



Multigroup analysis of the relationship loneliness, fear of missing out, problematic internet usage and peer perception in gifted and normally developing adolescents

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Abstract

The current study examined the effects of Internet usage characteristics and peer perception on loneliness. The mediating role of Internet usage characteristics was examined in the relationship between loneliness and peer perception. The sample included 661 Turkish adolescents ($N_{\text{girls}}=379$, 57.34%; $N_{\text{gifted}}=211$, 31.92%) aged 11–18 years. Structural equation model analyzes were conducted to test the hypothesis model across the group. Moreover, multigroup structural model was conducted to test the differences of the relationships across gifted and normally developing adolescents. The results of the structural model showed that Internet use characteristics did not have a mediating role in the relationship between adolescents' peer perception and loneliness. On the other hand, problematic Internet use had a full mediator role in the relationship between fear of missing out and loneliness. The results of the multigroup structural model emphasized the similar effects between the research variables in gifted and normally developing adolescents. The results were discussed with the effects of Internet use characteristics and peer perception on loneliness. We also pointed out that gifted and normally developing adolescents have similar social and technological outcomes and that these outcomes influence mental health.

Keywords Gifted students · Adolescents · Problematic internet usage · Fear of missing out · Loneliness · Peer perception

Introduction

Adolescence is a period of radical change in the social, emotional, and cognitive domains that is distinctive (Steinberg, 2009). Healthy adolescent development requires adaptation to these changes. However, adaptation problems can lead to adolescents being placed in a risk status for mental health problems (Wille et al., 2008). The importance of peers in interpersonal relationships increases during adolescence (Gifford-Smith & Brownell, 2003). The needs for trust, love and appraisal are met by family members in childhood, whereas these needs are more likely to be met by friends in adolescence (Dolgin, 2014). Adolescents with healthy peer

relationships experience less emotional disorder, behavior problems (Roseth et al., 2008), and lower feelings of loneliness (Parker & Asher, 1993). In contrast, the absence of an intimate increases feelings of loneliness (Hoza et al., 2000). Loneliness has been reported to peak (Perlman & Landolt, 1999). It is common during adolescents (Moore & Schultz, 1983) and girls are more likely to feel loneliness than boys (Borys & Perlman, 1985; Liu et al., 2020). Therefore, it is important to determine the predictors of loneliness in adolescents.

The use of online environments by adolescents for socialization and entertainment has gradually increased in recent years (Kokka et al., 2021). COVID-19 pandemic also affected adolescents' Internet use habits and their excessive usage increase (Sun et al., 2020). Excessive use of the Internet for entertainment can lead to neglecting activities of daily life such as studying, social relationships, and relaxation (Davis, 2001). FoMO is currently described as “a pervasive apprehension that others may have rewarding experiences from which one is absent” and is characterized by “the desire to stay continually connected with what others are doing” (Przybylski et al., 2013). Previous

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research has highlighted the positive association between FoMO, depression and anxiety (Elhai et al., 2016, 2020), as well as a negative association with well-being (Stead & Bibby, 2017). Additionally, problematic Internet use (PIU) which is related to excessive Internet use has been associated with mental health problems (Kim et al., 2006; Kitazawa et al., 2018; Panicker, 2014), social anxiety and loneliness (Caplan, 2006) and less positive peer relationships (Sanders et al., 2000). FoMO and PIU which are described as non-functional Internet use characteristics (Marlina, 2017) has a moderate association. In the current study, it was hypothesized that there would be a positive association between nonfunctional Internet use characteristics and loneliness.

Research that has examined effect of gender on FoMO and PIU have inconsistent result. Some research has shown that boys have higher PIU levels (Akbaş et al., 2019), however others have found no gender differences (Smahel et al., 2012). Similarly, FoMO has been shown to vary by gender (Rozgonjuk et al., 2021) or to be higher in boys (Przybylski et al., 2013). Research with gifted students has shown no gender differences (Kurnaz & Tepe, 2019).

