Utrecht University

A Multiplayer Solution? The Moderating Role of Peer and Family Support in the Relation between Stress and Gaming Activity

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Master thesis

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June 24, 2024

Word count: 5812

This thesis has been written as a study assignment under the supervision of a Utrecht University teacher. Ethical permission has been granted for this thesis project by the ethics board of the Faculty of Social and Behavioral Sciences, Utrecht University, and the thesis has been assessed by two university teachers. However, the thesis has not undergone a thorough peer-review process so conclusions and findings should be read as such.

Abstract

With the increasing popularity of online gaming, so has the number of problematic gamers increased. Following this trend, researchers have tried to understand the development of Internet Gaming Disorder (IGD). This cross-sectional quantitative study using the Dutch HBSC data (N = 4060) examined the relation between stress and IGD and stress and gaming intensity in adolescents aged 12-18. Additionally, the moderation of these relations by peer support and family support were tested, to fill this gap in the growing body of research. It was hypothesized that stress is positively associated with both IGD and gaming intensity, and that both peer support and family support would moderate these relations. Using stepwise linear regression analyses a negative relation was found between stress and both IGD and gaming intensity, as well as a main effect of peer support. No significant moderation effects were found. In conclusion, an increase in stress is associated with less IGD. This finding contradicts current literature, emphasizing the need for further research into this topic to achieve undisputed knowledge as a basis for intervention.

Keywords: Adolescents, Stress, IGD, Peer Support, Family Support

Table of contents

Internet Gaming Disorder 6
The Relation between Stress and IGD 6
Perceived Social Support 8
Peer Support 9
Family Support 10
Hypotheses 12
Methods 12
Design and Participants 12
Procedure and Ethics 13
Gaming Activity 15
Stress 15
Peer support 16
Family support 16
Analysis 16
Results 18
Descriptive statistics 18
Regression analysis 19
Model 1 19
Model 2 20
Discussion 22
Limitations and Recommendations 24
References 27
Appendix A 37
Appendix B 39
Appendix C 41

"Boy's suicide triggers debate over banning PlayerUnknown's Battlegrounds in India" (Dhillon, 2019). This headline was the result of the suicide of a 16-year-old boy after his mother reprimanded him for spending too much time on internet gaming instead of studying. While this is an extreme case, it displays the severe impact an excessive desire for gaming can have.

As the popularity of online gaming increases, so does the body of literature surrounding it. Gaming is found to be beneficial for motor skills (Afşar et al., 2018) and has a positive effect on well-being and maintaining happiness (Van Nguyen et al., 2018). Gaming can also be integrated with education, allowing games to play a positive role (Раскуражев et al., 2021; Tsoy et al., 2019). However, when gaming takes the form of a game addiction, or internet gaming disorder (IGD), there are detrimental effects. IGD is characterized by continuous and reoccurring gaming to the extent that harms daily life. People with IGD use less effective emotional regulation strategies then people without IGD, increasing the risk to their well-being (Yen et al., 2017). Comparable to other addictions, IGD leads to multiple neurocognitive deficits such as working memory impairment, deteriorated decision-making, and reduced personal perceptions (Chen-Guang et al., 2020). Thus, the consequences of IGD are severe and there is a substantial difference in gaming activity between IGD and gaming intensity (i.e. time spent gaming).

These severe consequences are not withheld from the Netherlands. 4,0% of Dutch secondary school children have an IGD (Stevens et al., 2018). Given the severity of the effects of an IGD in addition to the chronological trend of increased technology usage, concern is warranted. The number of secondary school intensive gamers (gaming 24 hours a week or more) was 8% in 2017 (Stevens et al., 2018). Moreover, the COVID-19 pandemic has led to a global increase in gaming activity, while restricted social contacts increased the

risk of problematic gaming (King et al., 2020; O'Loughlin et al., 2022). It is important to note that although gaming intensity acts as a risk factor and symptom of IGD, a high gaming intensity does not equate to IGD (American Psychiatric Association, 2013; King et al., 2020; World Health Organization, 2019). Therefore, it is of value to understand the distinction between high gaming intensity and IGD, to effectively address IGD.

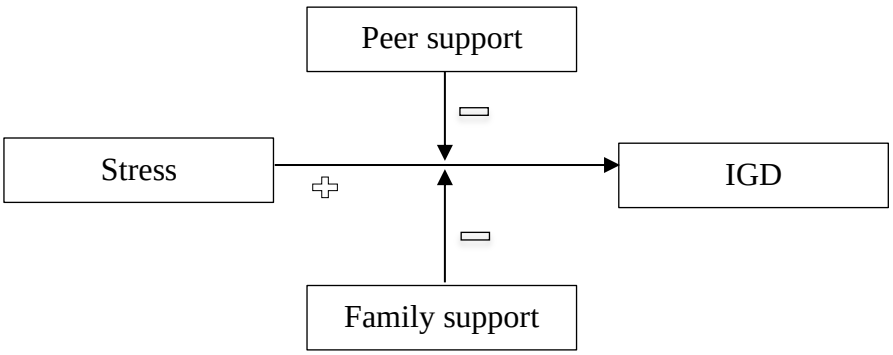
Additionally, to address IGD, it is crucial to understand what may cause it. Research about IGD often presents stress as one of the risk factors for IGD (Dong & Potenza, 2014; Gu & Mao, 2023; Kaess et al., 2017; Li et al., 2022). Stress and IGD seem to be interrelated in multiple ways. People use gaming as a way of stress-reduction (Dong & Potenza, 2014). The relationship between stress and IGD is consistent across various forms of stress: academic stress is found to be a risk factor for IGD (Gu & Mao, 2023), as well as stressful life events (Li et al., 2022). Recently, 49% of Dutch youth reported feeling stressed very often (Mentale Gezondheid Jongeren, 2023), which underscores the importance of further understanding this risk factor.

