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# Problematic Gaming Is Associated with Some Health-Related Behaviors Among Finnish Vocational School Students

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## Abstract

The objective of this work was to examine the connections between problematic digital gaming and various health-related behavior characteristics in a population of vocational school students. Data collection was performed ( $N = 1335$ ) via an online survey in vocational school units in northern Finland. The survey incorporated the Internet Gaming Disorder Test (IGD10) as well as self-reported measures including questions on socio-demographics, information on the living arrangements of participants, gaming habits, and health-related behaviors. Eighty-four percent ( $n = 773$ ) of the respondents (an average age of 17.5 years [ $SD = 4.4$ ]) played digital games regularly. Male gender, daily game use, having no close friends, self-perceived underweight status and monthly drug use were all significantly and positively associated with problematic gaming scores. Engagement in digital game playing was especially associated with participants who lived with a friend or friends or in a blended family structure engagement. These findings have implications for counselors and researchers working on the health-related behaviors of vocational school students.

**Keywords** Video games · Gaming disorder · Health

Digital game playing is a ubiquitous pastime among youths and adults (Duggan 2015). Technological advances and the rapid increase in Internet access over the past two decades have allowed the digital game industry to greatly expand its appeal, attracting the attention and

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interest of many young people. The most recent revision of the International Classification of Diseases (ICD11; World Health Organization [WHO] 2019), which published during 2018, identifies a Gaming Disorder (GD; or problematic gaming) as a mental health condition. Several scholars have voiced disagreements with this classification, arguing that it risks over-pathologizing healthy gaming (Aarseth et al. 2017). Previous studies on GD mainly approached this phenomenon using theoretical frameworks based on those developed for use with substance abuse disorders (Petry et al. 2014). These frameworks treat gaming behavior as something that is inherently addictive (Pontes et al. 2015), with addiction-based symptoms and related impairments similar to those of substance abuse, including loss of control, cravings, limited activity focus, and life conflicts (Kuss and Griffiths 2012). In addition, some scholars have conceptualized GD as a problem of self-regulation (e.g., Griffiths et al. 2016; Kardefelt-Winther 2014).

A growing body of literature suggests that problematic gaming can be linked to detrimental effects on health, although these findings are somewhat controversial. A handful of studies have shown that a moderate level of digital gaming can enhance healthy behaviors (Granic et al. 2014; Hofferth and Moon 2012), and large follow-up studies have demonstrated that even very excessive game playing over extended periods does not always have harmful effects on gamers (Parkes et al. 2013). It has also been suggested that fundamental dysregulation involving problematic gaming can be related to neuroticism among gamers (Peters and Malesky 2008). GD has also been linked to other dysfunctional behaviors including serious fighting, cigarette smoking, and other drug use (Desai et al. 2010). Problematic gaming may thus undermine mental, social, and physical health. It has been linked to reduced life satisfaction, increases in perceived anxiety, and symptoms of depression (Mentzoni et al. 2011), as well as sleep problems (Lam 2014). A recent meta-analysis (Männikkö et al. 2017) found that the effect sizes of the investigated health outcomes vary widely across studies and that independent estimates indicated that problematic gaming correlated only weakly or moderately with depression ( $r = 0.26$ ), anxiety ( $r = 0.28$ ), obsessive-compulsive disorder ( $r = 0.40$ ), and somatization ( $r = 0.40$ ).

Upper secondary education and training is based on a dual structure in Finland (Finnish National Agency for Education 2017). After compulsory basic education, young people have the option to continue with either general or vocational upper secondary education. These forms of education normally last 3 years and provide eligibility to continue with higher education studies. Typically, those students who enroll on the vocational upper secondary education are aged 16 to 19 years (Finnish National Agency for Education 2017). In addition to vocational upper secondary education, vocational qualifications can be taken as competence-based or apprenticeship training qualifications in Finland. According to the OECD (2017) report, the graduation age from the vocational education is higher in Finland than the average in OECD countries. In general, there is a slightly higher attendance from men than women in vocational upper secondary education in Finland (Ministry of Social Affairs and Health 2018). However, women usually dominate certain fields of study, such as the healthcare and social welfare sector, business, administration, and law in the country (OECD 2017).

