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Examining how online risk exposure and online social capital influence adolescent psychological stress

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ABSTRACT

The present study applies a social ecological framework of adolescent resilience to examine how online risk exposure (e.g., online harassment and sexual solicitations) and online social capital (i.e., resources and support garnered from one's community) influence psychological stress on adolescents. We conducted a web-based survey of adolescents (aged 13 to 17) in the United States, and found that exposure to online risks helped explain the association between Internet usage and adolescent psychological stress. Contrary to our hypotheses, online social capital moderated the relationship between online risk exposure and psychological stress in unanticipated ways. Instead of playing a protective role by reducing stress, high levels of online social capital strengthened the relationship between risk exposure and psychological stress. This suggests that adolescents who rely heavily on the formation of social capital online may be more vulnerable to psychological stress resulting from online risk exposure than adolescents who do not garner social capital from online environments. Our study is the first to identify online social capital as a potential risk factor in relation to Internet use and online risk exposure for adolescents. We discuss the implications of our findings for researchers, educators, parents and adolescents.

1. Introduction

Networked technology is an ever-present force in the lives of nearly all adolescents in the United States. According to Pew Research, 95% of adolescents have access to smartphones, 89% go online multiple times a day, with 45% reporting near-constant connectivity (Anderson & Jiang, 2018). Additionally, 71% of adolescents use more than one social media platform (Lenhart, 2015a), and 57% have met new friends online (Lenhart, 2015b). Given the high Internet usage among adolescents, the positive and negative outcomes of being connected are heavily debated within the literature. The Internet offers new and unprecedented opportunities to adolescents (Livingstone & Helsper, 2010), but it also amplifies the potential risks associated with unmediated access to online information and people (Gamez-Guadix et al., 2016). Even adolescents are ambivalent about the effect the Internet and social media have had on their lives. According to Pew Research, 31% of adolescents think

social media has a mostly positive effect by helping them connect with family and friends, 45% are neutral, and nearly a quarter of adolescents (24%) feel that social media has had a mostly negative impact on their lives due to increased bullying, social comparisons, interpersonal drama, a lack of personal closeness, and its propensity to contribute to mental health issues (Anderson & Jiang, 2018).

Prior work has highlighted several positive aspects of Internet usage in terms of entertainment value (Borca et al., 2015), cognitive growth (Valkenburg & Peter, 2011), and socio-emotional development (Antheunis et al., 2016; Best et al., 2014). Adolescents benefit from online interactions that allow them to explore their self-identities, seek social support, and search for new information (Livingstone & Helsper, 2010; Shapiro & Margolin, 2014). The benefits afforded to adolescents through the Internet can be considered a form of *social capital* (Ellison et al., 2007), which Putnam (1993) defined as connections among individuals that facilitate support, resources, and/or actions to the mutual

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benefit of the community members. Thus, our study focuses on the antecedents and outcomes of online social capital, or the formation of social capital via the Internet (Ellison et al., 2007).

Increased time spent online has been associated with the formation of social capital (Ellison et al., 2007), but has also been associated with increased exposure to online risks (Livingstone & Helsper, 2010; Wisniewski et al., 2015). The Crimes against Children Research Center reports that one in four youth in the U.S. have experienced unwanted exposure to Internet pornography, one in nine have been victims of online harassment, and one in eleven report receiving unwanted sexual solicitations online (Jones et al., 2012). Meanwhile, research has also shown that excessive use of the Internet and increased exposure to online risks are linked to higher levels of psychological stress (Sampasa-Kanyinga & Lewis, 2015; Seabrook et al., 2016; Wisniewski et al., 2015). *Psychological stress* is the experience of negative feelings arising from one's life experiences or thoughts that make a person feel frustrated, angry or nervous (Houston, 1987, pp. 373–399). Given the mixed positive and negative effects that have been associated with frequent use of the Internet among adolescents, we aim to study the relationships between Internet usage, online social capital, online risk exposure, and psychological stress for adolescents.

1.1. Purpose of the study

In this study, we built upon Wisniewski et al.'s (2015) prior work, which found that resilience plays a protective role (i.e., moderating) in mitigating adolescent psychological stress, even when adolescents are highly addicted to the Internet and exposed to online risks (e.g., online harassment, sexual solicitations, exposure to explicit content). Yet, relatively little is known about the other risk and/or protective factors that mediate (i.e., “the means by which”) and/or moderate (i.e., “under what conditions?”) the relationship between adolescent psychological stress and Internet use. Therefore, we extend their work in the following ways: 1) Instead of focusing on Internet addiction, we examine general Internet usage more broadly. We define “online” as using any Internet-enabled device such as smartphones or tablets to browse the web, communicate with others using a variety of social media, send emails, or use applications (“apps”) that are connected through the web. 2) We examine online social capital, or the formation of resources and relations based on trust and mutual benefits throughout online networks and social connections (Putnam, 1993), as a new factor that potentially influences adolescent stress outcomes. 3) We are using a theoretically grounded approach by applying the social ecological perspective of adolescent resilience (Ungar et al., 2013) to guide our research.