Research has found being bullied, bullying, and low self-esteem to be other risk factors for IGD (Gao et al., 2022). A common denominator for these factors is the influence of peer support. Peer support is found to mitigate the effect of bullying and reduce bullying (Cowie, 2011; Tzani et al., 2019), and increases self-esteem (Roach, 2018). Peer support has a relationship to stress as well, wherein stress is reduced through peer support (Agarwal et al., 2019). Similarly, family support has been found to decrease stress and increase general well-being (Arslan, 2009; Xian et al., 2022). Family support also promotes the engagement in significant social ties (Inguglia et al., 2014), posing it against bullying and low self-esteem as well. Therefore, peer and family support might alter the cognitions or feelings caused by

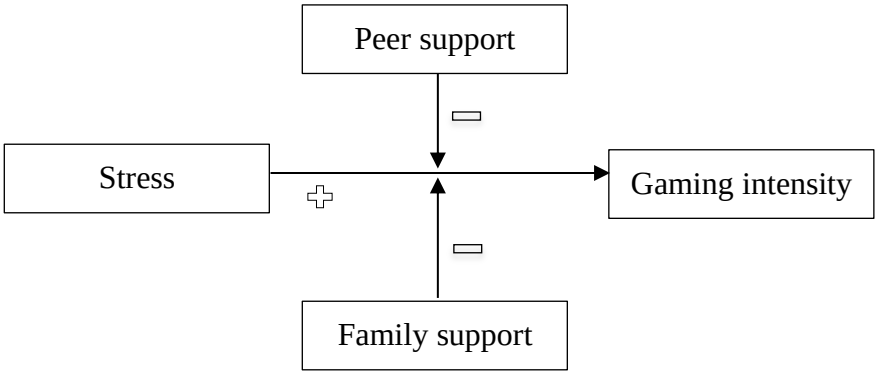
stress that lead to IGD. Accordingly, research including peer and family support might lead to a better understanding of the development of IGD.

Although peer support is connected to multiple risk factors for IGD, to the best of our knowledge, it has not been researched in combination with stress. No research was found examining stress, family support, and IGD either. Taking into consideration the rise in prevalence of both stress and IGD, peer and family support might play important roles in mitigating the possible harmful effects of gaming activity. Figure 1 shows conceptual models of these possible associations, where gaming activity is divided into IGD and gaming intensity. Thus, this research will focus on the research question: To what extent is perceived stress related to gaming activity, and is this moderated by peer support and/or family support in Dutch adolescents aged 12-18?

Figure 1
Relation Between Stress and Gaming Activity Moderated by Peer and Family Support
Model 1



Model 2



Internet Gaming Disorder

The American Psychiatric Association (APA) acknowledged the rise in concern about problematic gaming with the admission of Internet Gaming Disorder into the DSM-5 in 2013. Here, IGD is defined as "persistent and recurrent use of the internet to engage in games, often with other players, leading to impairment or clinically significant distress" (American Psychiatric Association, 2013, p. 795). Another commonly used definition for problematic online gaming is that of the World Health Organization (WHO). The difference between the definitions lies in the classification. WHO's definition states that a person must express this behavior for at least 12 months to be diagnosed with a gaming disorder (World Health Organization, 2019). In the DSM-5 the expression of at least five out of nine symptoms within a year can lead to a diagnosis of IGD.

Due to the harmful nature of addiction, it is beneficial to address this problem as early as possible. Therefore, this paper will use the APA formulated definition. Integrated within both definitions is the gaming intensity. Although time spent gaming does not equate to IGD, IGD is correlated with frequent gaming (Gandolfi et al., 2023; Gentile et al., 2017). To distinguish between avid gamers and IGD within the construct of gaming activity, this paper will separately examine correlations to IGD symptoms and gaming intensity.

The Relation between Stress and IGD

Stress is the result of environmental demands that exceed an individual's regulatory capacity. Oftentimes, these situations include unpredictability and uncontrollability (Koolhaas et al., 2011). Physiologically, stress can be described as "an anticipatory response (unpredictable) or a reduced recovery (uncontrollable) of the neuroendocrine reaction." (Koolhaas et al., 2011, p. 1291). This study will focus on perceived stress, which is defined as the extent to which the imbalance between environmental demands and the regulatory

capacity is experienced. Research has found stress to be related to IGD (Dong & Potenza, 2014; Gu & Mao, 2023; Kaess et al., 2017; Li et al., 2022).

Kaess et al. (2017) found that psychological and neurobiological stress reactivity in individuals with IGD differed from those without IGD as well as individuals with IGD reporting greater everyday- and chronic stress. Gaming has been theorized to act as a coping mechanism for this stress: Dong and Potenza (2014) theorized that gaming functioned as a stress reduction method, fulfilling a negative reinforcement model, while Gu and Mao (2023) found evidence for a mediating effect of escape and coping motives in the relation between stress and IGD. Li et al. (2022) found support for a relation between stressful life events and IGD, which was mediated by neuroticism in the diathesis stress model framework. These findings stipulate the position of gaming as a harmful coping strategy.

The relation between stress and IGD can possibly be explained by the self-determination theory (SDT). The SDT (Ryan & Deci, 2000, 2017) is a framework examining how social contexts and individual differences promote varying types of motivation. It posits that every individual has three basic psychological needs, the fulfillment of which leads to "the optimal motivational traits and states of autonomous motivation and intrinsic aspirations, which facilitate psychological health and effective engagement with the world." (Deci & Ryan, 2015, p. 486). The three basic psychological needs are the needs for autonomy, competence, and relatedness (Ryan & Deci, 2000, 2017).

Perceived stress leads to a decrease in psychological well-being (Klainin-Yobas et al., 2021), which reduces perceived autonomy (De-Juanas Oliva et al., 2020). SDT describes this as *needs frustration* (Ryan & Deci, 2000, 2017). When needs are frustrated in one domain of life, it results in need substitutes or compensatory behaviors to relieve this frustration (Vansteenkiste & Ryan, 2013). Need substitutes are goals set to fulfill the frustrated need

(Ryan & Deci, 2000). These are often extrinsic goals, as opposed to the intrinsic needs. Compensatory behaviors are releasing self-control, rigid behavioral patterns, and oppositional defiant behavior (Vansteenkiste & Ryan, 2013).

Research has shown that needs frustration is related to IGD and increased IGD symptoms (Mills & Allen, 2020; Mills et al., 2017). Mills et al. (2017) found evidence for a relation between both competence frustration and relatedness frustration and IGD, which they explained by a decrease in well-being. Autonomy frustration was found to be a mediator between specific types of motivation and IGD. The proposed explanation was that individual's solely felt valued and appreciated in the online gaming community, due to low self-esteem. Perceived stress is related to a lower self-esteem (Lee et al., 2012; Srivastava & Kiran, 2015), conceivably explaining the relation between stress and IGD in adolescents. Mills and Allen (2020) theorized that the association between needs frustration and IGD resulted from the tax of daily needs frustration on an individual's limited psychological resources to enact self-control. With a correlation between self-control and IGD, their findings substantiated this theory.