Vocational school students' health-related behavior is more risky than that of general upper secondary school students (Kim 2018; Luopa et al. 2014): A Finnish national school health promotion study found that compared to their counterparts in general upper secondary schools, vocational school students drink more alcohol, smoke more, are more likely to be overweight, sleep less, and are less physically active (National Institute of Health and Welfare 2019).

Furthermore, it has been documented that the vocational schools have the highest dropout rates in upper secondary education in Finland (Official Statistics of Finland 2015). Research has also supported the premise that substance abuse, mental health problems, and drop-out of education often co-occur among these students (Luopa et al. 2014; Mikkonen et al. 2018). Indeed, it has been found that differences in health-related behaviors are elucidated by family background factors (i.e., family structure, parents' education, and occupation status) and the close interplay between different forms of substance abuse (i.e., alcohol, tobacco, and drugs) (Ruokolainen and Mäki 2015). In addition, girls have reported lower level of health statuses and higher rates of psychological and physical symptoms than boys in vocational schools in Finland (Luopa et al. 2014). In 2016, the Mind the Gap project explored the relationships between excessive Internet use, school engagement, school burnout, and depression among adolescents in Finland, revealing that excessive Internet use was related to the development of school burnout in late adolescence (Salmela-Aro et al. 2017). Consequently, health risk behaviors among young adults (aged 15–34), including abuse of alcohol, tobacco, and/or other drugs, have attracted considerable attention in Europe (e.g., European Monitoring Centre for Drugs and Drug Addiction [EMCDDA] 2017). The growing concern about these risky behaviors has prompted the development of prevention plans that have been enacted in Finland. In addition, because vocational school students regularly use the Internet for recreational and educational activities, members of this group may have an elevated risk of problematic Internet use that is independent of their preferred forms of Internet content.

With respect to their health-related outcomes, both similarities and differences between problematic gaming and substance use disorders (i.e., excessive drinking, smoking, or use of other drugs) have been reported. Studies have suggested that adolescents and young adults with problematic gaming symptoms or substance use behaviors exhibit common psychosocial features including loneliness, low self-esteem, and low social competence (e.g., Lemmens et al. 2011; Walther et al. 2012). Furthermore, impulsivity and low self-control have been linked to both problem behaviors (e.g., Rho et al. 2017; van Rooij et al. 2014). Neurocognitive similarities between substance use and problematic gaming have been also reported (Kuss and Griffiths 2012). However, the personality trait of extroversion has been found to be more prevalent among substance users (e.g., Walther et al. 2012) than individuals with problematic gaming behavior (e.g., Montag et al. 2011). People with problematic gaming behavior were also more likely to exhibit hyperactivity (Rikkers et al. 2016; Strittmatter et al. 2015) and to display certain psychosocial characteristics including a disposition towards neuroticism (e.g., Lehenbauer-Baum et al. 2015) and obsessive-compulsive symptoms (Andreassen et al. 2016; Vukosavljevic-Gvozden et al. 2015). Substance use behavior has been linked to sensation seeking (Gunning et al. 2009), which has also been associated with problematic gaming (Mehroof and Griffiths 2010). Although most studies on problematic gaming characteristics have focused on youths (e.g., van Rooij et al. 2014), health-behavior related implications have also been indicated for adults (e.g., Männikkö et al. 2017). Even if certain emotional and behavioral problems are commonly associated with problematic gaming behavior, it is unclear whether problematic gaming precedes or follows these problems. Together, these findings support the view of an underlying vulnerability to both these problematic behaviors, but more research is needed to determine whether there are any specific psychoactive substance use habits that are particularly likely to co-occur with problematic gaming.

While the harmful influences of problematic gaming may be less noticeable or disturbing than substance use disorders, excessive involvement in gaming (as a type of sedentary and screen behavior) may interfere with meaningful daily life activities. More

specifically, time spent on gaming habits can cause neglect of activities (as described by the “displacement theory” of Huston et al. 1999) that are considered more beneficial for individuals’ health and functioning, such as physical (Carson et al. 2016) and social activities (Carson et al. 2016; Przybylski 2014). For instance, a recently published comprehensive and systematic review reported evidence for an association between higher levels of screen consumption (including gaming) and unfavorable body composition and/or fitness (Carson et al. 2016). While most of the relevant scientific literature supports the position that time allocated to screen-based activities should be in harmony with other activities that are considered more advantageous, there is no consensus about its importance in relation to risky behavior outcomes (Carson et al. 2016; Ferguson 2017), further indicating that quality matters of behavior may imply more.