1.2. Theoretical foundations: A social ecological perspective on Adolescent resilience

Adolescent resilience theory is a strength-based approach developed to explain divergent outcomes related to various adolescent risk behaviors, including substance abuse, violent behavior, and sexual promiscuity (Fergus & Zimmerman, 2005; Zimmerman, 2013). Resilience refers to an adolescent's ability to thrive despite significant adversity, and occurs in the interaction between the individual and the environment (Zimmerman, 2013). The social ecological perspective of resilience acknowledges the nested social systems (e.g., individual, family, peer, school, and community) in which adolescents are embedded (Benard, 1991), and that contribute to the proximal processes that facilitate their well-being under stressful circumstances (Ungar et al., 2013).

From a socioecological perspective, Bronfenbrenner (1986) theorized that individuals are affected by multiple overlapping systems. These systems include microsystems (e.g., family), mesosystems (e.g., interrelationship between two or more microsystems), exosystems (e.g., neighborhoods) and macrosystems (e.g., cultural beliefs). In addition to these systems, Johnson and Ptoplampu (2008) proposed technosystems as a new component to Bronfenbrenner's (1986) social ecological

model. According to them, an individual is linked to these other systems through technosystems, such as the Internet, smartphones, and social media (Johnson, 2010). Johnson and Ptoplampu (2008) used this extended framework to understand the developmental consequences of child Internet use as a function of home and school characteristics (i.e., microsystems) and technology use (e.g., email and instant messaging). Similarly, we frame the Internet as a technosystem that may facilitate the formation of online social capital between the other ecosystems that support youth. However, we also acknowledge that Internet usage may facilitate exposure to online risks, such as online harassment and unwanted sexual solicitations (Pinter et al., 2017). Therefore, our study examines adolescent psychological stress outcomes in relation to these two opposing forces (i.e., online risk exposure and online social capital formation) arising from adolescent use of the Internet.

2. Research framework

Our research framework applies the social ecological perspective of adolescent resilience to understand the roles that Internet usage, online social capital, and online risk exposure may have in influencing adolescent psychological stress. Our research framework is presented in Fig. 1.

2.1. Psychological stress

Psychological stress refers to a person-environment relationship that can be characterized as draining or surpassing an individual's resources to the point that it threatens their mental health (Lazarus & Folkman, 1984). The importance of studying psychological stress among adolescents in relationship to their technology usage is well recognized. A large group of scholars have linked spending too much time online with psychological stress (Canale et al., 2019; Feng et al., 2019; Gu, 2020; Heffer et al., 2019; Liu et al., 2019; Sampasa-Kanyinga & Lewis, 2015; Seabrook et al., 2016; Steele et al., 2019). Given recent evidence showing the impact of stressful life events on mental health issues, including depression and anxiety (Anyan et al., 2018; Chaby et al., 2015; Ghobadzadeh et al., 2019), we feel the prevalence of which psychological stress has been studied in prior literature is an important variable to be modeled.

2.2. Internet Usage

As noted, we have conceptualized the Internet as a part of the technosystem that affects adolescents' development. As such, Internet usage is defined here as any “online” activity, including but not limited to browsing the web, playing online games, or using smartphones, social media, or web-based apps (Kaplan & Haenlein, 2010). We purposely focused on general or overall Internet use, rather than problematic usage, to avoid the tautology that problematic Internet usage leads to negative outcomes. Indeed, the direct relationship between Internet use and adolescent psychological stress has received significant attention in the literature (Anderson et al., 2017; Merrill & Liang, 2019; Twenge et al., 2018). In addition, multiple scholars have shown that spending excessive amounts of time online can be a source of social pressure for adolescents (Allen et al., 2014; Dhoest et al., 2017), which can translate into higher levels of psychological stress (Kuss et al., 2014; Müller et al., 2018; Steers et al., 2014).