In addition to this release of self-control, gaming can be a rigid behavioral pattern providing structure, predictability, and security (Vansteenkiste & Ryan, 2013) in times of stress. IGD can therefore pose as different forms of need substitutes for adolescents with frustrated needs due to stress.

Perceived Social Support

This research will regard both peer support and family support as subcategories of perceived social support. Perceived social support can be defined as "information leading the subject to believe that he is cared for and loved, esteemed, and a member of a network of mutual obligations." (Cobb, 1976, p. 300).

Social support has been linked to improved well-being, especially in times of stress (Taylor, 2011). It has both psychological and physiological effects "by helping individuals to control their emotional response to stressful situations […] and by keeping physiological, neuroendocrine, and immunologic responses to stress at low levels or by promoting faster recovery of these systems following stress." (Taylor, 2011, p. 207). Furthermore, social support negatively correlates with different types of addiction (Cao & Zhou, 2019; Hatun & Kurtca, 2023). Thus, it is likely that social support decreases IGD as well.

Peer Support

Mead et al. (2001) state that peer support is based on the ability to identify with another person due to a likeliness to oneself. It is described as a system revolving around giving and receiving help based on respect, shared responsibility, and a shared notion of what is helpful (Mead et al., 2001). This includes emotional help through "understanding another's situation empathically through the shared experience of emotional and psychological pain" (Mead et al., 2001, p. 135). Especially in adolescence, when a sense of self is developed and social relations and cognitions become more eminent, peer support is consistently found to be very influential (Roach, 2018).

Peer support has also consistently been found to reduce stress (Agarwal et al., 2019; McClure & Moore, 2020; Peterson et al., 2008), therefore decreasing the risk of developing IGD. There are different explanatory theories about this relation. The reduction of stress has been attributed to the understanding of your unique stressors, the encouragement to take action, and simply confiding in others about your stressors (Agarwal et al., 2019; McClure & Moore, 2020; Peterson et al., 2008).

It can be argued that these explanations are all beneficial to self-control and self-esteem. Mead et al. (2001) found that as trust is built in the relationship, individuals can

respectfully challenge each other, creating room to experiment with new behaviors and to distance from previous self-concepts. Therefore, adolescents might distance themselves from a concept of low self-esteem or prioritize self-control. Other research has validated the positive effect of peer support on self-esteem (Alrashidi et al., 2023; Lan & Wang, 2019). Within the STD framework, this increase in self-esteem, and possibly self-control, will mitigate needs frustrations due to stress, especially the frustration of autonomy will be decreased when self-esteem increases. This will moderate the dependency on gaming to fulfill these frustrated needs.

When the need for relatedness is frustrated, gaming can provide adolescents with the feeling of connectedness in the form of a like-minded gaming community (Blake & Sauermilch, 2021). Moreover, the attractiveness of a gaming community is positively related to IGD (Gandolfi et al., 2023). Notably, the receptiveness of a game community correlates negatively with IGD (Gandolfi et al., 2023). Evidence suggests that gaming communities stimulate social learning and supportive communities are capable of mitigating IGD (Bandura, 1977; Gandolfi, 2022). Peer support is likely to mitigate IGD as well. Since peer support is based on a likeliness with the other, it can be argued that peer support will increase feelings of relatedness. Certain research regards peer support as a form of relatedness (Duncan et al., 2017). Therefore, it is likely that supporting peers can exert the same mitigating effect on IGD. Thus, peer support moderates the effect of stress on IGD through increasing self-esteem and self-control, which promotes autonomy satisfaction, as well as providing a feeling of relatedness, decreasing the need for a gaming community.

Family Support

This research will define family support as the extent to which the cognitions of being loved, esteemed, cared for, and being a part of the family, are endorsed by the adolescents'

family or within the home setting, most notably parents and siblings. This type of support is found to decrease stress (Arslan, 2009; Xian et al., 2022), especially when received from parents this form of support is more influential than peer's support (Alrashidi et al., 2023). Both parental influence and home context are of substantial importance to adolescent development (Zaborskis et al., 2022).

Stress is associated with needs frustration and decreases the feeling of autonomy and self-esteem (De-Juanas Oliva et al., 2020; Lee et al., 2012; Srivastava & Kiran, 2015), resulting in a heightened risk IGD. Alike peer support, parental support influences this relation by reducing needs frustration. Parental support is a predictor of both autonomy and relatedness (Inguglia et al., 2014), thereby moderating the relationship between stress and IGD for adolescents. Notably, perceived parental support linearly decreases as adolescents mature, while perceived peer support exponentially increases up to 27 years of age (Heppe et al., 2020). Due to the critical role of parents in family support, this might warrant a decrease of family support as a moderator over the course of adolescence. However, aside from its positive effect on relatedness, family support also stimulates the search for relatedness and the forming bonds with significant others (Inguglia et al., 2014). Consequently, family support can lead to increased peer support.

Furthermore, while family support increases relatedness, it decreases the likeliness of need substitution. Adolescents that receive family support value intrinsic motivation over extrinsic motivation, lessening the appeal of need substitution (Thøgersen-Ntoumani et al., 2010; Williams et al., 2000). Therefore, it can be argued that adolescents supported by their family, are less likely to use IGD as a compensatory behavior due to stress.

Thus, family support moderates the effect of stress on adolescent IGD through mitigating needs frustration by stimulating autonomy and relatedness satisfaction.

Additionally, family support reduces need substitution through increasing the value of intrinsic motivation. Lastly, family support increases perceived peer support, stimulating the mitigating effects of peer support on needs frustration caused by stress.

Hypotheses

The current study investigates the effect of stress on adolescent gaming activity, and the possible moderation of peer support and family support. With regards to the self-determination theory framework and the existing literature around internet gaming disorder, three hypotheses were formulated:

H1: Stress is positively associated with gaming activity;

H2: The associations between stress and gaming activity are negatively moderated by peer support;

H3: The associations between stress and game activity are negatively moderated by family support.