Gifted adolescents are superior compared to their peers in areas such as intellectual skills, creative thinking, and leadership skills (Davis & Rimm, 2004). Furthermore, they also differ from their peers in cognitive and social-emotional characteristics (Altman, 1983). Reasons for gifted adolescents' feelings of loneliness may differ from their normally developing peers. Their strong sense of justice, leadership characteristics (Bisland, 2004), strong sense of humor, and aesthetic traits (Holt & Willard-Holt, 1995) may make them a popular member of their peer group. Otherwise, asynchronous development (Bailey, 2011) and hypersensitivity may make them feel different from their peers (Silverman, 1993). In addition, some studies showed a relationship between giftedness and stamina, vulnerability (Neihart, 1999) and mental health problems (Blackett & Webb, 2011; Gross, 2002). As a result, gifted adolescents also suffer from loneliness (Kaiser & Berndt, 1985; Ogurlu et al., 2018). Internet use characteristics might be a factor influencing differentiation of feelings of loneliness on gifted and normally developing adolescents. Gifted adolescents use the Internet to support their own learning, to produce a creative product and to conduct research (Morgan, 1993). It has been shown that the purposes of Internet use among normally developing adolescents are entertainment, relief from academic pressure, self-expression, and socialization (Ling et al., 2011). However, gifted and normally developing adolescents has no difference in terms of internet addiction (Garcia et al., 2020).

The studies comparing gifted adolescents with normally developing adolescents in terms of their psychological health characteristics are limited (Martin et al., 2010) and the results of these studies are inconsistent. Some studies

showed no difference between the mental health of normally developing adolescents and gifted adolescents (Olszewski-Kubilius et al., 1988; Rafati et al., 2014). Results show that gifted adolescents perceive themselves differently than their peers (Rimm et al., 1999), so this perception negatively affects their social skills (Silverman, 2002), but they have better levels of interpersonal skills than their normally developing peers (e.g., McCallister et al., 1996). The inadequate and inconsistent findings on the social skills of gifted and normally developing adolescents indicate that more research is needed on this topic.

Positive face-to-face relationships with peers are a protective factor for loneliness (Heredia et al., 2017). However, online relationships with peers are associated with loneliness (Cauberghe et al., 2021). Therefore, changing relationships in the wake of the pandemic may increase the level of loneliness among adolescents. In addition, loneliness is associated with PIU (Kim et al., 2009) and FoMO (Przybylski et al., 2013). Although previous researches on mediating effects of PIU and FoMO has provided insight into underlying mechanisms to elucidate the relationship between peer perception and loneliness, some further areas of investigation can be explored. The mechanism of Internet use, loneliness, and peer perception in gifted and normally developing adolescents appears to be different.

First, testing the concurrent mediating effects of FoMO and PIU using the structural equation modeling, would extend our consolidated understanding of the mechanism how peer perception and loneliness are connected. Previous research has found that a multi-mediator model may be more meaningful than a single-mediator model, because it may provide our relative importance of these mediators (Zhao et al., 2013). For instance, Tokunaga (2014) found that mediating role of PIU in the relationships between psychosocial problems (i.e., social anxiety, loneliness, and depression) and impairment of interpersonal relationships have been examined in the previous literature. Second, we would use the multi-group analysis to identify whether there are significant giftedness differences in the mediational model. Taken together, the present study tested the mediation effects of both FoMO and PIU between peer perception and loneliness in Turkish adolescents.

The hypothesis model was presented in Fig. 1.

Methods

Procedure

Data for the current study were collected from 11 schools and two science and art centers. Informed consent was obtained from school principals and parents. Ethical approval was obtained from Hasan Kalyoncu University