2.3. Online risk exposure

In this study, online risk exposure is framed as the culmination of an adolescent's negative online risk experiences, including information breaches, online harassment, sexual solicitations, and exposure to explicit content (Wisniewski et al., 2015). In recent years, many studies have examined the association between problematic Internet use (Lenhart et al., 2010; Livingstone et al., 2014), online risk exposure (Fogel &

Theoretical Model of Adolescent Online Social Capital and Online Risk Exposure

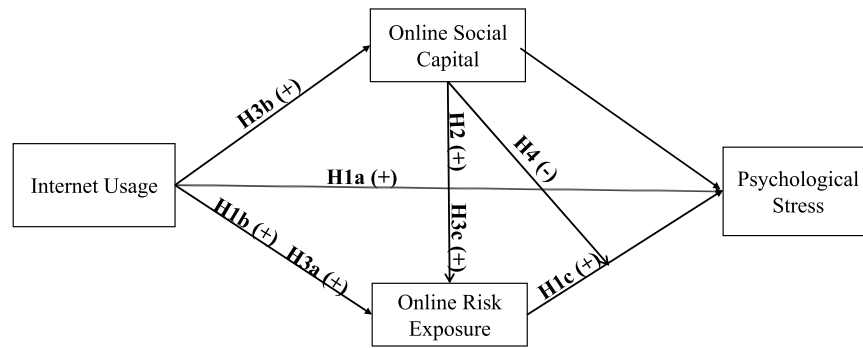


Fig. 1. Theoretical modal of adolescent online social capital and online risk exposure.

Nehmad, 2009; Livingstone & Smith, 2014) and negative emotional distress (; Müller et al., 2018; Van Den Eijnden et al., 2008). These studies found direct links between Internet addiction, online risk exposure and psychological symptoms related to stress (e.g., Livingstone et al., 2012). Meanwhile, Wisniewski et al. (2015) found that online risk exposure partially explains (or mediates) the relationships between Internet addiction and the negative affect of stress. We are interested in understanding whether general Internet use, rather than addictive use, has a similar relationship with psychological stress. Therefore, the current study replicates and extends the findings from Wisniewski et al. (2015), with the expectation that increased Internet usage also exposes adolescents to more risks online. This will further clarify the relationship between Internet usage and psychological stress. We hypothesize that online risk exposure mediates the relationship between Internet usage and psychological stress. This mediation hypothesis is represented in Fig. 1 by H1a, H1b, and H1c.

2.4. Online social capital

Social capital refers to “features of social organization such as networks, norms, and trust that facilitate action and cooperation for mutual benefit” (Putnam, 1993, p. 35). By extending Putnam’s explanation to online social settings, we define online social capital as resources that adolescents garner as they engage with others through the Internet. Research suggests that Internet usage may increase online social capital, but that it may also expose adolescents to more risks (Shahid, 2015). Trepte, Dienlin, and Reinecke’s (2013) findings showed that adolescents with a high level of social capital online might benefit from having a large number of people or groups to provide support or access to shared information. However, they also show that those with a high level of online social capital were exposed to more online risks that may lead adolescents to feel stressed. Similarly, Kaakinen et al. (2018) found that online social capital was linked to hate-oriented behaviors, which could be considered a form of online risk exposure. Therefore, even though online social capital is often considered an asset which adolescents gather through developing new interpersonal relationships online, these relationships may also involve negative experiences (Allen et al., 2014). Given this trade-off, we propose that online social capital is positively associated with online risk exposure (H2 in Fig. 1).

From a social ecological perspective of adolescent resilience (Ungar et al., 2013), however, the formation of online social capital might also mitigate the negative effects of online risk exposure. Online social capital is a social resource, where adolescents can share knowledge (Zhao et al., 2012), disclose personal information (Chen & Beaudoin, 2016), feel connected to a community (Hsiao & Chiou, 2012), and receive support that helps their wellbeing (Magsamen-Conrad & Greene, 2014). Thus, online social capital may play a protective role when adolescents encounter online risks. For example, adolescents who have strong networks might bolster support from their friends in a way that helps them

overcome negative experiences associated with cyberbullying (Brody & Vangelisti, 2016).

Based on such conflicting literature, the potential mediating and/or moderating role of online social capital in relation to Internet usage, online risk exposure, and psychological stress remains unclear. Therefore, we first propose that online social capital may help explain (i.e., mediate) the relationship between Internet use and psychological stress. We expect that adolescents who use the Internet frequently may be exposed to more online risks as they attempt to build social capital online. As such, online social capital will mediate the relationship between Internet use and online risk exposure (H3a, H3b, and H3c).

On the other hand, there is a need to examine how online social capital influences psychological outcomes of stress when adolescents are exposed to low and high levels of online risk. One pertinent area of inquiry is the extent to which online social capital operates as a protective factor in the relationship between online risk exposure and psychological stress. To this end, we propose that the formation of online social capital may alternatively help insulate adolescents who are exposed to online risk from experiencing psychological stress. More specifically, we hypothesize that online social capital moderates the relationship between online risk exposure and psychological stress by reducing the effect of online risk exposure on psychological stress (H4).