Methods

Design and Participants

This quantitative, cross-sectional research uses data from the Dutch Health Behavior in School-aged Children (HBSC) study (2021). The participants were Dutch primary and secondary school students. Participants were selected through a multistage sampling method. Firstly, schools were selected from a Dutch a government institution for education (DUO), after which they were stratified to municipal health service (GGD) regions. Additionally, the sample was tested for a representative division between rural and urban schools in the Netherlands. Samples for primary and secondary education were taken separately.

Secondly, the classes were selected. Classes were randomly selected in secondary schools. The number of selected classes was based on the size of the school: Three classes were selected on at small schools (< 500 students), four classes were selected at medium schools (550-1000 students), and five classes were selected at large schools (>1000 students). Classes with solely students from remedial education or less than 10 students, were excluded from the selection.

201 secondary schools were selected for participation. 171 were contacted between May and September of 2021. 77 agreed to participate. Six of these schools later withdrew due to closure of the school or COVID-19 related work pressure. Five secondary schools were international schools or special education and were excluded for this reason. The final response was 41.5%: 71 secondary schools participated. No difference in size, degree of urbanization, or percentage of students with a migration background was found between the participating and non-participating schools. The day that the research was conducted, 12.2% of students were absent, half of which due to illness. Inclusion criteria for the current study were being 12-18 years of age and attending secondary education. The final study included 5892 students.

Procedure and Ethics

Data was collected through a questionnaire administered in class by an assistant researcher between October 2021 and January 2022. Teachers were present but requested not to interfere. Completing the questionnaire took approximately 50 minutes. After an introduction from the assistant researcher, the questionnaire was filled in digitally in secondary education. When there were insufficient resources for digital participation, paper was used.

The study was reviewed by the ethical review board of the Trimbos-Institute. The theoretical background, primary research questions, study design, questionnaires, inform letters for schools and parents, and data management and handling, were reviewed. The research was approved after adaptations to the study design, questionnaires, and data management.

Parents were informed of the research through their children's school at least a week before the research was conducted. Parents that did not consent were able to report this to their children's teacher or mentor. For this reason, 35 secondary school students did not participate.

During the introduction students were made clear that participation in the study was voluntary and they were allowed to leave questions unanswered. For this reason, 34 secondary school students did not participate. Additionally, it was stressed that collected answers would not be shared with third parties. All students were referred to visit the GGD's website (www.jouwggd.nl) and the Dutch youth support line if they required support after participation. Due to anonymity precautions, children at risk for or suffering from mental health issues could not specifically be reached for additional care.

Before conducting the digital questionnaire, students received a card containing a weblink and a login code for the digital questionnaire. It was stressed that the cards were distributed randomly and that students were allowed to keep their card or discard it as they pleased. After conducting the questionnaire on paper, all questionnaires were individually put in an envelope and sealed directly to maintain anonymity.

Measurement Scales

Gaming Activity

In the questionnaire, gaming was defined as playing a game on a PC, Xbox, PlayStation, Wii, portable gaming console, iPad, or smartphone. Firstly, two items were used to assess the time spent gaming per week and per day, respectively. The first item used a seven-point Likert scale with a higher score relating to more time spent gaming (1= (almost) never), 2= less dan 1 day a week, 3=1 day a week, 4=2 or 3 days a week, 5= 4 or 5 days a week, 6=(almost) every day). The second item used a five-point Likert scale with a higher score relating to more time spent gaming (1=1 hour or less, 2=2 or 3 hours, 3=4 or 5 hours, 4=6 or 7 hours, 5=8 hours or more). The variable GameIntensity was made by multiplying these two scales to assess the intensity of gaming behavior.

Consecutively, IGD was measured using items representing each of the nine DSM-5 risk symptoms for IGD (9 items, e.g. *'In the past year, did you ever… feel bad because you were unable to game?'*). These items were scored 'no' (0) or 'yes' (1). The mean of the nine items comprised a total score. A higher score relating to more IGD symptoms. This score was transformed into the variable total_IGD. A Cronbach's α coefficient of 0.755 was found.

Stress

The four-item adaptation of Cohen's Perceived Stress Scale (PSS-4), as seen in Appendix A, was used to measure the independent variable stress (Cohen et al., 1983). A higher score relates to more perceived stress. The mean of this scale's score was transformed into the variable total_stress. The PSS-4 has a Cronbach's α coefficient of 0.669. Earlier research found a value of 0.848 (Du et al., 2023).

Peer support

A four-item scale was used to measure the predictor peer support (e.g. *'I can count on my friends when something goes wrong.'*). Each item was answered on a seven-point Likert scale (1= very strongly disagree, […], 7=very strongly agree). The higher the score, the more peer support was perceived. A Cronbach's α coefficient of 0.930 was found.

Family support

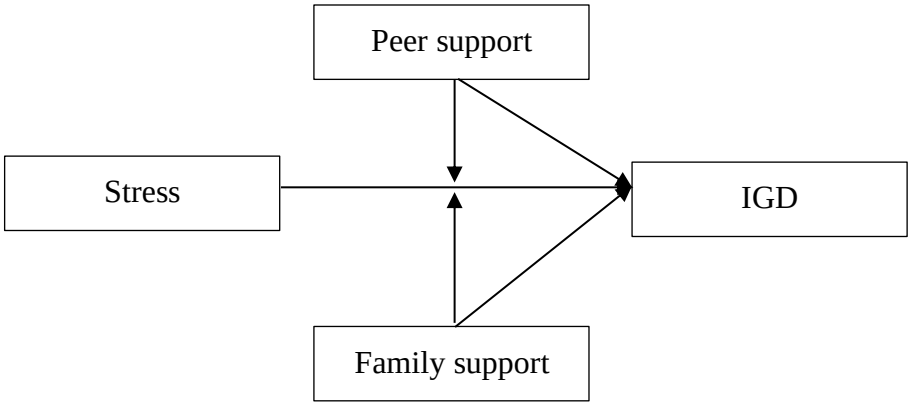
A four-item scale was used to measure the predictor family support (e.g. *'The people in my family really try their best to help me.'*). Each item was answered on a seven-point Likert scale (1= very strongly disagree, […], 7=very strongly agree). The higher the score, the more family support was perceived. A Cronbach's α coefficient of 0.928 was found.

