

**The Relation of Video Games and Social Problems and the Role of Sex,
Inattention and Hyperactivity Problems**

By

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Abstract

Background and Aims. Gaming has become increasingly popular among youth, with a small portion of them losing control of their behavior, resulting in negative consequences in their day-to-day lives. The current study aims to investigate risk factors associated with increased intensity and problematic gaming. The role of social problems, inattention and hyperactivity problems (IHPs) and sex is examined in relation to gaming behavior. **Method.** As part of the Health Behavior in School-aged Children (HBSC) study, a nationally representative sample of Dutch adolescent gamers ($N = 6435$) was utilized. **Results.** The findings of a stepwise regression analysis suggest a main effect of social problems on (problematic) gaming. The results show that this relation is stronger for those with IHPs. Additionally, boys appear more likely than girls, to develop problematic symptoms when gaming to compensate for social problems. **Conclusion.** The current study confirms the association of socially vulnerable youth and (problematic) gaming and the influence of IHPs on this relation. Furthermore, evidence suggests that both boys and girls compensate for social problems by playing games, but that particularly boys experience problems as a result. Longitudinal studies are required to gain a better understanding of the causality and the direction of the relation.

Keywords: problematic gaming, social problems, hyperactivity and attention problems, sex, adolescents

Achtergrond en doel. Gamen is in de recente jaren steeds populairder geworden en een kleine groep jongeren verliest controle over hun gedrag, wat resulteert in negatieve gevolgen voor hun dagelijks leven. De huidige studie probeert in kaart te brengen welke factoren geassocieerd zijn met meer gamen en problematisch gamen, gericht op de rol van sociale problemen, attentie- en hyperactiviteit problemen (AHPs) en geslacht. **Methode.** Als onderdeel van de *Health Behavior in School-aged Children* (HBSC) studie, is een nationaal representatieve steekproef van Nederlandse adolescenten gamers ($N = 6435$) gebruikt. **Resultaten.** De bevindingen van een regressie analyse suggereren een relatie tussen sociale problemen en (problematisch) gamen. De resultaten geven aan dat deze relatie sterker is voor mensen met AHPs en voor jongens. Daarnaast lijken jongens, bij gebruik van games als compensatie, vaker problematische symptomen te ontwikkelen dan meisjes. **Conclusie.** De huidige studie bevestigt de associatie van sociaal kwetsbare jeugd op gamegedrag en de invloed van AHPs op deze relatie. Verder is er bewijs dat zowel jongens als meisjes gamen als compensatie voor sociale problemen, maar dat deze strategie vooral voor jongens tot problemen leidt. Longitudinale onderzoeken zijn nodig om meer inzicht te krijgen in de richting en causaliteit van de relatie.

Sleutelwoorden: problematisch gamen, sociale problemen, attentie en hyperactiviteit
problemen, geslacht, adolescenten

The Relation of Video Games and Social Problems and the Role of Sex, Inattention and Hyperactivity Problems

In the past few years, gaming has become increasingly popular. A European based survey estimates that about 78% of the 6- to 24-years old youth are considered gamers. In the Netherlands, 35% of adolescents in middle school play games every day (Stevens et al., 2018). Generally, the amount of time spend on gaming does not necessarily reflect problematic use, however a small portion of youth does experience negative consequences as a result of gaming (Peeters et al., 2018; van den Eijnden et al., 2018). Consequences of excessive gaming can include depressive symptoms, anxiety, social phobia, aggression or lower school grades (Mihara & Higuchi, 2017; van den Eijnden et al., 2018). This problematic use is seen in 4% of secondary school students, with the majority of seven percent being male, compared to one percent female (Stevens et al., 2018).

The Diagnostic and Statistical Manual of Mental Disorders, (DSM-5) does not yet classify gaming as an addiction. It was however, added in the 5th edition as ‘a condition requiring further research’ (Mihara & Higuchi, 2017). This includes nine criteria or symptoms that can be endorsed, which are similar to other types of addiction, such as: withdrawal, tolerance, inability to control and jeopardizing career, school and relationships because of gaming (Pontes & Griffiths, 2015). In contrast, the World Health Organization (WHO) does recognize gaming addiction as a disorder, adding it to the 11th revision of the International Classification of Diseases (ICD-11) in 2018 (World Health Organization, 2018). To gain a better understanding of the underlying risk factors of problematic gaming behavior, a clear definition is important. For that reason, in this study the nine criteria of the DSM-5 are adopted to define when gaming becomes problematic.

More specifically, in this study the role of social problems, inattention and hyperactivity problems (IHPs) and sex is further examined in relation to gaming behavior in a national representative sample of young adolescents (12-16 years).