Much of the research on problematic gaming and its ramifications has focused on psychosocial determinants and has utilized online samples. Because of the co-occurrence of gaming and health-related problems as well as the growing concern of risky behaviors among vocational school students, the aim of this study was to investigate the connections between problematic digital gaming and selected health-related behavior characteristics in a population of vocational school students. The study uses survey data from a large sample of adults attending vocational school in northern Finland because descriptive information on the gaming and health-related habits of a first-year student sample could provide important insights into problematic gaming behavior and its relationship to health-related problems among young people in general. In particular, it would be useful to know whether these behavior problems exist and are interrelated before students start their vocational education, because such knowledge could facilitate the development of effective comprehensive health promotion strategies for vocational school students.

## Methods

### Participants and Procedure

Participants were recruited from a vocational school in the municipality of Oulu in northern Finland. The study population incorporated 1335 adolescents. All students at the eight separate vocational school units were invited to participate in the study. The vocational school offers qualifications in the following fields such as culture; natural resources and the environment; social science, business, and administration; social services, health, and sports; technology, communication, and transport sector; and tourism, catering, and domestic services and natural sciences. Data were gathered using a web-based survey that was administered in the school with the aid of teachers. The total sample consisted of 926 participants. Incomplete answers ( $n=2$ ) were excluded further analysis. This work is based on the subsample of respondents who had played digital games regularly during the last 12 months (151 of the original respondents did not satisfy this criterion). This subsample consisted of 773 subjects: 318 females [41.1%] and 455 males with an average age of 17.5 years ( $SD=4.4$ ).

The study was performed in accordance with the Helsinki declaration and with the permission of the school’s administrators. Students were informed about the research beforehand and provided passive consent via an information page. Participation was voluntary and anonymous; no identifying information was gathered.

## Measures

The survey consisted of three sections: (i) sociodemographic data and information on the living arrangements of participants (i.e., background variables), (ii) digital gaming behavior characteristics, and (iii) questions regarding health-related behaviors and qualities.

The socio-demographic part of the survey gathered information about the respondents' gender, age, and living arrangements. To assess living arrangements, participants were asked to select whom they live with as a rule, comprised of the following options: (1) "alone," (2) "with partner," (3) "with a friend or friends," (4) "with mother and father," (5) "with mother and mother's spouse," (6) with father and father's spouse, (7) "with mother," (8) "with father," and (9) "with someone other."

To assess gaming behavior characteristics, participants were asked to estimate the frequency with which they had played digital games in the last 12 months; the possible responses were 1 = "daily," 2 = "weekly," 3 = "about once a month," 4 = "seldom," and 5 = "never." Participants were also asked to say how much time (in minutes) they spent on gaming for leisure purposes on a typical day. In addition, the survey incorporated the Internet Gaming Disorder Test (IGDT-10; Király et al. 2017) questionnaire to explore problematic gaming behavior among the participating adolescents. A translation/back-translation method was utilized to adapt the test from English to Finnish (Brislin 1970). The test assesses nine problematic gaming behavior symptoms based on the Diagnostic and Statistical Manual for Mental Disorders, 5th Edition (DSM-5) (APA 2013), evaluating the severity of problematic gaming behavior over the preceding 12 months using 10 items rated on a 3-point Likert ordinal scale with possible scores of 0 = "never," 1 = "sometimes," and 2 = "often." The scores for the individual items on the test were summed to give composite scores, with higher composite scores corresponding to more severe problematic gaming behavior. The structural validity of the translated IGDT-10 scale was verified by obtaining acceptable fit model indices using confirmatory factor model analysis (CFA). The reliability of the CFA was evaluated on the basis of maximum likelihood using the root mean square error of approximation (RMSEA = 0.056), comparative fit index (CFI = 0.983), and Tucker-Lewis index (TLI = 0.978).