Analysis

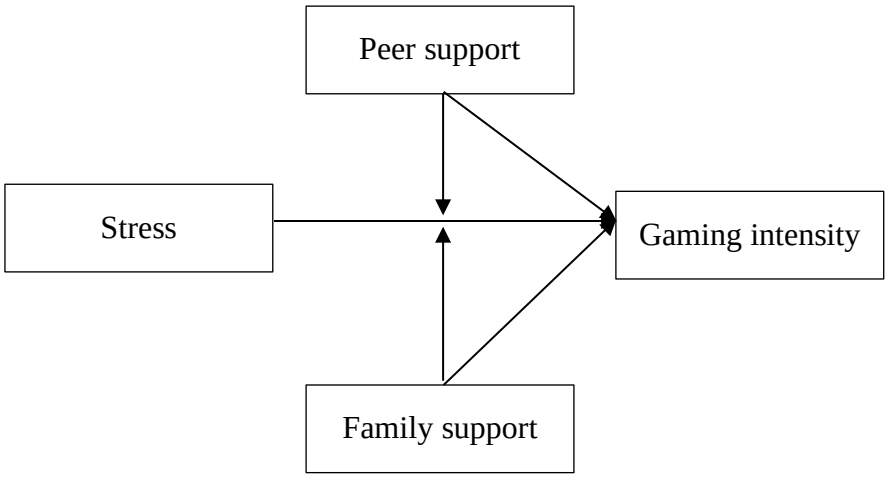
To answer the research question "To what extent is perceived stress related to gaming activity and is this moderated by peer support and/or family support in Dutch adolescents aged 12-18?" this study uses stepwise linear regression analyses. To this end, data were prepared and analyzed using JASP (Version 0.18.3). Before analyzing, the dataset was cleaned. All responses that did not meet the inclusion criteria were removed, resulting in 5892 valid participants. The predictors stress, peer support, and family support were centered. Moreover, participants with missing items were listwise deleted. There was a nonresponse from 1454 participants on one or more scale. Therefore, the final analyses were run with 4060 participants. Consequently, the assumptions were tested (see Appendix B). The histogram of standardized residuals showed a normality of residuals. Examining the residuals plot confirmed linearity and homoscedasticity. The highest measure of VIF was 1.458, therefore no multicollinearity was found. The maximum Cook's distance was .051, excluding influential cases.

Two hierarchic regression analysis were run, divided over two models. Model 1 has IGD as dependent variable. In the first step the direct effect of stress on IGD is tested. In the second step peer support and family support are added as predictors. In the third step the interaction effects between peer support and stress, and family support and stress are added to investigate moderation. Model 2 replaces the dependent variable IGD for gaming intensity and uses identical steps.

Figure 2
Analysis Models
Model 1



Model 2



Results

Descriptive statistics

This study investigated the relation between stress and gaming activity. It also reviewed the possible moderation of peer support and family support. Table 1 shows the family structure of the participants. The parents of most of the participants were not divorced. Of the participants that lived with divorced parents, most parents did not have a new partner. Table 2 displays the participants' distribution over age and the variables involved in the analyses. Correlations between these variables were found to be low to moderate (Table 3). Stress correlated negatively with IGD and gaming intensity. There was a moderate positive correlation between peer support and family support.

Table 1

Family Characteristics

	Sex		Nuclear family					
	Male	Female	Both parents	Only mother	Only father	Mother + step	Father + step	Other
N	2511	1546	3092	500	83	277	46	45
%	61.9	38.1	76.2	12.32	2.05	6.83	1.13	1.12

Note. Mother + step = mother with a new partner. Father + step = father with a new partner.

Table 2

Variable Distributions

Variable	*M*	*SD*	*Min*	*Max*
Age	13.99	1.51	12.00	18.00
Stress	.02	.74	-2.48	1.51
Peer support	-.10	1.43	-4.58	1.43
Family support	-.09	1.47	-4.87	1.13
IGD	.15	.20	0.00	1.00
Gaming intensity	10.04	6.20	2.00	30.00

Table 3

Pearson Correlation Matrix of Variables

Variable	1	2	3	4	5
1. Stress	—				
2. Famsup	.381*	—			
3. Peersup	.203*	.404*	—		
4. IGD	-.258*	-.170*	-.175*	—	
5. GameIntensity	-.086*	-.082*	-.118*	.413*	—

Note. Famsup = Family support. Peersup = Peer support. GameIntensity = Gaming intensity

* = significant at p < .001

Regression analysis

Model 1

Table 4 shows the results of the analyses for Model 1 and model 2. In the first step the relation between stress and IGD is examined. A significant negative association was

found between stress and IGD (B = -.071, β = -.258). This suggests that more perceived stress is associated with less IGD. Stress explained 6.6% of the variance in IGD. With these findings H1, that predicted perceived stress to be positively associated with IGD, is not supported.

In the second step peer support and family support are added as predictors to the analysis. Peer support is found to be a significant predictor of IGD. An increase in peer support is associated with a decrease of IGD (B = -.016, β = -.116). Similarly, an increase in family support was related to a decrease in gaming intensity (B = -.005, β = -.037). However, this finding was not significant. The predictors explained 8.3% of the variance in IGD.

H2 posed that the association between perceived stress and IGD is negatively moderated by peer support. Likewise, H3 posed that the association between perceived stress and IGD is negatively moderated by family support. In step 3 the interaction effects between stress and peer support and between stress and family support were added to the analysis. Both the interaction between peer support and stress, and family support and stress were not significant. Thus, no moderation effect was found. The predictors and interactions explained 8.4% of the variance in IGD. Consequently, no support was found for H2 nor H3.

Model 2

In the first step the relation between stress and gaming intensity is examined. A significant negative association was found between stress and gaming intensity (B = -.722, β = -.086). This suggests that more perceived stress is associated with less gaming intensity. Stress explained 0.7% of the variance in gaming intensity. With these findings H1, that predicted perceived stress to be positively associated with gaming intensity, is not supported.

In the second step peer support and family support are added as predictors to the analysis. Peer support is found to be a significant predictor of gaming intensity. An increase

in peer support is associated with a decrease of gaming intensity (B = -.451, β = -.104). Similarly, an increase in family support was related to a decrease in gaming intensity (B = -.094, β = -.022). However, this finding was not significant. The predictors explained 2% of the variance in gaming intensity.