Social Problems

It is theorized that for some adolescents, gaming may fulfill very basic psychological needs, such as the need for autonomy, competence and relatedness, that are the driving force behind intrinsic motivation (Przybylski et al., 2010). In line with the self-determination theory (Ryan & Deci, 2000), research on motives for gaming indicate that these forms of intrinsic motivation may play a vital part in motivating adolescents to continue playing (Przybylski et al., 2010). Particularly interesting in this context is the need for relatedness (i.e. the need for social connectedness). Considering that the need for relatedness may be difficult to fulfill if

one experiences difficulties in social relations, it is likely that some adolescents try to find alternative ways of fulfilling social needs, for example through online gaming. Games such as *World of Warcraft* allow players to traverse large virtual worlds in which both competitive and co-operative play is central to progression (Mandryk et al., 2020). This social aspect may provide players - specifically those struggling with social interaction - the opportunity to engage and interact with peers online, rather than face-to-face.

Several studies provide empirical substantiation for this theory. For instance, longitudinal findings show social vulnerability to be a predictor of problematic gaming behaviors among young adolescents aged 12 to 16 years (Peeters et al., 2018). Additionally, a higher social competence in children was associated with less time spent on gaming later in life (Hygen et al., 2020). Furthermore, adolescents who prefer online over face-to-face interactions are at risk for problematic gaming (Männikkö et al., 2015). The authors argued that, compared to face-to-face communication, online interactions form a more pleasant and easy conversational channel for adolescents who struggle with social interactions.

These findings support the idea that gaming may serve as a substitute for real-life social interactions among adolescents who experience social problems (Peeters et al., 2018). Therefore, it is hypothesized that adolescents who experience social problems are at risk for higher gaming intensity, as well as more problematic game play, as they may compensate for a lack of social needs fulfillment in real life by playing games.

Inattention and Hyperactivity Problems

It is well documented that children and adolescents with IHPs experience more difficulties in peer relations (de Boo & Prins, 2007; Hoza et al., 2005; Koffler et al., 2015). Adolescents with IHPs suffer from issues related to self-regulation, self-control and a different reinforcement system when compared to their healthy peers (Barkley, 1997; Jeong et al., 2020). These impairments underly a social challenge that may result in adolescents with IHPs to generally be less liked (Hoza et al., 2005) and have fewer friends (Heiman, 2005) than their peers.

As mentioned earlier, online gaming may allow socially struggling adolescents to compensate for their social deprivation by interacting with other players in online games. This makes it a viable strategy for adolescents with IHPs to cope with social problems, as the issues that may arise during face-to-face interaction, such as a lack of attention for the conversation (Berenguer Forner et al., 2017), may be less pronounced in an online gaming context.

While this may appear as a beneficial strategy, literature suggests that the combination of social problems and IHPs may underly a risk for problematic gaming. In accordance with the attraction hypothesis (Gentile et al., 2020), adolescents with IHPs are drawn more towards electronic media, due to the exciting and engaging nature of media features (Gentile et al., 2020). This engagement would require more self-control to quit, which is more difficult for adolescents with IHP's (Barkley, 1997; Gentile et al., 2020; Jeong et al., 2020). This theory is substantiated by a longitudinal study by Jeong et al. (2020), in which the authors argue that IHPs is characterized by a tendency of the brain's reward systems to overestimate the value of short-term rewards. Considering the design of video games, which is often centered around short-term rewards, it may be that adolescents with IHPs are more susceptible to these types of stimuli and experience more difficulties to control their game play, therefore having an increased risk of developing problematic gaming behaviors (Jeong et al., 2020).

Thus, adolescents that experience both social problems and IHPs may be at a particular risk for developing problematic gaming behaviors, as gaming may not only satisfy their social needs, but also contains reinforcing stimuli that adolescents with IHPs are vulnerable for. Therefore it is expected that the relation between social problems and (problematic) gaming is stronger for adolescents with IHPs than those without IHPs.

Sex Differences

Another well-known risk factor for high game intensity and problematic game play is being male. Large cross-sectional data shows that boys tend to spend significantly more time playing games and exhibit more problematic gaming symptoms than girls (Stevens et al., 2018; Su et al., 2020). Longitudinal research indicates that these differences are steady over time (van den Eijnden et al., 2018). Several explanations for sex differences can be considered.

Dong et al. (2018) suggest that there is evidence for a difference in the processing of neural signals, with boys having a higher activation of the thalamic system while engaging in video games. The thalamic system is responsible for experiencing cravings, and the higher activation may underlie a vulnerability for boys to develop problematic and addictive-like gaming behaviors. Alternatively, some researchers suggest that this difference between sexes is largely due to the competitive nature of games, which appeals more to boys than to girls (Wartberg et al., 2020). Barua and Barua (2012) add to this explanation, arguing that most video games are primarily targeted to and designed for boys. As boys continue to be the biggest consumer of games, video game designers will continue to be incentivized to include

features that are more attractive to boys, including masculinity, violence and similar characteristics which do not necessarily appeal to girls.

Considering that games may be more appealing to boys, it is hypothesized that when experiencing difficulties in social relations, gaming may be a more appealing compensation method for boys than for girls. Girls may more likely adopt different strategies, such as compensation through online social media sites (Booker et al., 2018; Keresteš & Štulhofer, 2018; Tsitsika et al., 2014). Therefore it is expected that the relationship between social problems and (problematic) gaming will be stronger for boys than girls.

