Relationship between internet use and depression: Focus on physiological mood oscillations, social networking and online addictive behavior

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ABSTRACT

The aim of the research was to investigate the potential relationship between internet addiction and depression in adolescents. A cross-sectional observational study was conducted on a sample of 336 high school students in Belgrade, Serbia. Each student was given a questionnaire consisting of Center for Epidemiologic Studies of Depression Scale for Children (CES-DC), Young Internet Addiction Test (IAT) as well as general questions related to internet and social networking site (SNS) use. The results of our study indicate that internet use and level of internet addiction measured with IAT scale are positively correlated with depressive symptoms. No such relationship existed between the time spent on social networking sites and depression, as well as between depression symptoms and SNS-related activities such as the number of Facebook friends. Neither the time spent on SNSs nor SNS-related activities had significant effect on the observed relationship between level of internet addiction and depression.

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1. Introduction

With the development of information technology, over the past two decades, many new issues have emerged regarding the potential connection between internet use and certain mental health problems. Several studies have so far suggested that internet use in general, as well as certain specific online activities, such as social networking may be associated with feelings of loneliness, low self-esteem and depression.

In 1998, Kraut et al. published one of the first studies on the issue of internet and mental health, with the results indicating that online activities are related to the reduction of communication between family members, and increased symptoms of depression. According to the observation, which was named "internet paradox", internet as a social technology decreases social involvement of users as well as their psychological well-being (Kraut et al., 1998). This research was later extensively cited and discussed, and numerous other efforts have been made to confirm or deny the connection between internet and symptoms of depression (Jelenchick, Eickhoff, & Moreno, 2013; Kraut et al., 1998; Pantic,

2014b; Pantic et al., 2012). So far, most of the research has been done on normal, healthy subjects (children, adolescents, students, etc.), and there is no proof that online activities cause or are related to depression as a clinical entity. However, some authors did indicate that internet use is associated with dysphoric mood often within a physiological range, measured by conventional psychiatric scales (Jelenchick et al., 2013; Kraut et al., 1998; Pantic, 2014b; Pantic et al., 2012).

During the last 10 years, with the creation and popularity of social networking, profound changes have been introduced in the way people communicate and interact in an online environment. Social networking sites (SNSs) today have more than one billion active users and many experts estimate that this number will further increase in the future. Recently, a number of authors have expressed concern that internet use in general, social networking, or at least certain online activities done on SNSs, might be related to mood disorders although there have been several conflicting reports on this issue (Gonzales & Hancock, 2011; Stieger & Burger, 2010; Tucker, 2010; Yao, He, Ko, & Pang, 2014; Zhang et al., 2012). For example, in 2012, Pantic et al. published a study on social networking and depression in adolescents in which the authors stated that the time spent on Facebook and other SNS platforms is positively related to depression symptoms quantified by

Beck depression inventory (Pantic et al., 2012). It was estimated that interpersonal connections made on SNSs may lack the necessary quality when compared to conventional, "face-to-face" communication between individuals.

Another reason why in scientific literature social networking is often connected with depression, is the assumption that an internet user often perceives his SNS "friends" as being happier and more successful. In computer-mediated communication, and especially in social networking setting, people tend to exaggerate their personal, professional and other qualities while at the same time concealing their potential faults. According to Chou and Edge this may be one of the factors affecting mood in online users (Chou & Edge, 2012). Mehdizadeh (2010) additionally point the possible negative impact of computer mediated communication on self-esteem, possibly associated with increased narcissistic conduct (Mehdizadeh, 2010).

The time average internet user spends on various online activities has recently increased so much that many authors today use the term "internet addiction" in order to describe similarities between compulsive internet behavior and certain elements of substance dependence (Cash, Rae, Steel, & Winkler, 2012; Fioravanti, Dettore, & Casale, 2012; Lee, Han, Kim, & Renshaw, 2013; Pramanik, Sherpa, & Shrestha, 2012; Rodgers, Melioli, Laconi, Bui, & Chabrol, 2013). Despite numerous studies on the issue of internet and social networking addiction, these conditions are not officially recognized as mental disorders according to the DSM and other classification and diagnostic tools. Nevertheless, most authors agree that internet addiction may be a serious public health concern which may have detrimental effects on overall psychological well-being (Akin, 2012; Alavi et al., 2012; Fioravanti et al., 2012; Pramanik et al., 2012; Smahel, Brown, & Blinka, 2012; Tonioni et al., 2012).

In our study, on a population of high school students, we tested the relationship between level of internet addiction and depressive symptoms using the established psychiatric scales. Based on the previously published data the research was done based on two hypotheses:

1. There is a statistically significant positive correlation between internet use and depression, or, in other words, depression level increases as the internet use increases and vice versa.
2. Time spent on social networking is positively correlated with level of depression and significantly impacts the above mentioned relationship.