H2 posed that the association between perceived stress and gaming intensity is negatively moderated by peer support. Likewise, H3 posed that the association between perceived stress and gaming intensity is negatively moderated by family support. In step 3 the interaction effects between stress and peer support and between stress and family support were added to the analysis. Both the interaction between peer support and stress, and family support and stress were not significant. Thus, no moderation effect was found. The predictors and interactions explained 2% of the variance in gaming intensity. Consequently, no support was found for H2 nor H3. Notably, all significant effect sizes were smaller in Model 2 compared to Model 1.

Table 4
Linear Regression Outcomes

Model		R^2		B	SE [B]	β	95% CI Lower	95% CI Upper
Model 1								
	Step 1	.066	Stress	-.071*	.004	-.258	-.079	-.063
	Step 2	.083	Peer support	-.016*	.002	-.116	-.021	-.012
			Family support	-.005	.002	-.037	-.010	-4.218×10^{-4}
	Step 3	.084	Stress*peer	-.004	.003	-.025	-.010	.001
			Stress*fam	.003	.003	.020	-.002	.009
Model 2								
	Step 1	.007	Stress	-.722*	.132	-.086	-.980	-.463
	Step 2	.020	Peer support	-.451*	.073	-.104	-.595	-.307
			Family support	-.094	.076	-.022	-.243	.055
	Step 3	.020	Stress*peer	-.186	.094	-.034	-.369	-.003
			Stress*fam	.080	.091	.016	-.099	.259

Note. Stress*peer = interaction effect of stress and peer support. Stress*fam = interaction effect of stress and family support.
* = significant at $p < .001$

Discussion

This study continued research on the emerging problem of internet gaming disorder. In times of increasing stress amongst adolescents, it investigated the effect of perceived stress on gaming activity, and the possible moderation of peer support and family support within the self-determination theory framework. Although research into stress and social support is readily available, as well as research into stress and gaming, to our knowledge this study is the first to combine these three concepts. Results showed that increased perceived stress correlates with decreased IGD. An effect for which no moderation effect of family or peer support was found. Gaming intensity followed a similar pattern, with a negative association

between perceived stress and gaming intensity and no moderation effects from family or peer support.

As opposed to H1, which predicted a positive association, a significant negative correlation was found between perceived stress and gaming activity. This result is inconsistent with current literature describing a positive association between stress and IGD (Dong & Potenza, 2014; Gu & Mao, 2023; Kaess et al., 2017; Li et al., 2022). The SDT framework predicted that stress would cause needs frustration through a decrease in well-being and self-esteem and gaming was theorized to act as a compensatory behavior. Following the results, needs frustration due to stress might have been overestimated or adolescents use other variables as need substitutes to decrease needs frustration.

Possibly, stress only acts as a predictor for IGD in adolescents with low self-esteem that view the gaming community as their only source of value, as described by Mills et al. (2017), thus overestimating its effect on IGD. However, this does not explain the negative association that was found. An alternative explanation is that gaming might incur needs frustration, as research associates game communities with increasing negative behaviors such as toxicity (Gandolfi & Ferdig, 2021; Kwak et al., 2015). Consequently, while acting as a compensatory behavior for autonomy satisfaction, gaming might simultaneously frustrate the need for relatedness. As a result, other need substitutes would be adopted, thus explaining the negative associations between stress and gaming activity. This would be in line with the findings of Gandolfi et al. (2023), stating that the attractiveness of a gaming community is positively associated with IGD. Thus, unappealing or toxic gaming communities might deter adolescents from developing IGD and decrease gaming overall.

As per H2, a moderation of peer support was expected in the relationship between perceived stress and gaming activity. This study has found no evidence for this hypothesis.

Remarkably, peer support did have a significant negative direct association with both IGD and gaming intensity. Therefore, it is likely that peer support in adolescence does not mitigate the needs frustration created by stress, but rather acts as protective factor against needs frustration in general. When adolescents do experience needs frustration, this result implies that they rather receive support from friends than use gaming as a need substitute.

H3 posed that family support would act as a moderator between perceived stress and gaming activity. The results showed no moderation effects. Although current literature is adamant in the positive influence of family support on well-being and needs satisfaction (Arslan, 2009; Inguglia et al., 2014; Xian et al., 2022; Zaborskis et al., 2022), this study finds no effect of family support in relation to IGD or gaming intensity. An explanation might be that the vital position of family in adolescents' lives might make family support a requirement for general well-being, rather than a remedy when needs do get frustrated (Kef & Deković, 2004; Kingon & O'Sullivan, 2001; Sheeber et al., 1997). It can be argued that needs frustration occurs despite family support, since family support is of critical importance of autonomy development, and therefore autonomy satisfaction, as well as a factor influencing relatedness.

Limitations and Recommendations

For the implementation of this study, the strengths and limitations must be noted. A strength of this study is the robust final sample of 4060 Dutch adolescents. The nationwide sample is expected to be an accurate representation of the Dutch secondary school population, increasing the possibility to generalize the results of this study.

A limitation of the current study is that both peer support and family support are elements of social support. As such, there is a considerable overlap between these two variables. Within the concept of family support, this study and its cited literature have

emphasized the effect of parental support. However, the operationalization in the used HBSC questionnaire was limited to four items, which measured siblings as well, reducing the efficacy of measuring this concept. Furthermore, the definitions in this study might not comply with broader theoretical conceptualizations and therefore caution is warranted when implementing this study.

Further limitations are the nonresponse in the study. All 1454 cases of nonresponse included the IGD scale (as opposed to e.g. 10 nonresponses for peer support) while oftentimes following scales were answered. Thus, it is likely that the IGD scale was intentionally left blank, indicating that the participants had motives not to respond to this scale. It is unknown whether this motive is related to game activity but is possibly of influence on the outcome of the analyses. Consequently, this data should likely be categorized as missing at random (MAR) or missing not at random (MNAR), rather than missing completely at random (MCAR). Multiple imputation could be used to obtain plausible replacement values. However, due to uncertainty between MAR and MNAR this would not eliminate the risk of bias. Moreover, the results may have been impacted by self-reports. However, this study specifically investigated perceived stress and perceived family and peer support, making self-reports an accurate measuring method.