3. Method

3.1. Participants

A web-based, self-report questionnaire was used to collect data from 215 adolescents (56% female) and their parent or legal guardian. Data was collected from across the United States. A Qualtrics panel was used to recruit participants who met the following inclusion criteria: 1) A parent or legal guardian participated in the study with their children, 2) the adolescent was between the ages of 13–17, and 3) both participants resided in the United States at the time of participation. While the research team was not directly involved in recruitment, Qualtrics used soft quotas to recruit a diverse and nationally representative sample of participants by region. This research study was approved by a post-secondary institutional ethics board. Adolescents participated in the questionnaire after providing their parent’s or legal guardian’s consent and their own assent. After the parents completed their surveys, adolescents were asked to complete their questionnaire. The current study only analyzed the data collected from adolescents. Table 1 shows participants’ demographics.

The sample was mostly female (56%) and the age distribution of adolescents ranged between thirteen and seventeen years old. Most participants (68%) were Caucasian, 13% were African-American, 13% were Hispanic, 2% were Asian, and 4% reported being of “Native Hawaiian or other Pacific Islander,” “American Indian/Alaska Native,” and “other” descent. Of 215 participants, 95% reported being online every

Table 1
Demographics of Study Sample (N = 215) in terms of Gender, Age, Race and Usage of Internet.

Factor	Total sample
Gender	
Male	44%
Female	56%
Age	
13-years old	27%
14-years old	17%
15-years old	19%
16-years old	25%
17-years old	12%
Race	
Caucasian	68%
African- American	13%
Hispanic	13%
Asian	2%
Native Hawaiian, Pacific Islander, American Indian, or Alaska Native	4%
Frequency of Internet Usage	
Going on the Internet several times an hour	18%
Going on the Internet several times a day	52%
Going on the Internet (almost) every day	25%
Going on the Internet once or twice a week	5%

day and 70% reported being online several times a day, with 56% of participants indicating that they had their own digital device. About 70% of participants also reported that they took privacy protection behaviours online, including blocking someone online that they do not want to hear from, changing privacy settings on a social networking profile, managing the risk of a virus attack by installing antivirus software, managing browser’s privacy and security options, uninstalling spyware and adware from their computer, keeping personal information secure and preventing strangers from contacting them online.

3.2. Measures

3.2.1. Psychological stress

Adolescents’ psychological stress was measured with the revised brief version of Watson’s Negative Affect scale (Watson et al., 1988). As the focus of the study was not on Positive Affect items, we only used 5 out of 10 items of the scale (alpha = 0.85 and 0.87; see Caprara et al., 2006), including feeling sad, afraid, miserable, mad and scared. Adolescents were asked to report their feelings or emotions based on a 5-point Likert scale, from 1 = *very slightly/not at all*, 2 = *a little*, 3 = *moderately*, 4 = *quite a bit*, to 5 = *extremely*. A higher score represents a higher level of psychological stress.

3.2.2. Internet Use

The scale of participants’ Internet use (e.g., use of social networking sites or social media, and being online via digital devices or any web-based applications) was revised from a scale of nine items (Livingstone et al., 2011). Adolescents were asked to report on average how often they used the Internet, social media or digital devices for a range of activities across different devices (See Appendix). These questions were based on frequency of use, applying a 5-point Likert scale, from 1 = *“less than once a week”* to 5 = *“several times an hour”*. A higher score represents greater use of the Internet.

3.2.3. Online social capital

Online social capital was operationalized by a pre-validated scale from Ellison et al. (2007), which was originally developed by Williams (2006). This scale measured both bonding (five items) and bridging (seven items) social capital. In Putnam’s (2000) view, bonding capital is specific to interactions that include strong social relationships (e.g., close friends). Bridging capital includes broader relationships (i.e., weak

ties). Items were scored on a 5-point Likert scale ranging from 1 = *strongly disagree*, 2 = *disagree*, 3 = *neutral*, 4 = *agree*, to 5 = *strongly agree* (See Appendix). A higher score represents higher social capital.

3.2.4. Online risk exposure

The online risk exposure measure was developed by Wisniewski et al. (2015). The scale was based on four items that probed adolescents’ online risk experiences across four types of risks: 1) information breaches, 2) online harassment, 3) sexual solicitations, and 4) exposure to explicit content (See Appendix). The four risk types were aggregated to create an overall measure of online risk exposure and were significantly correlated to one another (alpha = .85; Wisniewski et al., 2015). Items were scored on a 5-point Likert scale, ranging from 1 = *not at all*, 2 = *a little*, 3 = *somewhat*, 4 = *quite a bit*, to 5 = *a great deal*. Mean scores were obtained across participants’ responses, with higher mean scores representing higher exposure to online risks.