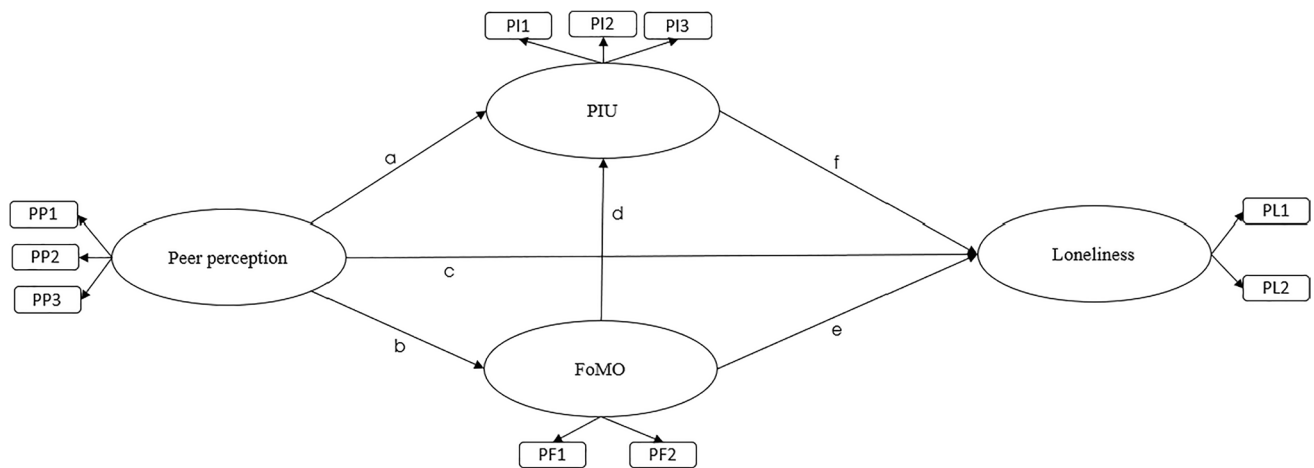


Fig. 1 The hypothesis model

and the National Ministry of Education. First, schools' and centers' principals were informed of the purpose of the study. Then, the school and center principals sent a link to the adolescents who used the class WhatsApp groups. The first part of the online link included informed consent, information about the opportunity to discontinue at any time, and confidentiality. If the adolescents accepted to participate in the study, they answered the study scale questions in the second part.

Participants

The sample included 661 students ($N = 379$ girls; 57.34%) aged 11–18 years. They were educated in secondary schools ($N = 251$, 37.97%) and high schools ($N = 410$, 62.03%). There were 211 gifted adolescents (31.92%) and 450 normally developing adolescents (68.08%) in the sample. All gifted youth attended a science and the arts. Gifted or talented students can be identified in the Turkish education system during the first three years of primary school (Akgül, 2021). Students are first reported to the National Ministry of Education by their classroom teachers if they show signs of above average giftedness. After the preliminary assessment, students who are deemed to show symptoms are invited to take a group exam. Students who score in the range set by the Ministry on this examination are taken for an individual intelligence test. Once identified, students qualify to attend the Science and Arts Center. Gifted and talented students are taught in science or art classes at these centers separately from their schools. Students can continue their education at the centers until they graduate from high school (Kurnaz & Ekici, 2020).

Measures

Problematic internet usage

To measure PIU, “Dysfunctional Internet Usage Scale (NIUS)” was used. The scale was developed by Atalan-Ergin (2018). It consisted of 15 items and three dimensions: excessive use, emotion regulation through the Internet, negative outcomes. The items were answered on a 5-point Likert scale ranging from never true (1) to always true (5). A higher score reflects a higher PIU score. Sample item includes “My performance in the course has declined because of the Internet.” The Cronbach Alpha reliability of the scale in this study was 0.91.

Fear of missing out

To measure the fear of missing out, the Fear of missing out scale (FoMOs) was used. The scale was developed by Przybylski et al. (2013) and adapted into Turkish by Can and Satici (2019). It consisted of ten items answered on a 5-point Likert scale ranging from (1) Not at all true to (5) Absolutely true. A higher score reflected a greater fear of missing out level. Sample item includes “I get anxious when I do not know what my friends are up to”. The Cronbach Alpha reliability of the scale in the present study was 0.81.

Peer perceptions

To measure the positive and negative characteristics of the children's peers, “Generalised Peer Relationship Scale” was used. The scale was developed by c and adapted into Turkish by Bayar and Uçanok (2012). It consisted of 13 items answered on a 5-point Likert scale ranging from (1) no, not

at all (4) yes, completely. A higher score reflects a more positive perception of peers. The sample item includes “They can really be relied on”. The Cronbach Alpha reliability of the scale in the current study was 0.91.

Loneliness

To measure adolescent loneliness, the “UCLA Loneliness Scale” was used. The scale was developed by Hays and DiMatteo (1987) and adapted from Turkish by Yıldız and Duy (2014). It consisted of seven items answered on a 5-point Likert scale ranging from (1) Never (4) Always. A higher score reflects a higher value for loneliness. The sample item includes “I feel left out.” The Cronbach Alpha reliability of the scale in the current study was 0.79.