The health section consisted of questions about health-related behaviors and qualities. Self-perceived loneliness was evaluated by means of an item asking participants to say how many close friends they had, with the possible answers being (1) "none at all," (2) "one close friend," (3) "two close friends," or (4) "several close friends." Students were also asked about their self-perceived weight status, with five possible responses: (1) "remarkably underweight," (2) "slightly underweight," (3) "appropriate weight," (4) "slightly overweight," and (5) "remarkably overweight." To characterize the participants' nutritional habits, they were asked to state which meals they ate on a typical weekday and weekend day. The possible responses were (1) "breakfast," (2) "lunch," (3) "dinner," (4) "evening snack," and (5) "snacks between meals." The participants' physical activity was studied by asking them to indicate the number of days per week on which they were physically active for at least 60 min; the possible responses were 0 to 7 days. Participants were also asked to say how much time they spent performing moderate-to-vigorous exercise outside school activities during a typical week: the possible responses ranged from not at all to seven times per week. The participants' sleep behavior was studied by asking them to say how many hours they slept on a typical day. Participants were also asked to indicate how often they use tobacco or snuff, with the possible responses being

(1) “not at all,” (2) “occasionally,” (3) “once a week,” (4) “two to four times per week,” (5) “five to six times per week,” or (6) “seven times per week.” To assess alcohol consumption, respondents were asked to state how frequently they drink; possible responses were (1) “never,” (2) “I have tried but do not use anymore at all,” (3) “occasionally,” (4) “once a month,” (5) “two to three times per month,” and (6) “at least once a week.” Respondents were also asked to indicate how frequently they used drugs, with the possible responses being (1) “I have never tried,” (2) “I have tried, but I do not use drugs nowadays,” (3) “occasionally,” (4) “once a month,” (5) “two to three times per month,” and (6) “at least once a week.”

## Statistical Analysis

Descriptive statistics were collected for the main sample, and Spearman correlation coefficients were conducted to compare the relationships between health-related behavior indices and gaming behavior characteristics. The Kruskal-Wallis test was used to compare statistical differences in problematic gaming scores for the different living arrangement statuses of respondents. Living arrangement statuses were coded as follows: (1) “alone,” (2) “with a partner,” (3) “with a friend or friends,” (4) with mother and father,” (5) “with a blended family,” (6) “with single-parent household,” and (7) “with someone other.” Multivariate linear regression model (General Linear Model) was used to evaluate group differences on IGDT10 scores, with health-related variables as independent variables. Because the data on health-related behaviors such as the number of close friends, weight status, physical activity, and various forms of substance use were not continuous, contrast-coded regression coefficients were created and evaluated as predictors in the regression model. The regression model included the following covariates: participant age, frequency of weekly physical activity (lasting at least 60 min), and daily hours of sleep. All health-related behavior variables were considered for inclusion in the model.

The first category compared male and female participants. The second category compared those participants who played digital games daily to those who played less frequently. The third category contrasted those with no close friends to those with one or two close friends and those with several close friends. The fourth category contrasted participants’ underweight (i.e., slightly underweight and underweight) status to other weight statuses such as appropriate weight and overweight (i.e., slightly overweight and overweight). The fifth category compared participants with regular eating habits (i.e., those consuming at least four meals daily) to those who ate irregularly (i.e., those eating three or fewer meals per day). The sixth category compared participants reporting no moderate or vigorous activity to those reporting engaging in such activity for about 30 to 60 min per week, 2 to 3 h per week, and at least 4 h (i.e., 4 to 6 and at least 7 h) weekly in a typical week. The seventh category contrasted participants who did not consume tobacco or snuff to those who used these substances occasionally (i.e., sometimes) and weekly (two to seven times per week). The eighth and ninth categories were coded in the same way, and compared non-users of alcohol and drugs to participants who had tried such substances (but no longer used them) as well as participants who used them occasionally and at least once monthly (with the latter category including participants who reported using drugs anywhere between once a month to at least once a week).

All data analyses were performed using IBM SPSS statistics version 22 for Windows. The significance threshold was set at  $p < 0.05$ .