Current Study

The current study aims to further identify the relation between social problems and (problematic) gaming behavior. Additionally, this study also tries to identify the influence of IHPs and sex on the relation between social problems and gaming behavior. These relations are all illustrated in the conceptual model (see Figure 1), and are in accordance with the following hypotheses.

First, findings suggest that some adolescents are motivated to play games through their need for relatedness with peers. Those with social problems may use games as an alternative to fill these social needs (Hygen et al., 2020; Peeters et al., 2019). Additionally, games may provide an easier channel for social communications (Männikkö et al., 2015). Thus, leading to the following hypothesis:

H1: There is a positive association between social problems and (problematic) gaming behavior

Second, literature suggest that adolescents with IHPs experience more social problems than their healthy peers (de Boo & Prins, 2007; Hoza et al., 2005; Koffler et al., 2015). Additionally, it is known that adolescents with IHPs experience difficulties in self-control and have a tendency to overestimate the value of short term rewards in video games (Barkley, 1997; Jeong et al., 2020). This creates the following hypothesis:

H2: The relation between social problems and (problematic) gaming behavior is stronger for adolescents with inattention and hyperactivity problems.

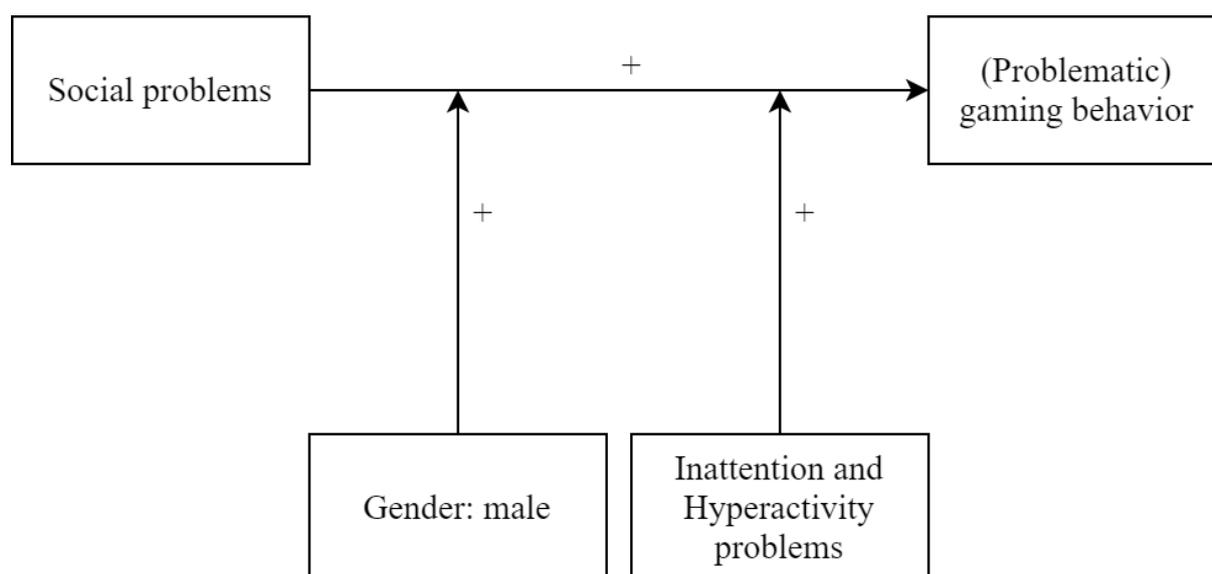
Third and finally, findings on sex differences suggest that the activation of the thalamic system is stronger for boys than for girls. This suggests that boys may experience gaming as rewarding and are more vulnerable to develop addictive-like symptoms as a result of games (Dong et al., 2018). Also taking into account the design of video games, which are largely targeted towards boys (Barua & Barua, 2012; Wartberg et al., 2020), the following hypothesis is assumed:

H3: The relation between social problems and (problematic) gaming behavior is stronger for boys than for girls.

Research also indicates that there are several factors that should be controlled for (Stevens et al., 2018), including: educational level, familial circumstances and social economic status (SES).

Figure 1

Visual representation of the proposed model



Method

Participants

The current study used data from the Health Behavior in School-aged Children (HBSC) study (Stevens et al., 2018). This is an ongoing cohort study amongst a representative sample of Dutch adolescents between 12-16 years old, aimed to monitor the health and lifestyle of today's youth on a wide range of topics. The HBSC study collects data every 4 years, however, the participants included in this particular study are limited to the 2017 measurement, as this is the first measurement including the questionnaire on gaming behavior.

In the total sample (N= 8965), sex was mostly evenly distributed (49% boys) and the average age was 13.6 (SD = 1.91; range 10 - 20). The majority (77%) lived with both parents and originated from a native Dutch household (79%). Of the secondary school students, 31% followed preuniversity level education (i.e. the highest level of secondary education), 26%

followed higher general secondary education, 28% went to higher vocational level education and 15% to lower vocational level education.