Data analysis

First, descriptive statistics (mean and standard deviation) were calculated to analyze FoMO, loneliness, PIU, and peer perception of gifted and normally developing adolescents separately. Second, mean differences by gender, age, and gifted/non-gifted were examined using an independent t-test. Third, SEM analyzes were conducted to test the hypothesis model in whole groups. SEM provides the flexibility to test relationships between latent variables (Kline, 2011). Prior to testing SEM, the measurement model was conducted. Additionally, we tested the hypothesis model for gifted and normally developing adolescents in multiple groups using SEM. This analysis ensures an effective tool to assess the similarities and differences between different groups (Cole & Maxwell, 1985; Deng & Yuan, 2015). Therefore, in the current study, multigroup analysis SEM was used to test the relationships between gifted and normally developing adolescents. Based on the approach of Little et al. (2002), we used the item parceling method because it provides a better model than using all items. The model’s goodness of fit was assessed using χ^2 , CFI, RMSEA, and TLI. The thresholds for χ^2/df were between 2 and 3; CFI and TLI were higher than 0.09; RMSEA values lower than 0.08 (Bryne, 2013).

To investigate the mediation effect hypothesis, we followed the four-step procedure proposed by Baron and Kenny (1986). The procedure requires: (a) a significant relationship between peer perception and loneliness; (b) a significant

relationship between peer perception and FoMO, PIU; (c) a significant relationship between loneliness and FoMO (or PIU) when controlling for peer perception; and (d) when controlling for the effect of PIU (or FoMO), the relationship between peer perception and loneliness is no longer significant.

The models were assessed based on chi-square (χ^2), comparative fit index (CFI), and estimated root-mean-square error of approximation (RMSEA). RMSEA values of 0.08, CFI values of >0.90 indicate a reasonably good fit (Kline, 2011). There was no missing data and no violations to assumptions of homoscedasticity, normality, and linearity.

Results

Descriptive results

The means, standard deviations, and Pearson bivariate correlations between the study variables were presented in Table 1. The loneliness ($t_{(659)} = 2.236, p < .05, d = 0.17, CI = 0.021, 0.330$) and FoMO level ($t_{(1659)} = 2.215, p < .05, d = 0.16, CI = 0.013, 0.312$) was significantly different between the gender group. Girls specified that higher loneliness ($\bar{x} = 14.08$) than boys ($\bar{x} = 13.18$). Similarly, girls reported a higher FoMO level ($\bar{x} = 24.41$) than boys ($\bar{x} = 23.03$). But there were no gender differences in PIU ($t_{(659)} = 0.598, p > .05, d = 0.04, CI = -0.201, 0.107$) and peer perception ($t_{(659)} = 1.407, p > .05, d = 0.11, CI = -0.265, 0.044$). According to whether being gifted or not, there were no mean differences in adolescents’ loneliness ($t_{(659)} = 1.837, p > .05, d = 0.15, CI = -0.317, 0.011$), peer perception ($t_{(659)} = 0.680, p > .05, d = 0.05, CI = -0.220, 0.107$), PIU ($t_{(659)} = 0.729, p > .05, d = 0.06, CI = -0.224, 0.103$), and FoMO ($t_{(659)} = 0.649, p > .05, d = 0.05, CI = -0.218, 0.109$).

Measurement model for whole sample

Measurement model invariance was tested using the software Lisrel 8.80 (Jöreskog & Sörbom, 2006). The model fit the data $\chi^2(29) = 76.81, p < .01, CFI = 0.99, TLI = 98, RMSEA = 0.05$. The results of the measurement model showed that peer perception was negatively related to PIU ($\beta = -0.19^*, p < .01$) and loneliness ($\beta = -0.50^*, p < .01$),

Table 1 Means, standard deviations and correlations among study variables

Variables	1	2	3	4	M	SD
1. PIU	1				34.02	13.55
2. Peer relationship	-0.17***	1			40.10	8.72
3. Loneliness	0.19***	-0.44***	1		13.70	5.13
4. FoMO	0.50***	-0.07	0.19***	1	23.82	8.26

* $p < .05$, ** $p < .01$, *** $p < .001$

but not to FoMO ($\beta = -0.04, p > .01$). FoMO was positively related to PIU ($\beta = 0.59^*, p < .01$) and loneliness ($\beta = 0.19^*, p < .01$). PIU had a positive association with loneliness ($\beta = 0.23^*, p < .01$). These results were similar to Pearson correlation coefficients. Then, we tested the relationships between the research variables for whole group.

Structural equation modelling

The results of the structural model for whole sample were presented in Fig. 2.