## Results

The mean IGDT10 score among all participants was 2.06 (SD = 3.09, skewness = 2.44 (SE = 0.088), kurtosis = 7.85 (SE = 0.176)). Men reported higher total IGDT10 scores than women ( $M = 2.66$  vs  $1.19$ ,  $SD = 3.18$  vs  $2.74$ ;  $t(737) = -6.869$ ,  $p < .001$ ). Table 1 presents respondents' reported characteristics of background variables, gaming, and health-related behaviors. Approximately half of the respondents (50.6%) lived with mother and father, whereas 12.5% of the students lived alone. Most of the participants reported having many close friends (60.3%) and an appropriate self-perceived weight status (63.4%). In addition, approximately 58% of the participants claimed to perform at least 2 to 3 h of moderate to vigorous physical activity in a typical week. The respondents reported sleeping for an average of 6.8 (SD = 1.95) h on a typical night. Approximately half of the participants (51.2%) said that they had never used tobacco or snuff, and a minority (3.9%) said they used alcohol weekly. However, most (85.2%) of the students claimed never to have used drugs.

A group comparison of the differences in the problematic gaming scores between different living arrangements showed that engagement in digital game playing was significantly higher among those students living with a friend or friends ( $\chi^2(6) = 13.55$ ,  $p = .035$ ) compared to the participants who lived alone, with partner, with mother and father, or with someone other. In this comparison, differences in problematic gaming scores were not significant for groups of blended and single-parent family structures. Mean rank scores for problematic gaming for different groups were as follows: 359 for "alone," 347 for "with a partner," 446 for "with a friend or friends," 383 with mother and father," 428 for "with a blended family," 398 for "with single-parent household," and 271 for "with someone other."

Table 2 presents the correlations between health-related behaviors and IGDT10 scores. These correlations indicate that tobacco, alcohol, and drug use seem to co-occur. However, these three variables were not significantly related to higher IGDT10 scores. Having many close friends seemed to be associated with a reduced susceptibility to problematic gaming symptoms ( $r = -0.112$ ,  $p < .01$ ).

Models comparing different health-related behavior scores to total IGDT10 scores based on participant age, frequency of weekly physical activity (lasting at least 60 min), and daily sleep time are presented in Table 3. Univariate analyses indicated that male gender ( $B = 1.21$ ;  $p < 0.001$ ), daily game use ( $B = 1.72$ ,  $p < 0.001$ ), and monthly drug use ( $B = 4.55$ ;  $p < 0.001$ ) were all significantly associated with IGDT10 scores. Having many close friends ( $B = -1.17$ ;  $p < 0.05$ ) and self-perceived appropriate or overweight status ( $B = -1.764$ ;  $p < 0.001$ ) were significantly inversely related to IGDT10 scores. The covariates were not significantly ( $p > 0.05$ ) related to higher levels of problematic gaming: The estimated coefficients for the relationship between problematic gaming and age, daily sleep time, and frequency of physical activity were  $B = 0.01$  (95% CI  $-0.040$  to  $0.059$ ),  $B = -0.07$  (95% CI  $-0.204$  to  $0.049$ ), and  $B = -0.08$  (95% CI  $-0.243$  to  $0.0868$ ), respectively.

## Discussion

This work was conducted to explore health-related behavior factors related to problematic gaming that have been understudied among vocational school students. Our results indicate that male gender, daily game playing, number of close friends, and regular drug use are associated with problematic gaming. The main finding of this work is that a set of health-