Future research should try to reach participants that are less likely to respond to IGD scales in order to obtain a more accurate image of the interplay between these variables. To achieve this goal, the identity of this population must be known. Researchers can try to gain insight into this population through means of qualitative research. Moreover, since this study contradicts the current literature about the effects of stress on gaming activity, additional research should aim to further understand the precise effects in both directions. To this end more knowledge about the interplay of the gaming community and personal factors such as

self-esteem are needed to obtain a full image of this societal problem of IGD. Qualitative research might be of help to determine which gaming facets satisfy frustrated needs, as well as the exact domains of needs frustration.

In conclusion, this study has found that more perceived stress is related to a decrease in IGD and gaming intensity in Dutch adolescents, which is not moderated by peer or family support. Due to the discrepancy in research outcomes, the effect of stress should be examined further before implementation. If further research corroborates the negative association between stress and IGD, this may entail that gaming is just a pastime for the average adolescent and problematic gaming is limited to a specific group, shifting the scope of future research. Additionally, increased peer support is associated with decreased IGD and gaming intensity. Following these findings, interventions could focus on the effect of peers rather than family to decrease IGD and time spent gaming amongst adolescents. This can entail the stimulation of physical activities between peers. Lastly, in the debate in India over PlayerUnknown's Battlegrounds, banning this game might be excessive. However, as this study shows, it could not hurt to take a break from gaming to be with your friends.

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Appendix A

Perceived Stress Scale 4 (PSS-4)

Instructions

The questions in this scale ask you about your feelings and thoughts during THE LAST MONTH. In each case, please indicate your response by placing an "X" over the square representing HOW OFTEN you felt or thought a certain way.

1. In the last month, how often have you felt that you were unable to control the important things in your life?

Never (0), Almost never (1), Sometimes (2), Often (3), Very Often (4)

2. In the last month, how often have you felt confident about your ability to handle your personal problems?

Never (0), Almost never (1), Sometimes (2), Often (3), Very Often (4)

3. In the last month, how often have you felt that things were going your way?

Never (0), Almost never (1), Sometimes (2), Often (3), Very Often (4)

4. In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?

Never (0), Almost never (1), Sometimes (2), Often (3), Very Often (4)

Scoring for the Perceived Stress Scale 4:

<u>Questions 1 and 4</u>

0 = Never

1 = Almost Never

2 = Sometimes

3 = Fairly Often

4 = Very Often

Questions 2 and 3

4 = Never

3 = Almost Never

2 = Sometimes

1 = Fairly Often

0 = Very Often

Lowest score: 0

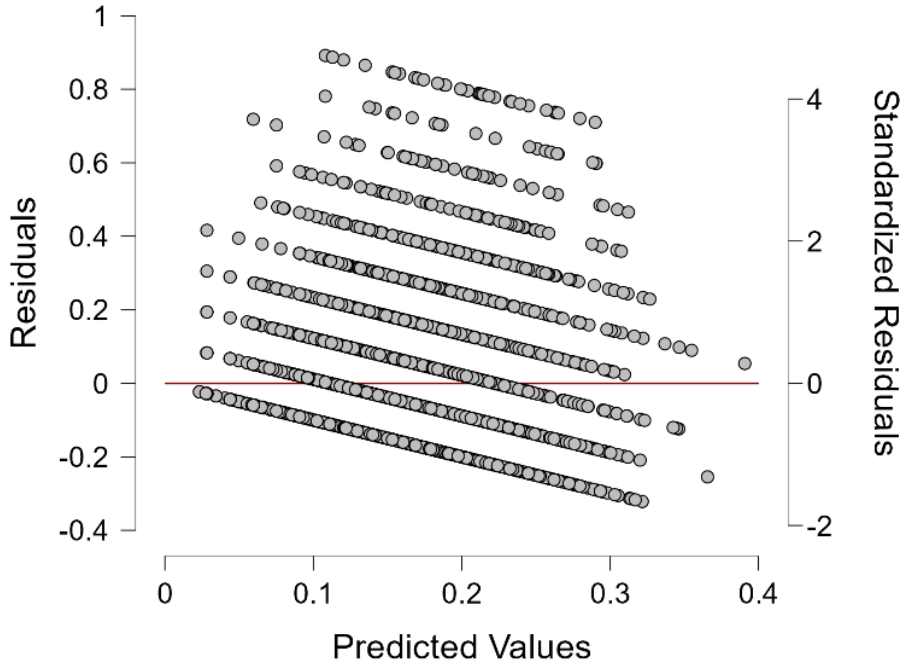
Highest score: 16

Higher scores are correlated to more stress.