The structural model results did not provide an acceptable fit to the data $\chi^2(30) = 89.84, p < .01$; CFI = 0.95; TLI = 92; RMSEA = 0.09. Two modification indices of error variance were proposed to improve the RMSEA values. Adding a covariance term between PP2 and PP3 improved the model fit indices $\chi^2(29) = 72.69, p < .01$; CFI = 0.96; TLI = 94; RMSEA = 0.08. As a result, peer perception was negatively related to PIU ($\beta = -0.18^*, p < .01$) and loneliness ($\beta = -0.51^*, p < .01$), but it was not related to FoMO ($\beta = 0.05^*, p > .01$). FoMO was positively related to PIU ($\beta = 0.50^*, p < .01$) but not to loneliness ($\beta = -0.06^*, p > .01$). Also, PIU had a significant positive relationship with loneliness ($\beta = 0.37^*, p < .01$). Furthermore, based on Baron and Kenny’s (1986) model, the relationship between FoMO and loneliness was no longer via PIU. In other words, PIU had the full mediating effect in the relationship between FoMO and loneliness.

Measurement model and invariance testing

We tested configural and metric invariance to verify that the based model was equivalent between groups and that factor loadings were invariant across groups (Cheung & Rensvold, 2002). The chi-square difference test was used to test the

assumptions about measurement invariance. Then, multi-group SEM was conducted to test the relationships among the research variables.

Configural invariance

Configural invariance was assessed by comparing constructs across groups (Steenkamp & Baumgartner, 1998). We tested factor loadings for each latent factor in the measurement model. All factor loadings were significant and loaded in the expected direction. In addition, we examined the model fit indices for both groups. The measurement model fit the data for normally developing $\chi^2(29) = 55.432, p < .01$; CFI = 0.99; TLI = 98; RMSEA = 0.04; and gifted adolescents $\chi^2(29) = 59.184, p < .01$; CFI = 0.97; TLI = 96; RMSEA = 0.07. In addition, the measurement model had acceptable model fit indices $\chi^2(29) = 82.755, p < .01$; CFI = 0.98; TLI = 97; RMSEA = 0.05. Thus, configural invariance, one of the methods used to test measurement invariance, was verified.

Metric invariance

Metric invariance was assessed by possible group differences in factor loadings. We estimated metric invariance using chi-square differences for both groups. First, unconstrained model that assumed that factor loadings were not to be equal between gifted and normally developing adolescents. It had very good fit indices $\chi^2(84) = 160.19, p < .01$; CFI = 0.98; TLI = 98; RMSEA = 0.05. Then constrained model was run in which the factor loadings should be equal between the groups. It also had very good indices $\chi^2(78) = 162.18, p < .01$; CFI = 0.98; TLI = 98; RMSEA = 0.05. The results show that the chi-square differences for gifted and normally

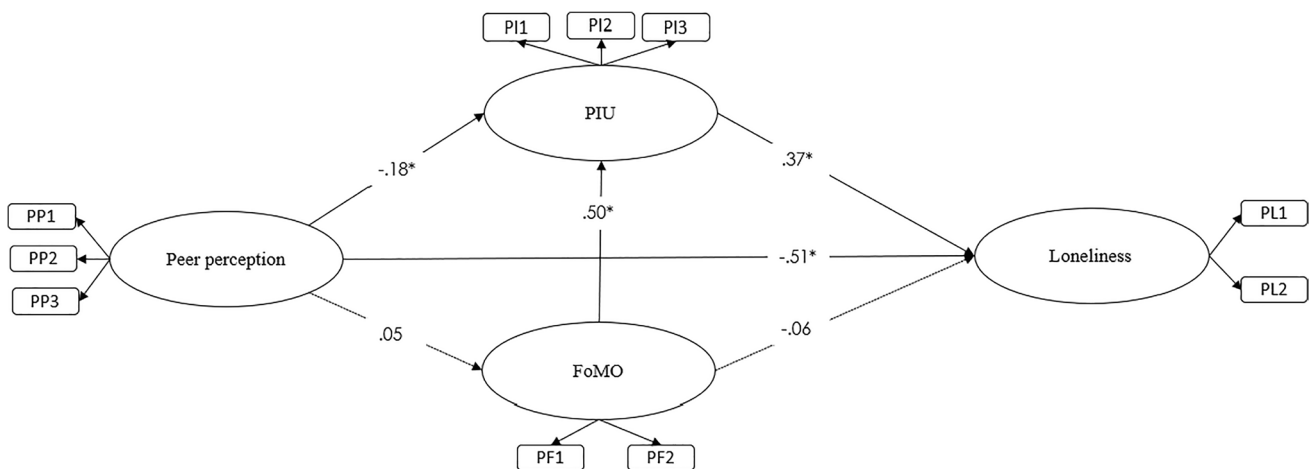


Fig. 2 Standardized structural model results for loneliness, peer perception, PIU, and FoMO in whole sample

developing groups are invariant and the metric invariance was verified.