**Table 1** Characteristics of the study sample

Variable	<i>n</i> (%) / mean (SD)
Gender	
Female	318 (41.1%)
Male	455 (58.9%)
Living arrangements	
(1) “alone”	97 (12.5%)
(2) “with a partner”	57 (7.4%)
(3) “with a friend or friends”	59 (7.6%)
(4) “with a mother and father”	391 (50.6%)
(5) “with mother and mother’s spouse”	52 (6.7%)
(6) “with father and father’s spouse”	15 (1.9%)
(7) “with mother”	73 (9.4%)
(8) “with father”	20 (2.6%)
(9) “with someone other”	9 (1.2%)
Close friend	
(1) “not at all”	46 (6%)
(2) “one close friend”	146 (18.9%)
(3) “two close friends”	115 (14.9%)
(4) “several close friends”	466 (60.3%)
Self-perceived weight status	
(1) “remarkably underweight”	6 (0.8%)
(2) “slightly underweight”	71 (9.2%)
(3) “appropriate weight”	490 (63.4%)
(4) “slightly overweight”	181 (23.4%)
(5) “remarkably overweight”	25 (3.2%)
Having meals, weekday	
(1) “breakfast”	550 (71.2%)
(2) “lunch”	735 (95.1%)
(3) dinner	702 (90.8%)
(4) “evening snack”	682 (88.2%)
(5) “snacks between meals”	492 (63.6%)
Having meals, weekend day	
(1) “breakfast”	582 (75.3%)
(2) “lunch”	519 (67.1%)
(3) dinner	703 (90.9%)
(4) “evening snack”	696 (90%)
(5) “snacks between meals”	538 (69.6%)
Frequency of engagement in moderate-to-vigorous intense sports or exercise outside school activities (i.e., get winded and sweating)	
(1) “Never”	80 (10.3%)
(2) “About 30 min per week”	100 (12.9%)
(3) “About an hour per week”	143 (18.5%)
(4) “2–3 h per week”	195 (25.2%)
(5) “4–6 h per week”	160 (20.7%)
(6) “At least 7 h per week”	95 (12.3%)
Tobacco or snuff use	
(1) “not at all”	396 (51.2%)
(2) “sometimes”	122 (15.8%)
(3) “once a week”	11 (1.4%)
(4) “two to four times per week”	27 (3.5%)
(5) “five to six times per week”	33 (4.3%)
(6) “seven times per week”	184 (23.8%)
Alcohol use	
(1) “never”	192 (24.9%)
(2) “I have tried but do not use anymore at all”	193 (25%)
(3) “occasionally”	224 (29.1%)
(4) “once a month”	58 (7.5%)

**Table 1** (continued)

Variable	<i>n</i> (%) / mean (SD)
(5) “two to three times per month”	74 (9.6%)
(6) “at least once a week”	30 (3.9%)
Drugs use	
(1) “I have never tried”	654 (85.2%)
(2) “I have tried, but I do not use nowadays”	90 (11.7%)
(3) “occasionally”	14 (1.8%)
(4) “once a month”	1 (0.1%)
(5) “two to three times per month”	2 (0.3%)
(6) “at least once a week”	7 (0.9%)
Frequency of engagement in exercise lasting at least 60 min in typical week	3.47 (2.04)
Sleep time per day	6.81 (1.95)
IGDT-10 scores	2.06 (3.09)

related behaviors co-occurred with high game playing frequency and a high incidence of reported problem gaming symptoms in a group of first-year vocational school students sampled shortly after the beginning of the school year.

Male gender and frequent playing were related to increased rates of problematic gaming. Previous studies have similarly linked these characteristics to problematic gaming in both general communities (e.g., Lemmens et al. 2015; Männikkö et al. 2015) and school-based communities (e.g., van Rooij et al. 2014; Walther et al. 2012) samples.

A few studies have focused on the interplay between substance use and problematic gaming. This work showed that individuals who use drugs regularly may be more prone to problematic gaming, in keeping with previous findings (van Rooij et al. 2014; Walther et al. 2012). However, this work also indicated that while consumption of drugs was linked to problematic gaming, consumption of alcohol and cigarettes was not. Similar findings were reported by Walther et al. (2012). Conversely, van Rooij et al. (2014) found associations between alcohol, nicotine, and cannabis use and problematic gaming. However, it is worth noting that van Rooij et al. (2014) focused solely on adolescent students, whereas this study included both adolescent and adult participants. A recent study by Rho et al. (2017) found no connection between alcohol and nicotine dependence and problematic gaming among adults, but a different study indicated that an earlier age of first use of cigarettes, alcohol, and cannabis

**Table 2** Correlations between health-related behavior and IGDT10 scores

Variable	1	2	3	4	5	6	7	8
1 Close friends	–							
2 Weight status	–.086	–						
3 Engagement exercise lasting at least 60 min	.099**	–.89*	–					
4 Moderate-to-vigorous level exercise	.160**	–.116**	.646**	–				
5 Sleep duration	.098*	–.124**	.146**	.122**	–			
6 Tobacco use	.096**	–.004	–.049	–.072*	–.142**	–		
7 Alcohol use	.042	.092*	–.124**	–.131**	–.233**	.551**	–	
8 Drugs use	–.075*	.070	–.036	–.135**	–.106*	.353**	.373**	–
9 IGDT10 scores	–.112**	–.050	–.015	–.053	–.096*	–.010	–.029	.057