Procedure

The participants were recruited through the Dutch school system. Schools were approached with an initial request to participate in the study, of which 72 primary schools and 85 secondary schools agreed to participate. Parents of the corresponding classes were contacted to inform them of the study and to give the option to withdraw their child from the research. Additionally, the participating adolescents also provided consent for participation. Research-assistants administered the tests in the classrooms and provided the verbal explanation of anonymity, voluntariness and instructions for the questionnaires. For a more detailed description of the procedures, see the full rapport by Stevens et al. (2018).

The HBSC study was approved by the Facultaire Ethische Toetsingscommissie (FETC) of Utrecht University (FETC17-079 Stevens-de Looze), as was the use of the data in the current study (FETC20-0492).

Measures

Gaming Intensity

Gaming intensity was measured using two items. The first item assessed on how many days a week an individual plays, answered on a 6-point Likert scale (1 = *(almost) never*, 6 = *(almost) everyday*), with lower scores indicating lower frequency of gaming behaviors. The second item assessed the hours played during a given session, answered on a 5-point Likert scale (1 = *1 hour or less*, 5 = *8 hours or more*), with lower scores indicating fewer hours spent on gaming. Both items were recoded into continuous variables and multiplied to calculate the average hours spent gaming on a weekly basis. Internal consistency could not be measured due to the two-item nature of the scale.

Problematic Gaming

Problematic gaming was measured using the Internet Gaming Disorder Scale (Lemmens et al., 2015). This scale consists of nine dichotomous items based on the DSM-5 criteria for Internet Gaming Disorder. Participants will indicate whether or not they perceived the proposed symptoms. A higher score indicates more symptoms. An example item is; “In the past half year, have you experienced serious conflicts with friends or your parents as a result of gaming?” Cronbach’s α for this subscale was acceptable ($\alpha = .74$).

Social Problems

The construct of social problems was measured using the subscale ‘peer problems’ from the Strength-Difficulties Questionnaire (SDQ; Goodman, 1997). Answered on a 3-point

Likert scale (0 = *not true*, 1 = *slightly true*, 2 = *very true*). An example item is; “In general, other peers of my age tend to like me”. Lower scores indicate more social problems. Cronbach’s α of this subscale was low ($\alpha = .43$). The validity of the SDQ has been supported by a recent study in a Dutch national sample (Duijnhof et al., 2015). The authors conclude the subscale to be invariant over time and valid between subgroups with different backgrounds.

Inattention/ Hyperactivity Problems

To measure IHPs, the subscale hyperactivity/attention problems from the SDQ was used (Goodman, 1997). Questions are answered on a 3-point Likert scale (0 = *not true*, 1 = *slightly true*, 2 = *very true*). Examples items are: “I am easily distracted”, and “I find it hard to concentrate”. Higher scores indicate greater intensity of IHPs. Cronbach’s α of this subscale was acceptable ($\alpha = .69$).

Data Analysis

To answer the main question, a stepwise regression analyses was performed to examine the main effect of social competence on gaming intensity and problematic gaming, while controlling for educational level, two-parent families and SES. An interaction was added to the model to test whether sex or IHPs moderates the relation between social competence and gaming intensity and problematic gaming. Descriptive statistics were retrieved for the all study variables and *t*-tests were used to examine differences between groups. All analyses were performed in IBM SPSS statistics version 27.

Assumptions

Before the regression analysis, variables were recoded and means and standard deviation were calculated for each scale. The data was screened on inconsistencies and several assumption were checked. No high correlations between the independent variables were seen, indicating no multicollinearity. Inspection of distribution revealed that the variables social problems, IHPs and problematic gaming behavior were left-skewed. Consequently, those who scored relatively high on any of the skewed variables were indicated by the software as outliers. However, no further action was taken, as these outliers and the non-normality of the data were inherent to the nature of the items. Lastly, scatterplots were used to check for linearity between variables. These showed the assumption of linearity to be violated as there is no linear relation between the dependent and independent variable. The violation of these assumptions should be considered when interpreting the results.

Results

Descriptive Statistics

Descriptive statistics are shown in table 1. Only participants that indicated to play games at least once a week were included in the analysis sample. *T*-tests were performed to test if the non-gamers significantly differed from the gamer sample. This indicated that the non-gamer scored slightly lower on social problems ($t = -2.61, p < .01$) and IHPs ($t = -3.29, p < .01$). Non-gamers were also more often female ($t = -54.07, p < .01$).

After the non-gamers (2526, 84% female) were excluded, a subsample of gamers remained (6435, 37% female). Within the sample of gamers, girls reported fewer hours spent ($t = -30.55, p < .01$) and fewer problematic gaming symptoms ($t = -25.51, p < .01$) compared to boys. No sex differences were found for families with two parents, educational level, social or attention problems.

