	0.43	0.41	0.84	0.02
	Openness to experience	0.63	0.36	0.99	0.28
	Extraversion	0.26	0.44	0.70	-0.17
	Narcissism	0.48	0.43	0.92	0.05

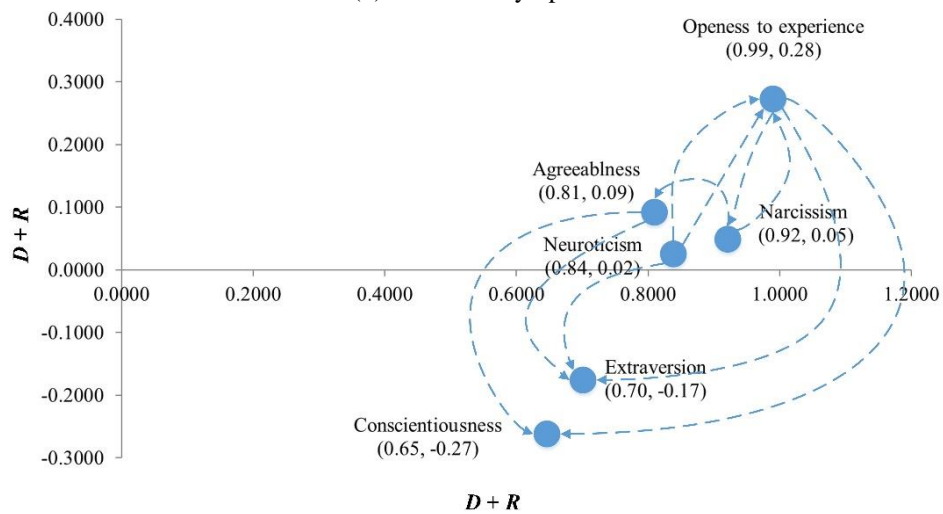
to the respondents' accounts. The results are presented in Table 7 which show that loneliness, openness to experience and depression are the most important predictors across the psychosocial, personality and comorbid symptom dimensions, respectively. The results further reveal that life satisfaction, empathy, compulsivity, conscientiousness, and extraversion are net receiver factors with negative values for  $D - R$ , and FoMo, loneliness, self-esteem, depression, impulsivity, narcissism, neuroticism and agreeableness are net causer factors, indicating these factors have a significant impact on the other factors for social media addiction.



(a) Psychosocial factors

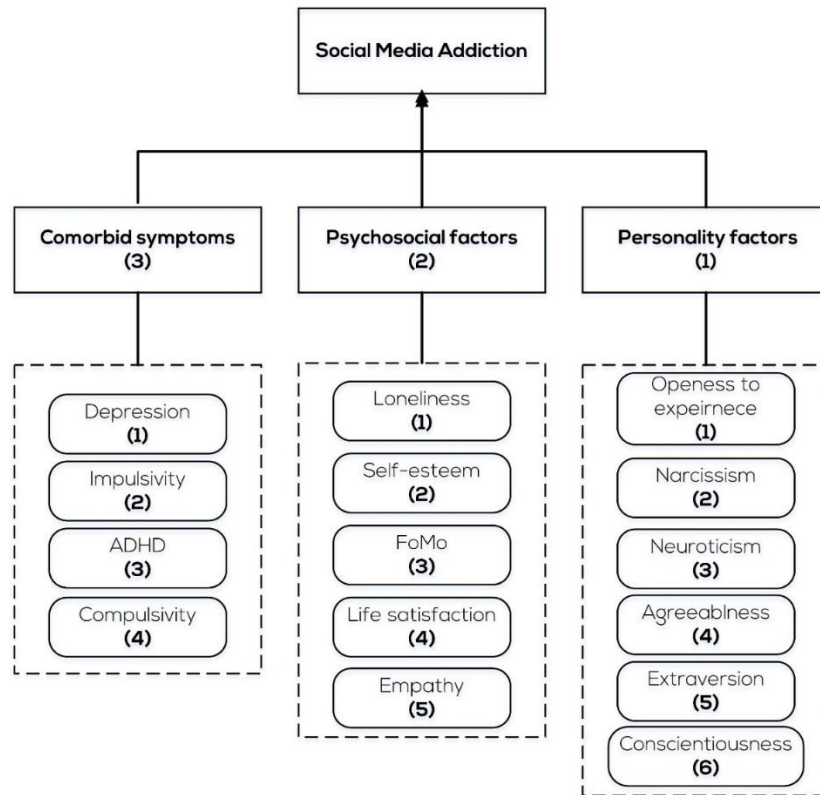


(b) Comorbid symptom



(c) Personality factors

**Figure 4:** The significant relationships between the predictors of social media addiction



**Figure 5:** Rankings according to the DEMATEL results

The significant relationships are presented in Figure 4. From the plots in Figure 4, the influence of specific factors on the others can be better understood. For example, as seen in Figure 4a, loneliness has influenced all other factors in the psychosocial dimension, which means psychosocial interventions for social media addiction should focus more on the loneliness which was recognized as the net cause predictor among the other predictors in the psychosocial factors dimension. In addition, from Figure 4b, it can be seen that compulsivity was impacted by depression and impulsivity factors. It means that to decrease compulsivity, interventions should focus on alleviating depression and impulsivity symptoms of social media addicts. The results in Figure 4c also reveal that conscientiousness and extraversion were impacted by the other factors, indicating that there were no impacts from these factors on agreeableness, neuroticism, openness to experience and narcissism.