Multigroup SEM

Multigroup analysis provides an opportunity to examine differences in the model between groups. We used SEM, to find significant differences in the group-specific parameter estimates (Hair et al., 2014). The chi-square difference test was performed for the estimation of the multi-group effects (Table 2). To examine the difference in the χ^2 -values of the two models, the difference in the two χ^2 -values and degrees of freedom are examined. If the χ^2 difference value is significant, the model containing more parameters and fewer degrees of freedom is accepted; conversely, if the χ^2 difference value is not significant, the model containing fewer parameters and more degrees of freedom is accepted (Werner & Schermelleh-Engel, 2010).

The results showed that there were no differences in the relationships between loneliness, peer perception, PIU and FoMO among gifted and normally developing adolescents.

Discussion

Peer perception is a critical variable that influences socialization, experiences, and the learning of new behaviors in adolescents (Steinberg, 2009). It was hypothesized that there is a direct relationship between loneliness and peer perception. The results supported this assumption. The adolescents with lower levels of peer perception have higher levels of loneliness. In addition, we thought that nonfunctional Internet use characteristics might play a mediating role in the relationship between peer perception and loneliness. However, the results showed that both PIU and FoMO did not have a mediating role. The reason could be that there are strong negative relationships between peer relationships and loneliness (Sletta et al., 1996). In addition, we assumed peer perception is related to both FoMO and PIU. We found a negative relationship between peer perception and PIU, but

no relationship between peer perception and FoMO. Our results emphasize the mediating role of PIU in the relationship between FoMO and loneliness. Last, we hypothesized that structural relationships would differ between gifted and normally developing adolescents. However, the results of the multigroup study SEM showed no differences between the groups.

Internet use habits might change depends on many personal features. Gender role is not clear regarding effect on Internet use and researches results are inconsistent in terms of gender effect (Akbaş et al., 2019; Przybylski et al., 2013; Rozgonjuk et al., 2021; Smahel et al., 2012). These results might be related to the rapidly changing Internet usage habits. It is known that Internet use has increased recent years and boys use the Internet more than girls (International Telecommunication Union, 2020). But girls may suffer from consequences of Internet use (Anthony et al., 1997; Hitschfeld et al., 2015). Therefore, the effect of gender on PIU and FoMO may not appear consistent. In addition, the data of the study were collected during the COVID – 19 pandemic. During pandemic, people's daily routines and their social relationships have changed (Ruiz-Frutos et al., 2020). It is known that Internet use has increased (Dong et al., 2020) and the purpose of use have changed (Cauberghe et al., 2021). While Internet use is increasing for both genders, girls used the Internet to connect social media, boys used it to play games (Lemenager et al., 2021).

There were no gender differences in terms of peer perception. Peer perception is also influenced different factors in boys and girls. For instance, girls are more intimate-oriented (Rose, 2002) and have fewer friends (Santrock, 2019). Conversely, boys are more object-oriented (Galambos et al., 2009) and tend to be more solitary (Santrock, 2019). This explanation supports the current finding on loneliness which showed girls were more likely to have higher levels of loneliness than boys in current research. Girls are more care their peers and can feel more loneliness feeling (Borys & Perlman, 1985; Liu et al., 2020).

Gifted adolescents differ from their normally developing peers in terms of social, cognitive, and behavioral

Table 2 Chi-square differences test for assessing multi-group effects and estimations of gifted- normally developing adolescents

Variables	Chi-square	Δ Chi-square	df	Δ df	p	Standardized estimates		p
						Gifted	Normally developing	
Based model	279.53		85					
1. Peer perception \rightarrow PIU	279.85	0.32	84	1	ns	−0.16***	−0.17***	ns
2. Peer perception \rightarrow FoMO	279.57	0.04	84	1	ns	−0.05	−0.06	ns
3. FoMO \rightarrow PIU	276.70	2.83	84	1	ns	0.45***	0.63***	ns
4. FoMO \rightarrow Loneliness	279.58	0.05	84	1	ns	0.10***	0.10***	ns
5. PIU \diamond Loneliness	278.25	1.28	84	1	ns	0.29***	0.15***	ns