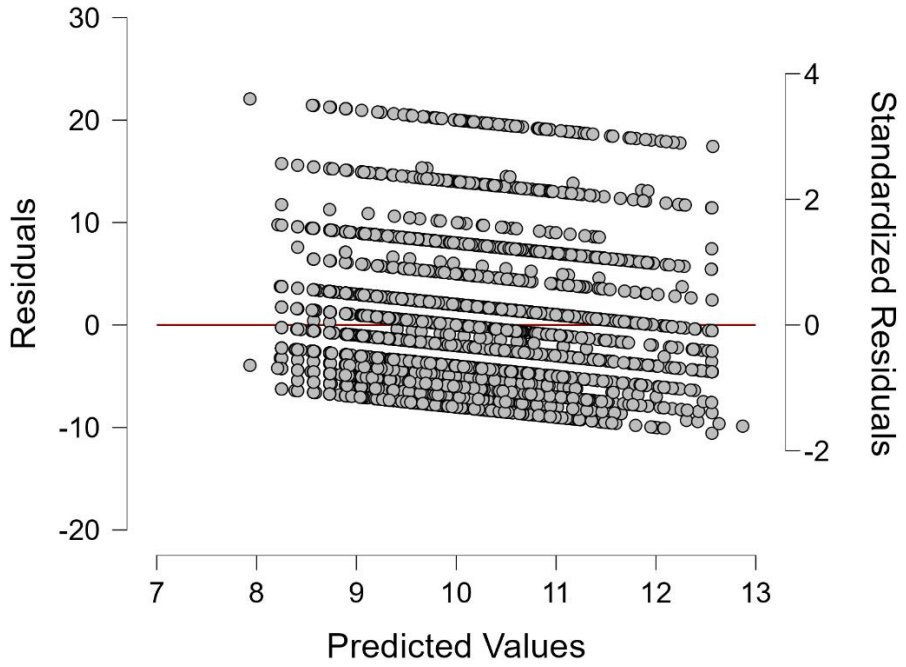
Appendix B

Linearity and Homoscedasticity

Model 1

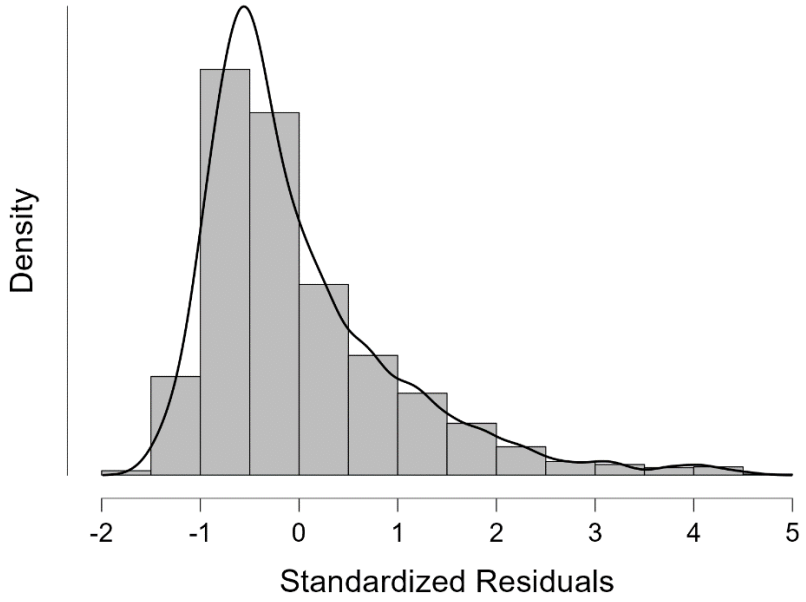


Model 2

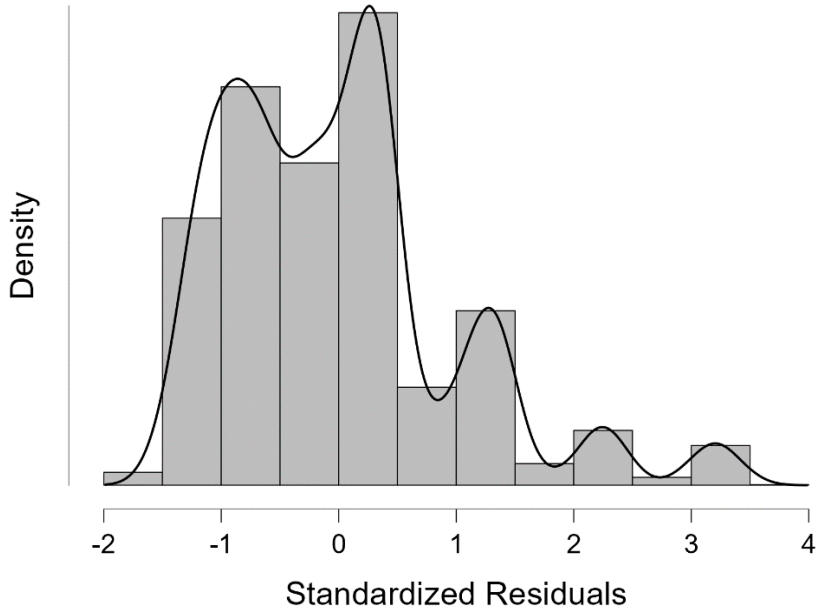


Normality of residuals

Model 1



Model 2



Appendix C

Reflection on interdisciplinarity

This study revolves around stress, internet gaming disorder (IGD), gaming intensity, peer support, and family support. The research was approached from a social science perspective. As such, different disciplines were used, although there is much overlap between the different (sub)disciplines.

The theoretic argumentation is largely based upon the self-determination theory (SDT), which finds its base in psychology. Insight into the intrinsic motivation of adolescents was key to understand the way in which stress drives adolescents to IGD. Or as it turns out in this case, why it does not. As family support and social learning are involved into the framework pedagogy comes into play. This is an important element because it helps shape both the current social support network the adolescent relies on, as well as the cognitive paradigms. In this research, pedagogy is involved in the development of the three basic psychological needs, and family support mainly affects autonomy and relatedness. It also effects underlying personal characteristics such as self-esteem and self-control. Although it could be argued that this enters the field of child psychology.

In this research, peer interactions extended into online communities. Sociology has helped determining how peers and adolescents interact in these game communities through the concepts of community attractiveness and receptiveness and the accompanying literature. It is important to understand the interplay between the community as a group and the adolescent, to determine in what way the game community affects the three basic psychological needs and possibly stress itself. The stress that was theorized to drive adolescents to game, has a biological aspect as well, but this was mostly overlooked in this research.

Combining these disciplines has helped gain a more complete overview of interactions between stress, peer support, family support, IGD, and gaming intensity, which shaped the theoretical framework that was used in this study. In doing so, it was easier to relate existing literature to the current study, as well as notice mechanisms that are possibly related to IGD. This helped with further argumentation and understanding of this societal problem.

Outside the field of social sciences, the insights of game developers and companies could be of use. Game distribution is a market and there is an enormous financial drive to keep adolescents engaged in gaming. As such, it could be very beneficial to understand in what way game developers enforce or exploit possible addicting game mechanics, or in what way addiction can be prevented. Additionally, the insights of politicians could be useful as well. Modern society continues to bring technological advances and it is very likely that the problem of IGD will only increase. As opposed to substance use addictions, gaming is very much legal and can therefore be much harder to address, especially for adolescents and older age groups that have their own residence and limited social control. Knowing to what extent politicians are willing to make changes, as well as the possibilities for both interventions and laws, can help shape interventions.

The current body of literature is based mostly on quantitative research. As described in the recommendations, qualitative research might help to understand the intrinsic motivations for gaming that lead to IGD. Knowing the intrinsic drive will make research into possible moderators and effective prevention easier.

The use of multiple analytical levels might be able to distinguish the exact factors contributing to IGD. However, due to the widespread use of gaming, and the heterogeneity of

players, I believe qualitative research to be a more effective way of deducing the specific variables that lead to an IGD.