3.3. Data analysis approach

Preliminary analyses were conducted to analyze the correlations among the variables (Table 2), evaluate the reliability (internal consistency based on Cronbach’s alpha) of each of the measures, and summarize the descriptive statistics for each of the scales (Table 3). In addition, all measures were assessed to ensure that assumptions of normality, non-linearity, multicollinearity, and heteroscedasticity were satisfied. Additionally, histograms and scatterplots were generated to observe the shape of the distribution (skewness, kurtosis) and to identify outliers. Table 3 shows the scale reliabilities and descriptive statistics for all the main constructs in our model.

To examine the mediation effects (H1 and H3), the Sobel test (Sobel, 1982) and the Baron and Kenny approach (1986) were used. We tested the mediation effect of online risk exposure on the relationship between Internet use and psychological stress (H1), and the mediation effect of online social capital on the relationship between Internet use and online risk exposure (H3). Bivariate zero-order correlations were computed as an initial examination of the relations among variables to verify expected relations among independent, dependent and moderator variables (H2). According to Wu and Zumbo (2008), moderation effects are most likely to be evident when the independent and dependent variables are strongly related, but may also be evident when the effects are weak or non-existent. However, the independent variable should not be correlated with the moderator variable (online social capital; H4). To address the last hypothesis, separate regression analysis was computed for psychological stress as an outcome variable, and online social capital and online risk exposure as independent variables, using hierarchical regression.

4. Results

4.1. Descriptive statistics and correlations

The results of our preliminary analyses showed that variables had a

Table 2
Correlations between internet usage, online risk exposure, online social capital and psychological stress.

Measures	Internet Usage	Online Risk Exposure	Online Social Capital	Psychological Stress
Internet Usage	1			
Online Risk Exposure	.37**	1		
Online Social Capital	.38**	.22**	1	
Psychological Stress	.23**	.27**	.21**	1

Table 3
Scale reliabilities and descriptive statistics.

Measures	No. of items	Cronbach's alpha	Mean	SD	Range	Skewness	Kurtosis
Internet Usage	9	.86	2.77	0.85	1–5	0.31	–0.34
Online Risk Exposure	4	.95	2.32	1.34	1–5	0.68	–0.92
Online Social Capital	10	.91	3.22	1.05	1–5	- 0.61	–0.18
Psychological Stress	5	.92	1.63	0.84	1–4.8	1.78	2.92

low amount of missing data, representing less than 3% for each variable. Also, no outliers were identified in the data. The results of descriptive statistics, Cronbach's alpha's, and zero-order correlations among all study variables are shown in Tables 2 and 3. Correlations which were significant among all variables ($p < 0.001$) suggested favorable conditions for examining the mediation hypotheses.

Cronbach's alpha values suggested adequate internal consistency for all constructs in our model.

4.2. The mediating role of online risk exposure (H1)

Hypothesis 1 was partially supported in that online risk exposure somewhat, but not fully, explained the relationship between Internet usage and psychological stress (Fig. 2). We tested our hypothesis by utilizing the modern version of Baron and Kenny's (1986) causal approach and applying the Sobel test. In Step 1 of the mediation model, the result of the regression of psychological stress on Internet use, ignoring the mediator, was significant, $b < 0.35$, $t(213) = 5.50$, $p < 0.001$. Step 2 showed that the regression of the Internet use scores on the mediator, online risk exposure, was also significant, $b = 0.64$, $t(213) = 6.42$, $p < 0.001$. Step 3 of the mediation process showed that the mediator, online risk exposure, was significant, $b = 0.23$, $t(213) = 5.73$, $p < 0.001$. Step 4 of the analyses revealed that, controlling for the mediator of online risk exposure, Internet use was still a significant predictor of psychological stress, $b = 0.24$, $t(213) = 3.61$, $p < 0.001$. Next, a Sobel test was conducted and found partial mediation in the model ($z = 4.28$, $p < 0.001$) because the relation between Internet usage and psychological stress was different from zero after online risk exposure was included in the model, as shown in Fig. 2.

4.3. The relationship between online social capital and online risk exposure (H2)

Hypothesis 2 was supported in that online social capital was significantly and positively associated with online risk exposure ($r = 0.22$, $P < 0.01$). To examine the second hypothesis, we used regression analysis. Results showed that online social capital was significantly and positively associated with online risk exposure. This means that adolescents who reported a high level of online social capital were also more likely to report being exposed to online risks than those who reported a low level of online social capital.