\* $p < 0.05$ ; \*\* $p < 0.01$

**Table 3** The relationship between IGDT10 scores and health-related behavior predictors

Variable	<i>B</i> <sup>a</sup>	SE	95% CI	<i>p</i>
Gender				
Male vs female	1.220	0.288	.654 to 1.787	<0.001
Gaming frequency				
Daily vs occasional use	1.699	0.287	1.134 to 2.263	<0.001
Close friends				
One to two friends vs none	−0.959	0.546	−2.032 to 0.114	0.080
Several close friends vs none	−1.231	0.537	−2.287 to −0.176	0.022
Self-perceived weight status				
Appropriate weight vs underweight	−1.809	0.427	−2.649 to −0.970	<0.001
Overweight vs underweight	−1.253	0.472	−2.180 to −0.326	0.008
Having regular meals week day				
Regular meals to irregular meals	−0.258	0.328	−0.902 to 0.386	0.431
Having regular meals weekend day				
Regular meals to irregular meals	−0.045	0.303	−0.641 to 0.551	0.882
Moderate-to-vigorous physical activity				
30 to 60 min per week vs none	0.145	0.445	−0.729 to 1.020	0.744
Two to 3 h per week vs none	0.085	0.498	−0.894 to 1.065	0.864
At least 4 h per week vs none	0.318	0.543	−0.750 to 1.386	0.559
Tobacco or snuff use				
Sometimes vs no use	0.001	0.385	−0.756 to 0.758	0.998
Weekly vs no use	0.139	0.347	−0.544 to 0.822	0.689
Alcohol use				
Tried but no more use vs no use	−0.186	0.362	−0.898 to 0.526	0.612
Occasional use vs no use	−0.261	0.396	−1.038 to 0.517	0.508
At least monthly use vs no use	−0.810	0.479	−1.751 to 0.132	0.092
Drugs use				
Tried but no more use vs no use	0.299	0.404	−0.495 to 1.092	0.460
Occasional use vs no use	0.865	1.005	−1.109 to 2.839	0.390
At least monthly use vs no use	4.407	1.178	2.093 to 6.721	<0.001

*B* unstandardized regression coefficients, *SE* standard error, *CI* confidence interval

<sup>a</sup> Results from multivariate linear regression model using general estimating equations for estimation, adjusted participant age, frequency of weekly physical activity (lasting at least 60 min), and daily hours of sleep

during adolescence was linked to an increased risk of problematic gaming (Coëffec et al. 2015).

Although the findings presented here and those from previous studies indicate that drug use and problematic gaming may co-occur among young adults, it is not clear exactly why these risky behaviors coincide. In line with previous findings (e.g., Lemmens et al. 2011; Walther et al. 2012), our results indicate that problematic gaming seems most common among individuals without close friends (i.e., those suffering from loneliness). An individual's number of close friends was also inversely related to their frequency of drug use. Previous studies have shown that social anxiety, loneliness, weak self-esteem, and social self-efficacy may have important effects on both kinds of risky behavior (e.g., Lemmens et al. 2011; Walther et al. 2012). Time spent alone playing digital games can provide an escape from more pressing offline social obligations. It is possible that these features could exacerbate the negative effects of psychoactive drug use and/or gaming-related social interaction, further promoting sedentary and isolating activities. Consequently, the combination of these risk factors could negatively affect school performance (e.g., Gentile et al. 2011; van Rooij et al. 2014). As such, these findings suggest that there is a need for activities designed to prevent social isolation and/or loneliness among students.

The co-occurrence of social isolation and problematic gaming can be explained using the Compensatory Internet Use model (Kardefelt-Winther 2014). Specifically, some gamers may compensate for difficulties in real-life situations arising from psychosocial problems by relying more on online activities. Our findings support the premise that these risky behaviors are linked to common intrapersonal characteristics of gamers, but further longitudinal studies are needed to clarify the mechanisms involved in their interplay.