* $p < .05$, ** $p < .01$, *** $p < .001$

characteristics. Their Internet use behaviors may also differ from those of normally developing adolescents (Siegle, 2005; Zimlich, 2016). But the multigroup model did not support the difference between the normally developing and the gifted adolescents. PIU and FoMO are related to interpersonal relationships (Sanders et al., 2000), mental health (Caplan, 2006; Kim et al., 2006; Panicker, 2014), personality (Bulut-Serin, 2011; Rozgonjuk et al., 2021), family characteristics (Bloemen & De Coninck, 2020; Cacioppo et al., 2019; Sela et al., 2020). Therefore, the structural model could lead to the same results in gifted and normally developing adolescents. There is research conducted with both gifted and normally developing adolescent examining problematic Internet use (Garcia et al., 2020). Its findings support the results of the current study. It showed that there was no difference in problematic internet use between the groups. However, no study was found that examined FoMO in gifted adolescents.

PIU and FoMO might defined as nonfunctional Internet usage concepts. As expected, and supported by previous research (Marlina, 2017) FoMO and PIU was related to each other. FoMO and PIU affected face to face communication and caused interpersonal relationships problems in adolescents (Milani et al., 2009; Wang et al., 2019). The current study results showed the link between the negative peer perception and PIU. Unexpectedly, peer perception had not a relationship with peer perception. As far as we know, this is the first study handle peer perception and FoMO. Peer relationship involves both behavior and thinking (Parker & Asher, 1993). However, perception is a concept that only encompasses an individual's thoughts (Salmivalli & Isaacs, 2005). Whether adolescents' thoughts about their peers are positive or negative, they may not miss out on nothing. It is suggested that the literature on this topic should be expanded.

Loneliness is related to loneliness and peer perception. The absence of a close friend increases feelings of loneliness. In contrast, peer acceptance and the presence of close friends results in less feelings of loneliness (Parker & Asher, 1993). Also, loneliness has a link with PIU. Prior findings supported the association between PIU and loneliness (Caplan, 2006). In the model, PIU seems to be the mediator between the relationship between FoMO and loneliness. Although these two concepts may seem similar due to the nonfunctional Internet use, PIU is a concept that includes individual use, while FoMO is related to relationships in virtual media (Przybylski et al., 2013). The Internet can be used for a variety of purposes such as online gaming, shopping, communication and social media (Kircaburun & Griffiths, 2018). PIU may include all excessive use in all these areas (Kim & Davis, 2009), while FoMO is more associated with social media. Therefore, the association between FoMO and loneliness may be related to the personal and social domains

covered by PIU. Lonely people use the Internet more frequently and primarily to communicate with others, meet new people, and receive emotional support (Morahan- Martin & Schumacher, 2000). For this reason, PIU is believed to be a mediator between FoMO and loneliness.

This study has certain limitations. First, PIU and FoMO were examined in the use of Internet use, but digital gaming habits, which vary by gender and tend to be favoured by male adolescents (Griffiths et al., 2004), were not considered. Rural areas, where internet access and opportunities may vary, were not included in the study. In addition, being gifted is a diagnostic group with a wide range. In this study, the levels of giftedness were not assessed. Another limitation is that the data of the study were collected during the pandemic COVID – 19, but without considering the social and emotional variables that may be affected by this phase. Stressful situations and incidents may lead to an increase in PIU (Cerniglia et al., 2017). Therefore, future studies should preferably consider the differences associated with Internet use during the pandemic. There are limitations with cross-sectional data. We asked students questions about their Internet use and loneliness. However, it is not possible to evaluate data that may differ before and after the time of data collection. Moreover, a longitudinal evaluation of both Internet use and loneliness will provide rich data in a process with variables and limitations such as COVID – 19. Cross-sectional studies cannot establish a cause-and-effect relationship between the findings. The cross-sectional study of gifted and normally developing adolescents in this study may be longitudinal in future studies. Finally, prevention and intervention studies on Internet use among gifted and normal students in school settings could reduce the level of loneliness.

Data availability The datasets generated during and/or analysed during the current study are available from the corresponding author on reasonable request.

Declarations

Competing interest The authors declare that they have no conflict of interest.

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