4.3.1. The mediating role of online social capital (H3)

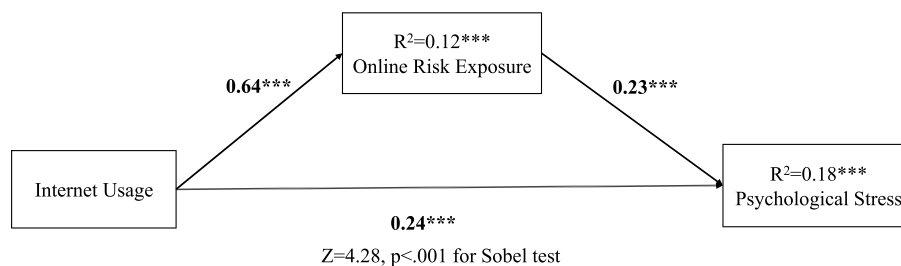
Our third hypothesis was also partially supported, in that online social capital partially mediated the relationship between Internet use and online risk exposure. In addition to the regression analysis, we re-applied the Sobel test and Baron and Kenny's approach (1986) to test our third hypothesis. In Step 1 of the mediation model, the results showed that the regression of online risk exposure on Internet use, ignoring the mediator, was significant, $b = 0.35$, $t(213) = 5.49$, $p < 0.001$. Step 2 showed that the regression of the Internet use scores on the mediator, online social capital, was also significant, $b = 0.51$, $t(213) = 7.74$, $p < 0.001$. Step 3 of the mediation process showed that the mediator of online social capital was significant, $b = 0.23$, $t(213) = 3.94$, $p < 0.001$. Step 4 of the analyses revealed that, controlling for the mediator of online social capital, online risk exposure was still a significant predictor of psychological stress scores, $b = 0.35$, $t(213) = 5.49$, $p < 0.001$. Then, after calculating the Sobel test score, the results showed that there was a significant mediation effect on the relation between Internet use and online risk exposure ($z = 0.39$, $p < 0.001$). As the relation between Internet usage and online risk exposure was different from zero after online social capital was included in the model (Fig. 3), we found that online social capital partially mediated the relationship.

4.3.2. The moderating effect of online social capital (H4)

Our fourth hypothesis was not supported. In fact, the relationship was significant ($b = 0.83$; $p = 0.002$), but in the opposite direction of our hypothesis. We expected that a high level of social capital would play a protective role by reducing the psychological stress of risk exposure. However, results showed the opposite. There was a link and positive between high levels of social capital and increased psychological stress from online risk exposure. The significant interaction effect (Fig. 4) was found by testing the conditional effects of online risk exposure at two levels, low and high online risk exposures.

For adolescents who reported low levels of online social capital, this neutralized the previously found negative and significant effect of online risk exposure on psychological stress. However, for adolescents who reported high levels of online social capital, this strengthened the significant and negative relationship between online risk exposure and psychological stress. This suggests that online social capital acted as a risk factor, rather than a protective factor, in relation to online risk exposure and psychological stress.

Effects of Internet Usage and Online Risk Exposure on Psychological Stress



* p-value < 0.05, ** < 0.01, *** < 0.001

Fig. 2. Effects of internet usage and online risk exposure on psychological stress.

Effects of Internet Usage and Online Social Capital on Online Risk Exposure

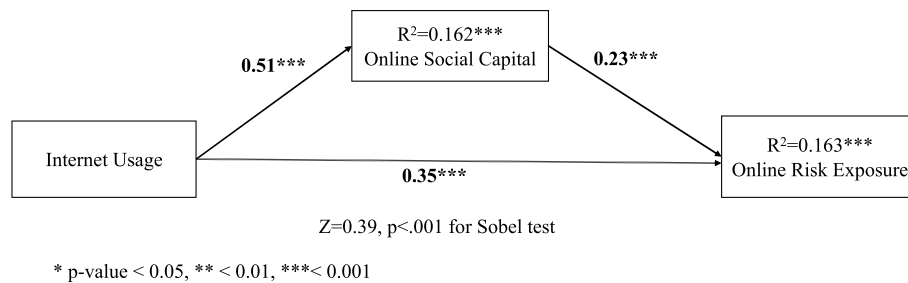


Fig. 3. Effects of internet usage and online social capital on online risk exposure.