In the current study, most of the students' ages were under 18 years (average age of 17.5 years (SD = 4.4.) and the majority of the respondents lived with their parents. In Finland, youths usually move away from home when they become an adult under the law (i.e., aged 18 years) or when they begin studying for an occupation or find a job. In the current study, higher scores of the problematic gaming behavior were especially associated with participants who lived with a friend or friends or in a blended family structure. Previous studies have also shown that certain social status factors (i.e., family structure, parents' education, and occupation status) are closely associated with different forms of substance abuse (i.e., alcohol, tobacco, and drugs) (Ruokolainen and Mäki 2015) and also for problematic gaming behavior (e.g., single-parent family, Rehbein and Baier 2013; and blended family structure, Männikkö et al. 2018), supporting a view of dispositions and norms concerning health-related behaviors are highly conveyed through the balanced home environment following the individual from childhood into adulthood. Similarly, adolescents' lower commitment in family social activities has been shown to link to higher rates of problematic gaming symptoms (Jeong and Kim 2011), whereas strong parent-child relationships may prevent the risks regarding gaming behavior (Bleakley et al. 2016; Wartberg et al. 2017). It can be argued that if an underage person lives with their friend or friends, it may play a substantial role in aggravating the balanced dialogue with the home supporters and/or further in other ways, possibly interfering in individuals' healthy ways to satisfy basic psychological needs.

There were no significant connections between daily sleep duration and problematic gaming. However, no attempt was made to characterize respondents' sleeping patterns and problems (e.g., difficulties falling asleep or restless sleep) in this work; such problems have been linked to problematic gaming among school-aged children and adolescents (e.g., Hale and Guan 2015; Hysing et al. 2015). This work also failed to identify any significant connection between time spent on physical activities and problematic gaming. Some previous studies have supported the argument that participation in physical activity may protect against this risky behavior, although the suggested importance of this relationship varies between studies (e.g., Henchoz et al. 2016; Przybylski et al. 2017). Surprisingly, a significant correlation was found between respondents' self-perceived underweight status and problematic gaming behavior. We also observed a slight negative but non-significant association between regular eating habits and problematic gaming, which may indicate that excessive gaming disrupts normal food intake pattern (resulting in unhealthy eating habits; Kayhan Tetik et al. 2018).

In school-based counselling practices for behavioral problems, the evidence has highlighted the importance of reinforcing the protective factors (e.g., sufficient sleep and regular eating habits) and reducing the harm-induced factors (e.g., psychosocial difficulties and comorbid symptoms). Attention should be paid to the individual factors of interpersonal elements, such as family participation and school connections (Jackson et al. 2012; Throuvala et al. 2018). Given the fact that the psychosocial problems, weakened academic performance, problems related to substance use, and certain psychiatric disorders might be tied to gaming disorder, health counsellors need to be aware of the nature of a cluster of risk behaviors that appear to be interrelated (Jackson et al. 2012). Therefore, health counselors in schools have an important

role in responding to their students' immediate health-related needs, intervening with these problems and supporting lifestyle changes (Fritsch and Heckert 2007; Lineberry and Ickes 2015). They can effectively collaborate and provide educational sessions for students, teachers, and parents regarding ways to promote healthy gaming or Internet use.

This study has several limitations. First, it was conducted in only one area of Finland and one vocational school setting, and participants were not recruited randomly. Consequently, the findings cannot necessarily be generalized to the wider population. Second, the incidence of problematic gaming behavior was assessed based on a self-report questionnaire and may thus be underestimated. Finally, the temporal relationship between problematic gaming and health-related behaviors was not addressed.

In sum, this study indicated that problematic gaming among vocational school students is associated with drug use, having few or no close friends, and a high frequency of gaming. Use of substances including tobacco, snuff, or alcohol was not related to problematic gaming. Further studies are needed to clarify these findings, to determine whether they hold in other settings, and to further evaluate the influence of the specific health-related behaviors associated with problematic gaming. These findings have implications for practitioners and researchers working on health-related counselling for vocational school students. The development and evaluation of intervention strategies for preventing risky behavior could potentially reduce the harm associated with problematic gaming among vocational school students. It is hoped that the findings presented here will be useful in guiding future research on health-related behavior and problematic gaming.

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## Compliance with Ethical Standards

**Conflict of Interest** The authors declare no conflict of interest.

**Research Involving Human Participants** All procedures performed in this study involving human participants were conducted in accordance with the ethical standards of the institutional and state research committee and with the 1964 Helsinki declaration and its later amendments.

**Informed Consent** Informed consent was obtained from all individual participants included in the study. Students agreed to participate in the study through the information page.

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