2. Methods

A cross-sectional observational study was conducted in 2014 on a sample of 336 students (average age 18 years, 116 males and 222 females) from central Belgrade High School, Serbia. All participants, as well as the teaching supervisors had previously been informed about the details of the study and agreed to participate. Each student was given a questionnaire consisting of Center for Epidemiologic Studies of Depression Scale for Children, Young Internet Addiction Test as well as general questions related to internet and social networking use.

Center for Epidemiologic Studies of Depression Scale for Children (CES-DC) is a 20 statement self-report test, today commonly used for quantification of depression symptoms in children and adolescents. The CES-DC inventory is thought to have the especially high reliability and validity for the age groups between 12 and 18 years (Fendrich, Weissman, & Warner, 1990). In CES-DC scoring system, each statement has 4 possible answers: "Not At All", "A Little", "Some", "A Lot" based on which, the points are added in order to calculate the final score which can range between 0 and 60. Higher CES-DC score indicates a higher

depression level (Faulstich, Carey, Ruggiero, Enyart, & Gresham, 1986; Olsson & von Knorring, 1997).

Young Internet Addiction Test, designed by Dr. Kimberly Young is a 20 item inventory that is a reliable quantification of internet use and internet-related addictive behavior (Faraci, Craparo, Messina, & Severino, 2013; Jelenchick, Becker, & Moreno, 2012). It consists of questions related to compulsive internet use, effects of internet on offline activities and responsibilities (school grades, overall performance and productivity, relationships with other people, etc.). Each question is answered using the following scale: 0-Does not apply; 1-Rarely; 2-Occasionally; 3-Frequently; 4-Often; 5-Always. The higher final score indicates greater use of internet and potential addiction. The range of scores for the Young Addiction test is from 20 to 100 points. The score above 50 points indicates that internet use is causing significant problems in normal social functioning of an individual (Young, 2014). For details regarding IAT and CES-DC questionnaires and protocols, the reader is referred to previously published works (Faulstich et al., 1986; Olsson & von Knorring, 1997; Yao et al., 2014; Young, 1999, 2014).

Apart from completing Internet Addiction Test (IAT) and CES-DC, the participants were also asked questions about the average time spent on social networking, number of friends on their Facebook accounts as well as the number of self-portrait photographs posted on their Facebook account (if any). The data was collected and analyzed blindly. Statistical analysis was done using SPSS statistical software (SPSS, Chicago, IL). Multivariate regression analysis was used for determining the relationship between the variables. P value less than 0.05 was considered statistically significant.

3. Results

Average values of CES-DC and IAT scores in the study sample were 18.45 ± 9.16 (males 16.22 ± 8.09, females 19.91 ± 9.93, $p < 0.01$) and 24.74 ± 17.33 (males 24.40 ± 14.46, females 24.78 ± 18.68, $p > 0.05$), respectively. There was a statistically highly significant positive correlation between these two scores ($r = +0.27$, $p < 0.001$). This relationship implies that as the level of internet addiction increased, depressive symptoms also increased and vice versa. The results of the two inventories for each participant are plotted in Fig. 1. When the data were analyzed for males and females separately, the correlation was present in both subsamples, although in females it was much stronger ($r = +0.17$ and $r = +0.30$, respectively). Gender as a confounding factor did not significantly influence the overall relationship between CES-DC and IAT scores, or CES-DC and time spent on social networking activities. Age of participant, being relatively homogenous with standard deviation of only 0.83 years, also did not significantly impact the tested correlations.
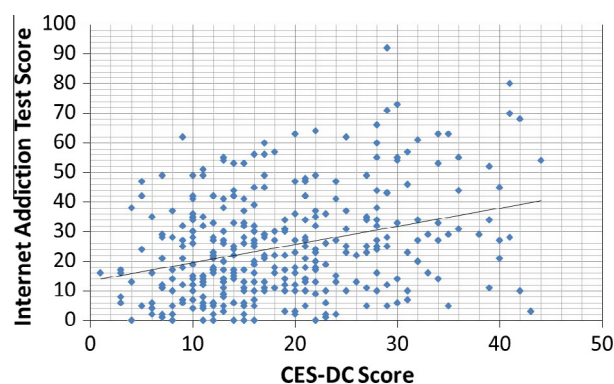

Fig. 1. The plotted data for CES-DC and IAT scores. Statistically significant ($p < 0.0001$) positive correlation was observed between the two variables. The central regression line represents possible linear relationship.