Online Social Capital Moderates the Relationship between Psychological Stress and Online Risk Exposure

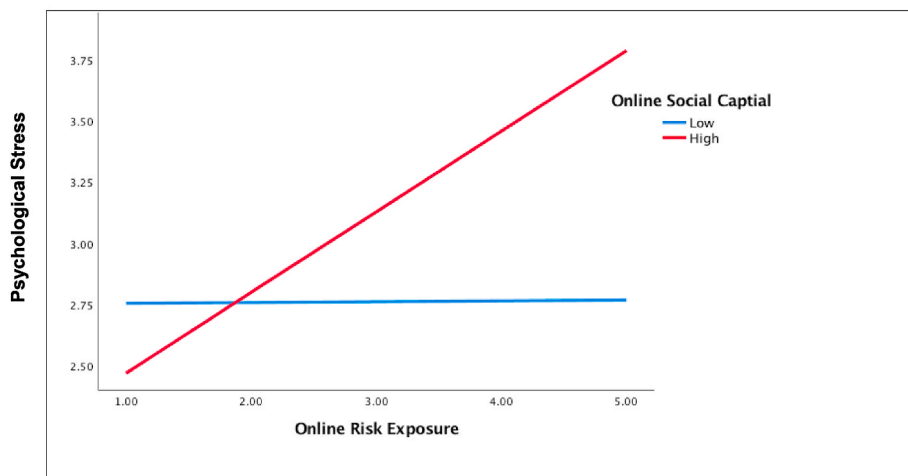


Fig. 4. Online social capital moderates the relationship between psychological stress and online risk exposure.

5. Discussion

5.1. Summary of results

Our study revealed that adolescents' Internet use was significantly related to increases in psychological stress. Furthermore, online risk exposure partially mediated the relationship between Internet use and psychological stress (H1). This finding is consistent with previous literature (Wisniewski et al., 2015), which showed that online risk exposure contributes to negative psychological outcomes for adolescents. To this end, we served to replicate the prior work, which had a small sample size of 75 adolescents, with the current sample that was larger and more diverse. Therefore, we contribute to establishing the generalizability of this finding from past research.

Beyond replicating findings from past research, our results showed that online social capital was a significant predictor of online risk exposure. This is a novel finding from our study that suggests that the formation of online social capital also contributes to online risk exposure for adolescents. Internet socializing may increase the likelihood of developing new positive relationships, but may also lead to negative interactions with friends, acquaintances, and/or strangers. We also found that online social capital partially mediated the relationship between Internet usage and online risk exposure. Understandably, adolescents may open themselves up to some level of online risk because they want to strengthen their existing relationships (i.e. bond) or cultivate new relationships with others (i.e. bridge). This rationale, that increasing the level of Internet use and expanding online social relations may harm adolescents, is supported by anecdotal examples of

cyberbullied adolescents, such as the case of Amanda Todd, who posted her video on YouTube describing how an online stranger distributed nude photos of her on a Facebook profile (YouTube, 2012). While increased online social capital increases online risks, this more superficial form of friendship, as opposed to deeper offline friendships, does not have the ability to insulate adolescents from the psychological stress caused by online risk exposure. Additionally, our results indicate that when online engagement replaces deeper offline engagement, this may amplify the negative effects of online risk exposure.

Considering the moderation effect of online social capital, the current study suggests that online social capital is intertwined with online risk exposure in a way that amplifies instead of protects against adolescents' psychological stress. The most critical and unanticipated finding from this study was that online social capital moderated the relationship between online risk exposure and psychological stress in the opposite direction than expected. More specifically, adolescents who garner high levels of social capital online and were exposed frequently to online risks report a significantly higher level of psychological stress. Overall, it appears that online social capital can be harmful in adolescents' lives, depending on the level and the depth of their online social relationships. If an adolescent has too much online social capital, he or she may become overly dependent on online relationships. Thus, when these adolescents experience online risks resulting from their online interactions with others, these experiences carry more weight. While prior research has shown a relationship between adolescent psychological stress and excessive Internet usage, we demonstrate how an over-emphasis on online social capital is associated with increased psychological stress, even if Internet usage itself is not problematic. Therefore,

online social capital significantly influences psychological stress and should be considered in future research that examines the effects of Internet usage on adolescents.

5.2. Practical implications

The findings of this study have implications for parents, educators, and adolescents. First, it is important to consider the quality of adolescents' offline and online relationships when assessing the role that the Internet may play in their overall mental health and well-being. Our results showed that although some adolescents may benefit from online social capital by expanding their online relations, they may also be at increased risk of being cyberbullied, as well as being exposed to pornography, violence, or other explicit content. Our results revealed that online social capital likely means something different in online settings versus offline or face-to-face settings. This was consistent with other studies looking at online social relations, which were shown to increase the propensity for negative online behaviors (e.g., cyberaggression; Barlińska et al., 2013; Peluchette et al., 2015). However, having a high level of family social capital and emotional support were related to lower engagement in online and offline aggression (Kwan, 2012). Thus, exploring in more detail the role of online social capital in adolescents' online risk exposure and psychological stress requires detailed information about relationships with online friends, the content of online relationships, and the type of online social capital from which they benefit. Gaining such information provides more accurate evidence that can be helpful in developing interventions aimed at online social capital as a form of accumulation or alienation.