According to the results provided above, it is concluded that from the three dimensions, personality factors are recognized as the most important dimension in explaining adolescents' social media addiction from the respondents' perspective. From the personality factors, the respondents identified traits of openness to experience and narcissism as the two most important ones predicting social media addiction. For psychosocial factors, as the second important dimension, the predictors loneliness and self-esteem were highlighted as the two most important ones. Finally, depression and impulsivity, as the determinants grouped under comorbid symptoms, were expressed as the first two important predictors. Figure 5 illustrates the final ranking of dimensions and related predictors of social media addiction based on the respondents' perspective.

## 6 Discussion and conclusion

The present study aimed to provide psychotherapists' and researchers' perspectives on the predictors of social media addiction based on the established research evidence. The impact of related constructs, including the fear of missing out, compulsive use, self-esteem, attention deficit disorder, impulsivity, loneliness, personality traits, narcissism, life satisfaction, depression and empathy were considered by 35 individuals familiar with the field, most of whom have professional experience of working with social media addiction in research and clinical contexts for more than three years. Based on a previously established framework (Kuss *et al.*, 2014), predictors were grouped into psychosocial factors, comorbid symptoms, and personality factors. To reveal the respondents' points of views, the DEMATEL method approach has been applied. The utilization of the DEMATEL method in the context of social media addiction has a number of advantages such as (1) analyzing the mutual influences between the predictors of social media addiction (both direct and indirect relationships) and understanding the cause and effect correlations in decision-making problems; (2) the ability to visualize the interrelationships between the predictors through the IRM diagram to assist decision-makers to further understand which predictors are impacting one another; and (3) the DEMATEL method helps not only to rank the predictors of social media addiction according to their level of importance, but also to identify the most critical dimensions and predictors of social media addiction.

In a recent study, Brand *et al.* (2016) developed an integrated model of Internet-related addictions and disorders called "Interaction of Person-Affect-Cognition-Execution (I-PACE)". The purpose of I-PACE model was to reveal that the addiction to a specific type of Internet application or site could be explained with one's core characteristics, predisposing factors, and some moderator or mediator variables (Kircaburun and Griffiths, 2018). For personality traits, the I-PACE model asserted that while consistent correlations among some personality traits and addiction has been found in the literature (e.g., Błachnio *et al.*, 2017; Kircaburun *et al.*, 2018; Kircaburun and Griffiths, 2018; Singh *et al.*, 2018), it is important to investigate such correlation and relationship for a specific type of Internet application. Consistent with the results of previous studies and following the recommendation of the I-PACE model, the current study investigated the importance of the correlation between personality traits and addiction in the context of social media.

The results indicate that personality factors were the strongest predictors across the three dimensions, especially openness to experience and narcissism. Openness to experience has previously been found to be associated with online gaming addiction in university students (Kuss *et al.*, 2013a), indicating the more open to experience participants were and the more time they spent engaged in online gaming, the higher their addiction scores were. Recent research on social media usage supported the link with openness to experience for women only (Correa *et al.*, 2010). Given social media are a relatively new application and women engage with it more frequently and possibly more problematically than men (Kanjo *et al.*, 2017), this result is not surprising. Females use social media for its social functions and to stay connected, which is a different usage motivation in comparison to that of males, who tend to play online games for competition and reward-related motivations, which is similarly evident in the clinical context (Kuss and Griffiths, 2015).

In terms of narcissism, previous research has indicated that individuals who score higher on narcissism scales appear to have a more pronounced presence on social media sites, and are



more likely to post selfies and engage in other activities on social media in order to gain interest and admiration from friends and followers on these websites, which has been linked to “grandiose exhibitionism” (Singh *et al.*, 2018). It appears narcissistic individuals use social media in order to satisfy their needs for recognition and esteem, which, if used to excess, may be predictive of compulsive and addictive use.

The results of the study also showed that the trait of neuroticism received great attention from the respondents participated in the current study. Neuroticism found to be positively related to problematic social media use (e.g., Blackwell *et al.*, 2017; Lachmann *et al.*, 2018; Tang *et al.*, 2016). Individuals with a high degree of neuroticism are more intend to use social media applications and sites such as Instagram or Facebook to further receive “[...] feedback and reassurance from others” (Blackwell *et al.*, 2017), or maybe they prefer such medium to communicate rather than the face-to-face one. In the study by Blackwell *et al.* (2017), the authors reported the mediated relationship between neuroticism and social media addiction, in that, the effect of neuroticism was stronger once mediated through the insecure attachment style.