Table 1

Descriptive statistics

	<i>M (SD)</i>			
	Non-gamers	Gamers	Boys* (63%)	Girls* (37%)
Two-parent family (yes)	77%	77%	77%	76%
Educational level				
<i>Preuniversity</i>	30%	31%	30%	32%
<i>Higher general</i>	26%	26%	27%	25%
<i>Higher vocational</i>	28%	28%	27%	28%
<i>Lower vocational</i>	16%	15%	16%	15%
Problematic gaming	-	1.22 (1.70)	1.58 (1.85)	0.62 (1.18)
Gaming intensity	-	12.09 (11.32)	14.98 (11.86)	7.24 (8.37)
Social problems	1.32 (0.32)	1.34 (0.32)	1.34 (0.33)	1.34 (0.32)
IHPs	1.80 (0.48)	1.83 (0.47)	1.83 (0.47)	1.83 (0.48)

Note. *Subsample only includes gamers

Correlations

Table 2 shows the correlations between all study variables. Higher scores on problematic gaming were associated with higher gaming intensity ($r = .46, p < .01$), more social problems ($r = .24, p < .01$), having IHPs ($r = .20, p < .01$) and being male ($r = .28, p < .01$). Similar associations were found for intensity of gaming, which shows a higher gaming intensity was associated with more social problems ($r = .14, p < .01$), having IHPs ($r = .12, p$

< .01) and being male ($r = .33, p < .01$). Additionally higher scores on IHPs were associated with more social problems ($r = .11, p < .01$).

Table 2

Correlation matrix between variables.

	1.	2.	3.	4.	5.	6.	7.	8.
1. Problematic gaming								
2. Gaming intensity	0.46**							
3. Educational level	-0.06**	-0.15**						
4. Two-parent families	-0.05**	-0.07**	0.16**					
5. SES	-0.02	-0.02	0.20**	0.14**				
6. Social problems	0.24**	0.14**	-0.20**	-0.08**	-0.14**			
7. IHPs	0.20**	0.12**	-0.16**	-0.07**	0.03	0.11**		
8. Sex	0.28**	0.33**	-0.01	0.02	0.07**	.00	.00	

Note. Effect is significant at ** $p < .01$ and * $p < .05$ (two-tailed).

Regression

Main association of social problems, sex and IHPs in (problematic) gaming

To test the main association between social problems and (problematic) gaming, regression analyses were performed while controlling for educational level, having two parents and family SES. These results are shown in Table 3 and 4. In model 2, the predictor social problems was added and the results indicated a positive association between problematic gaming and social problems ($\beta = .08, p < .01$), as well as a positive association between gaming intensity and social problems ($\beta = .12, p < .01$). The main effects while controlling for educational level, two-parent families and SES, explain 6% of the variance in problematic gaming ($R^2 = .06, p < .01$) and 4% in intensity of gaming ($R^2 = .04, p < .01$).

Furthermore, in model 3 both sex and IHPs were added, which showed to be positively associated with problematic gaming ($\beta = .23, p < .01$; $\beta = .18, p < .01$) and gaming intensity ($\beta = .34, p < .01$; $\beta = .09, p < .01$). Model 3, which included all three main associations and while controlling for educational level, two-parent families and SES, explained 17% of the variance in problematic gaming ($R^2 = .17, p < .01$) and 16% in intensity of gaming ($R^2 = .16, p < .01$).

Finally, the confounding variables were tested in model 1, which showed problematic gaming was negatively associated with educational level ($\beta = -.05, p < .01$) and living in a

two-parent family ($\beta = -.04, p = .01$), indicating that adolescents who were problematic gamers were more likely to be in the lower educational levels and more likely lived in single parent families. SES was not significantly associated in any model. Overall, the confounding variables explained less than 1% of the variance in problematic gaming ($R^2 < .01, p < .01$) and 3% in gaming intensity ($R^2 = .03, p < .01$).

Table 3

Relations of social problems, sex and IHPs on problematic gaming

	Model 1	Model 2	Model 3	Model 4	Model 5
	Problematic gaming β				
1. Educational level	-.05**	.02	.03*	.03*	.03*
2. Two-parent families	-.04*	.06*	-.02	-.02	-.02
3. SES	.00	.04	-.01	-.01	-.01
4. Social problems		.08**	.23**	.23**	.16**
5. IHPs			.29**	.03	.18**
6. Sex			.18**	.29**	.06
7. Social problems * IHPs				.15**	
8. Social problems * sex					.25**
R^2	<.01**	.06**	.17**	.17**	.17**

Note. Effect is significant at ** $p < .01$ and * $p < .05$ (two-tailed).