5.3. Limitations and future work

Our analysis was based on a cross-section of adolescents between the ages of 13 and 17 in the United States. Therefore, statistically significant relationships are correlative, not necessarily causal. For instance, online social capital formation is associated with online risk exposure. However, we cannot say whether one primarily leads to the other. Second, our results are only generalizable to the sample characteristics of this

study. Therefore, our results should not be used to make inferences for younger children, adults, or adolescents outside of the United States. Future studies should be conducted to confirm the relationships, processes, and underlying mechanisms that contribute to online social capital formation and risk exposure for adolescents, particularly among LGBT+ (Clark, 2016) or foster adolescents (Badillo-Urquiola & Wisniewski, 2019).

6. Conclusion

The purpose of this research was to explore the impact of Internet usage, online social capital, and online risk exposure on psychological stress within an adolescent population. The social ecological perspective of adolescent resilience was used to guide our research. We found that (1) online risk exposure partially explained the relationship between Internet usage and psychological stress, (2) online social capital somewhat, but not fully, explained the relationship between Internet usage and psychological stress, (3) online social capital was significantly and positively associated with online risk exposure, and (4) online social capital did not play a protective role in reducing psychological stress. On the contrary, online social capital amplified psychological stress when online risk exposure occurred. Our results suggest that online social capital, particularly among adolescents, currently functions as a risk factor, rather than a protective factor, in relation to online risk exposure and psychological stress among adolescents. An over-reliance on online relationships may make adolescents even more vulnerable to online risk exposure. As such, future research should focus on understanding what forms a healthy balance between offline and online social capital formation for adolescents.

CRedit authorship contribution statement

Rose Maghsoudi: Conceptualization, Methodology, Formal analysis, Writing - original draft. **Jennifer Shapka:** Writing - review & editing. **Pamela Wisniewski:** Data curation, Formal analysis, Writing - review & editing.

APPENDIX

Questionnaire

Scale Items for Internet Usage, Online Social Capital and Online Risk Exposure.

Construct	Measures	N	M	SD	Min	Max	Alpha
Internet usage	Used the internet for schoolwork. Used a social networking site. Used instant messaging. Read/watched the news on the Internet. Played games with other people on the Internet. Put/posted photos, videos or music to share with others. Used a webcam. Spent time in virtual world. Written a blog or online diary.	215	2.77	0.85	1	5	.86
Online social capital							.90
Online social capital-bonding	There is someone online I can turn to for advice about making very important decisions. There are several people online I trust to help solve my problems. The people I interact with online would put their reputation on the line for me. I don't know people online/offline well enough to get them to do anything important. When I feel lonely, there are several people online I can talk to.	215	3	.95	1	5	.79
Online social capital-bridging	Interacting with people online makes me feel connected to the bigger picture. Talking with people online makes me curious about other places in the world. Interacting with people online makes me want to try new things.	215	3.45	1.1	1	5	.95

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Construct	Measures	N	M	SD	Min	Max	Alpha
Online risk exposure (all)	Interacting with people online makes me interested in things that happen outside of my town.	215	2.43	1.52	1	5	.95 (for all risks)
	Interacting with people online makes me feel like part of a larger community						
Online Risk Exposure_ Information Breaches	Someone else shared your information or a photo of you that you didn't want them to post. You shared personal information or a photo of yourself that you later regretted sharing. You have been the victim of what you felt was an improper invasion of privacy or misuse of your information in some other way	215	2.43	1.52	1	5	
Online Risk Exposure_ Cyberbullying	You were treated in a hurtful or nasty way online	215	2.32	1.44	1	5	
Online Risk Exposure_ Sexual Solicitation	Someone made rude or mean comments about you or threatened you in some way online. Someone tried to spread a mean rumor about you online. There are other types of negative and unwanted interactions that hurt your feelings, and made you feel embarrassed, or unsafe	215	2.25	1.42	1	5	
	Someone you know sent you a sexual message ("Sexting")						
Online Risk Exposure_ Explicit Content	Someone you know asked you to send them a sexual message, or a revealing or naked photo of yourself. A stranger asked you to meet them offline. There are other types of sexually suggestive interactions that made you feel even a little uncomfortable.	215	2.28	1.4	1	5	
	You saw online stories, images or videos that were pornographic (naked or sexual in nature).						
	You saw online stories, images or videos that contained excessive violence.						
	You saw online stories, images or videos of illegal or deviant (morally questionable) behavior. You saw online content that promoted self-harm (such as eating disorders, cutting, suicide, etc.). You saw other online content that made you feel uncomfortable some way.						

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