For the psychosocial factors, as the second important dimension predicting social media addiction in the current study, the predictor's loneliness, self-esteem, and FOMO were highlighted as most important. Although increasing connection and the potential to interact via the online platforms, social media interactions miss the inherent ingredient of face-to-face interaction, namely that of limbic resonance (Lewis *et al.*, 2001), in essence, the idea of why I feel what you feel. Without the possibility to observe a conversation partner, there is no possibility of picking up on non-verbal cues transmitted via body language and facial expression, limiting the amount of social context cues (Sproull and Kiesler, 1986) and social presence (Rice and Love, 1987), with the possible consequence of loneliness despite connection.

Limited self-esteem, on the other hand, has previously been associated with the use of the photo-sharing site Instagram (Tiggemann and Zaccardo, 2015) due to increased social comparison and self-objectification (Ward *et al.*, 2018). This can lead to body image dissatisfaction and physical appearance anxiety (Sherlock and Wagstaff, 2018), and may contribute to feelings of depression (Donnelly and Kuss, 2016). The comparisons made on social media platforms such as Instagram are often unfavorable for the user, as many individuals with large numbers of followers (i.e., celebrities) tend to lead more luxurious and adventurous lives, to which the average user's life pales in comparison, with the effect of decreased self-esteem.

FOMO, the need to feel constantly connected online, has been coined recently (Przybylski *et al.*, 2013), and has been found to be a strong driver for social media use in previous research (Kuss and Griffiths, 2017). Recent research (Pontes *et al.*, 2018) indicates that FOMO, alongside irrational beliefs and poor mental health, is a strong predictor of social media addiction. Given that nowadays smartphone notifications serve as constant reminders of what is going on in our social media feeds (Kanjo *et al.*, 2017), FOMO can be driven, and result in addictive use.

Finally, depression, as one of the determinants grouped under comorbid symptoms, appeared as the most important predictor of social media addiction within this dimension in the present study. This replicates previous studies' findings that have indicated depression was strongly associated with social media use in a large sample of US young adults (Lin *et al.*, 2016) as well as a sample of Scottish adolescents (Woods and Scott, 2016), in which emotional investment contributed to the results. It appears that the extent to which users are invested in their social media accounts and the connections they have on those websites may be a contributing factor to feeling low and experiencing symptoms of depression.

## 7 Contributions

Implications of the current study are for both theory and practice. Altogether, the present study contributes to a growing body of knowledge within the field of excessive and addictive social media use and paves the way for additional research that may replicate and extend the findings by adding a qualitative element, which will allow experts to provide more detail on their professional experience with working with social media addiction, including risk and protective factors. In addition to this, research (Donnelly and Kuss, 2016) has previously pointed to the requirement of needing to distinguish between the use of different social media platforms, as the use of some was found to be associated with higher levels of depression and addiction symptoms; i.e., the excessive use of the video-sharing site Instagram appears as a more severe problem in comparison to other sites, such as Facebook, Twitter, and Snapchat.

Practically, the results of the study can help psychotherapists to prioritize their intervention plans and programs according to the reported importance of the predictors. Young (2013) developed a three-phase treatment model of Internet addiction called Cognitive Behavioral Therapy – Internet Addiction (CBT-IA). The results of the present study can be applied in the second phase of the CBT-IA, which focuses on recognizing and addressing maladaptive cognitions. During the treatment phase, a therapist can prioritize recognition approach according to the order of the predictors of social media addiction and further apply related interventions. In another study Young and Brand (2017) combined the CBT-IA therapy model and the I-PACE theoretical model to further guide experts through treatment of specific Internet addiction. Since the current study investigated more distal predictors of social media addiction, the retrieved results can be applied in first box of the proposed model that is person's core characteristics. To apply the harm reduction phase of CBT-IA to this section, psychotherapists can adjust their recognition and treatment programs in accordance with the importance level of predictors reported in this study.

## 8 Conclusion

Social media addiction is an unwelcome yet growing problem especially for young users of these kinds of websites. National reports (Griffiths *et al.*, 2018) indicate the need for more government-sponsored research as well as the need for shared responsibility on behalf of parents, educators, researchers, practitioners and the social media providers in terms of safeguarding users. Collaborative work is required to make social media a safe space to be enjoyed by all users. Although novel and insightful in its approach, the DEMATEL approach applied in the present study had a small number of limitations. This study relied on respondents' own views and experience with working with social media addiction, inevitably integrating a subjective element within the research. In addition to this, some of the researchers and clinicians involved in the study as participants have had less than three years' experience working with this problematic online behavior, which may have impacted knowledge and understanding of the problem at hand. Future replications of the study should ensure that breadth and depth of knowledge of and experience with social media addiction are confirmed through the length of experience, and professional qualifications. Future research will also benefit from the accounts of users who experience addiction-related symptoms as a consequence of their social media use, including the associated personality, comorbid and psychosocial factors, and the DEMATEL approach should be applied within this group.

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