Table 4*Relations of social problems, sex and IHPs on gaming intensity*

	Model 1	Model 2	Model 3	Model 4	Model 5
	Game intensity β				
1. Educational level	-.14**	-.12**	-.10**	-.10**	-.10**
2. Two-parent families	-.05**	-.05**	-.05**	-.04**	-.05**
3. SES	.00	.02	-.01	-.01	-.01
4. Social problems		.12**	.11**	.11**	.10**
5. IHPs			.09**	-.11	.09**
6. Sex			.34**	.34**	.28**
7. Social problems * IHPs				.20**	
8. Social problems * sex					.06
R^2	.03**	.04**	.16**	.16**	.16**

Note. Effect is significant at ** $p < .01$ and * $p < .05$ (two-tailed).

Interaction of sex and IHPs with social problems on (problematic) gaming

To test the interaction of sex and IHPs on the relation between social problems and problematic and intensity of gaming, interaction terms were added in model 4 and 5. For the relation with problematic gaming, model 4 shows the interaction effect of IHPs was significant ($\beta = .15$ $p < .01$), indicating that the relationship between social problems and problematic gaming is stronger for adolescents with IHPs (see Figure 3). Similarly, for the relation with gaming intensity, the interaction with IHPs was also significant ($\beta = .20$ $p < .01$), indicating that the relationship between social problems and gaming intensity is particularly strong for adolescents with IHPs (see Figure 4). While controlling for educational level, two-parent families and SES, the interaction effects of IHPs and main associations explain 17% of the variance in problematic gaming ($R^2 = .17$, $p < .01$) and 16% in gaming intensity ($R^2 = .16$, $p < .01$).

For the relation with problematic gaming, model 5 shows a significant interaction effect of sex ($\beta = .25$ $p < .01$). This finding indicates that the relationship between social problems and problematic gaming is particularly strong for boys (see Figure 2). With regards

to gaming intensity, the interaction effect of sex was not significant. While controlling for educational level, two-parent families and SES, the interaction effects of sex and main associations accounted for 17% of the variance in problematic gaming ($R^2 = .17, p < .01$) and 16% in gaming intensity ($R^2 = .16, p < .01$).

Figure 2

Simple slopes for the interaction of IHPs with social problems and problematic gaming

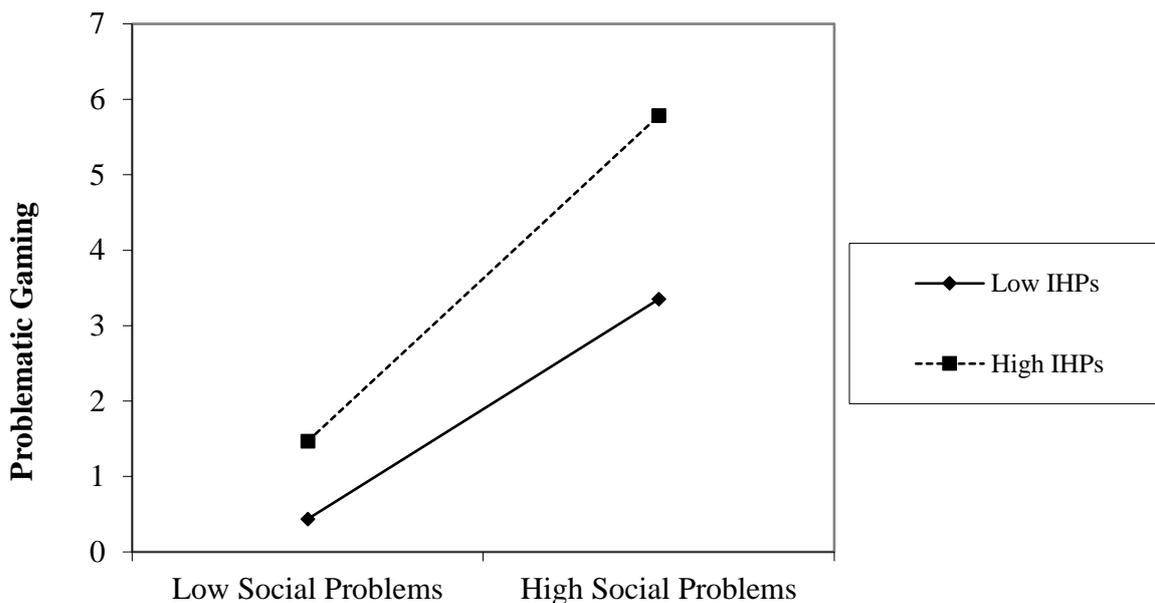


Figure 3

Simple slopes for the interaction of sex with social problems and problematic gaming

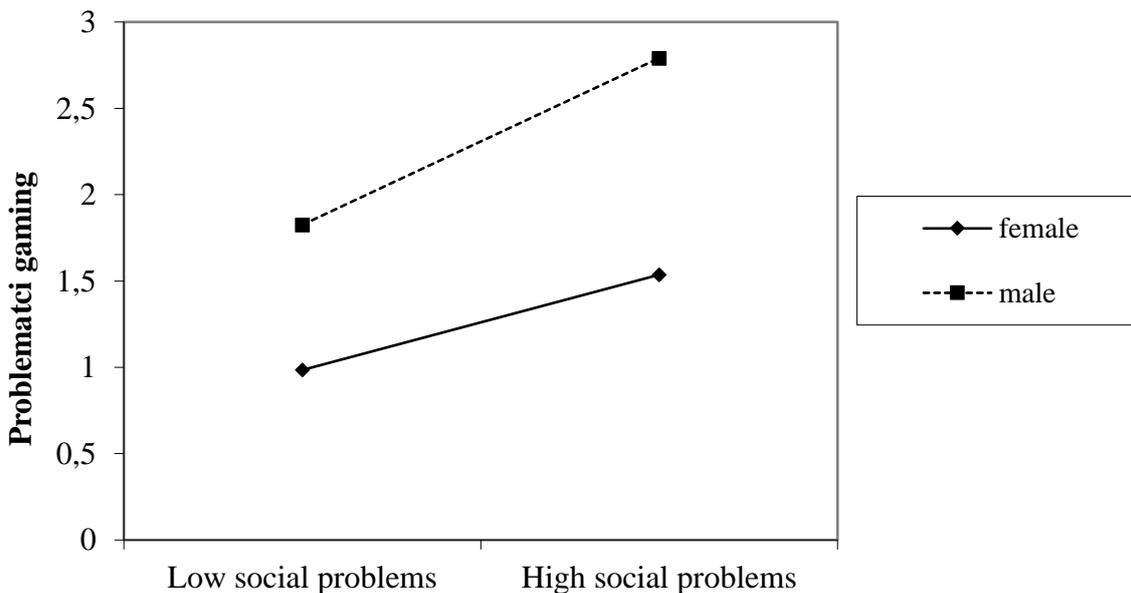
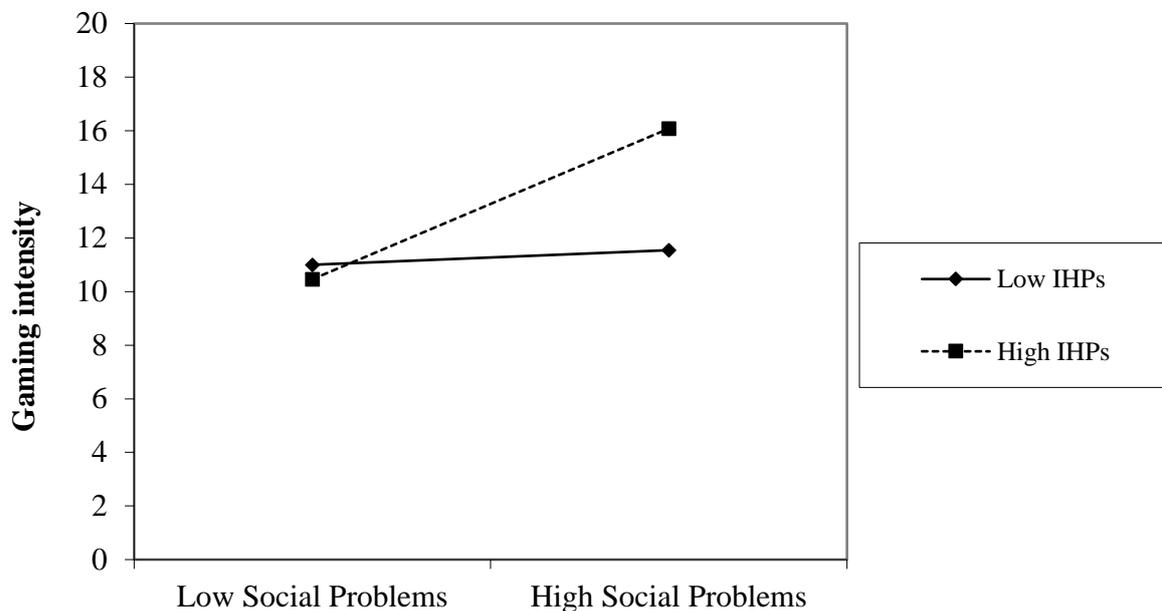


Figure 4

Simple slopes for the interaction of IHPs with social problems and gaming intensity



Discussion

Principle findings

The aim of the present study was twofold. First, to strengthen the knowledge regarding the relation between social problems and (problematic) gaming. Second, to explore how this relation may be influenced by IHPs and sex.

With respect to the first aim, it was hypothesized that adolescents who experience social problems will report higher gaming intensity and will experience more problematic gaming symptoms. The results of the current study confirm this hypothesis. These findings are in line with the literature, indicating that adolescents with social problems may use games as an alternative to fill certain social needs (Hygen et al., 2020; Peeters et al., 2018) that are otherwise not being met. More specifically, a need for relatedness (i.e. social connectedness), as discussed in the self-determination theory of motivation (Ryan & Deci, 2000), may be vital to adolescents' intrinsic motivation for playing games. This can motivate adolescents to continue to play games, despite the possible tangible (e.g. the costs of games) and social (e.g. conflicts with parents) costs of playing (Przybylski et al., 2010). Simultaneously, games may provide the individual with a communication channel that can be easier to navigate than face-to-face interactions (Männikkö et al., 2015).

With respect to the second aim, it was expected that the relation between social problems and (problematic) gaming was particularly strong for adolescents with IHPs and

boys. As hypothesized, the results indicate that the relation between social problems and (problematic) gaming is stronger for adolescents with IHPs. These findings are in line with the current literature, indicating that adolescents with IHPs are known to struggle in social interactions (de Boo & Prins, 2007; Hoza et al., 2005; Koffler et al., 2015) and games may provide a pleasant alternative. The interactive and engaging nature of games may grasp the attention of adolescents with IHPs in a way that offline interaction may not (Gentile et al., 2020). This makes games an attractive alternative to fulfill their social needs. Additionally, literature suggest that adolescents with IHPs may be more susceptible to reinforcement stimuli typical in games (Barkley, 1997; Gentile et al., 2020; Jeong et al., 2020). These reinforcement stimuli may make it harder to quit the games, providing opportunity for problematic symptoms to develop. The combination of aggravated social problems and attention grabbing features in games may therefor increase the likelihood of higher game intensity and problematic gaming in adolescents with IHPs.

With respect to sex, it was expected that the relation between social problems and (problematic) gaming was stronger for boys than for girls. The results partially confirmed this hypothesis. For problematic gaming, there was indeed a stronger relation between social problems and problematic gaming for boys than for girls. This is in line with previous literature, suggesting that for boys, games may provide a more appealing compensation method for their social problems than for girls. In addition, prior research suggests that sex differences in neural processing may cause boys to experience addiction-like cravings for games stronger than girls (Dong et al., 2018). These increased cravings may be the foundation for the development of problematic gaming behavior. Additionally, it is known that most games are more designed and marketed towards boys, further increasing the attractiveness as a coping strategy to deal with social difficulties for boys in particular (Barua & Barua, 2012; Wartberg et al., 2020). Girls may turn to other outlets, such as social media (Booker et al., 2018; Keresteš & Štulhofer, 2018; Tsitsika et al., 2014).

Results on gaming intensity only showed a main association of sex on gaming intensity and no interaction of sex, indicating that the relationship between social problems and intensity of gaming is not necessarily stronger for boys. Explanations for this finding may be found in the differences in how each boys and girls differently adopt coping strategies to deal with social difficulties (van den Eijnden et al., 2018).

Considering that the relation of social problems with problematic gaming is stronger for boys, findings of the current study suggest that, while girls do use gaming as compensation strategy for social problems, particularly boys tend to develop problematic

gaming as a result of it. Interestingly, girls seem to cope with their social difficulties by using social media (Booker et al., 2018; Keresteš & Štulhofer, 2018; Tsitsika et al., 2014). Girls are generally more likely to develop problematic social media use symptoms than boys (van den Eijnden et al., 2018). This illustrates that, in context of compensation strategies for social problems, boys may be more likely to develop problematic gaming, whereas girls may more likely develop problematic social media use.

Strengths and limitations

The results of the current study provide support for social problems, IHPs and sex as being important risk factors for problematic gaming. The results have to be interpreted with some caution, as there are several limitations that may have influenced the results. First, this study uses cross-sectional data, therefore no effects of causality or longitudinal relations may be inferred. For example, based on this study it remains unclear whether (problematic) gaming causes an individual to experience social problems or if social problems may cause an increase in gaming intensity and problems. Though, the results are in line with longitudinal studies finding similar results (van den Eijnden et al., 2018).

Additionally, the measurement used in the current study to assess problematic gaming is under criticism with respect to its validity and specificity. Several authors have published works criticizing the DSM-5 criteria-based diagnosis for its vague description (Kuss et al., 2017), as well as the content and wording of the criteria themselves (Griffiths et al., 2016; Kiraly et al., 2017). Further research into the definition and conceptualization of the disorder as well as the differentiation of disordered gamers versus engaged gamers is required.

Conclusion and implications

To conclude, the results of this study contribute to prior research by replicating the finding that social problems are a risk factor for problematic gaming, in a national representative adolescent sample. This replication in a national cohort is important because it increases our understanding of problematic gaming and associated risk factors in general adolescent samples. Identification of risk factors facilitates the development of interventions for specific adolescents. Indeed, while healthy gameplay may be no immediate cause for concern, excessive use should be monitored. Based on the findings regarding social problems, interventions targeting alternative compensation methods for social problems may prove useful in decreasing the amount of time spent playing games. Hobbies such as sport may be particularly interesting for adolescents with IHP and males. In general, sports are more popular amongst males (Elling et al., 2018) and may additionally provide adolescents with IHPs an outlet for their excess energy that may benefit their overall cognitive abilities

(Hattabi et al., 2019; Pan et al., 2016; Suarez-Manzano et al., 2018). Therefore, future research should focus on investigating whether sport-based intervention may prove effective for addressing this specific risk group of problematic adolescent gamers.

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