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Traditional Bullying and Cyberbullying Victimization Independently Predict Changes in Problematic Internet Gaming in a Longitudinal Sample

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A B S T R A C T

Purpose: Bullying and problematic Internet gaming (PIG) are two concerning phenomena among adolescents. Research suggests an association between them; however, longitudinal studies are scarce. Therefore, this study examined whether traditional and cybervictimization are prospective risk factors for PIG and how gender, school type, and age influence these relationships.
Methods: Adolescents (grades 5−13; N = 4,390) answered two surveys one year apart which were linked by individual codes. They were classified as "victims" based on the Olweus Bullying Questionnaire-Revised. Changes in PIG (T2-T1) were computed based on nine items reflecting the diagnostic criteria for DSM-5 Internet Gaming Disorder.
Results: Traditional and cybervictimization independently predicted changes in PIG. The emergence of traditional victimization only, cybervictimization only, and particularly, both forms of victimization simultaneously, was associated with an increase in PIG. A decrease in PIG was only found if victimization terminated in both contexts. Further, an additive effect was found if traditional victimization newly extended to cyberspace. For boys and B-level students, the emergence of traditional victimization was associated with a larger increase in PIG than for girls and A-level students, when compared to the absence of traditional victimization. For boys, this also applied for cybervictimization.
Discussion: The emergence of bullying victimization in either an offline or online context appears to be a risk factor for PIG. Importantly, victimization must be stopped in both contexts for a decrease in PIG. Therefore, prevention programs need to focus on bullying offline as well as online to counter PIG. Efforts should especially focus on boys and B-level students.

IMPLICATIONS AND CONTRIBUTIONS

Traditional bullying and cyberbullying victimization appear to be risk factors for problematic Internet gaming (PIG). Importantly, PIG only decreases if the victimization is terminated offline as well as in cyberspace. Thus, anti-bullying programs must address bullying offline and online alike to counter PIG—especially in boys and B-level students.

Bullying is a common and concerning issue at schools and in neighborhoods (i.e., traditional bullying), which more recently extended to the cyberspace (i.e., cyberbullying). According to a recent cross-cultural study, 17.7% of participating adolescents reported being a victim of traditional bullying (but not of

cyberbullying), 5.1% reported being a victim of cyberbullying (but not of traditional bullying), and 6.1% reported being a victim of traditional as well as cyberbullying [1]. Thus, more than half of those who reported cybervictimization were also victims of traditional bullying, and similarly high overlaps between the two were found in other studies [2,3].

Traditional as well as cybervictimization can have a variety of negative impacts on mental health. Several meta-analyses found associations with depression, suicidality, use of alcohol and drugs [4,5], and there is growing evidence that these relationships are causal [6] and persistent [7–9]. Some research suggests that the unique features of cybervictimization (e.g., anonymous perpetrators, larger audience) may contribute to mental health issues beyond those associated with traditional victimization [3,10]. This highlights the importance of examining the two contexts in which victimization can take place separately.

Relatively novel mental health problems that have gained increased attention in the public and the research community are Internet-related disorders. During the past decade, problematic Internet use (PIU) has risen [11] and was found to be associated with traditional [12,13] and cybervictimization [14,15]. Regarding traditional bullying, victims were 2.7 times more likely to show problematic/pathological Internet use [16], and for cyberbullying, one longitudinal study suggested that cybervictimization predicted PIU six months later, whereas PIU did not predict cybervictimization [17].

Although these findings indicate an impact of traditional and cybervictimization on PIU alike, only few studies explored differences between bullying victimization in an offline, as opposed to an online, context. However, depending on the context in which bullying takes place, there may be variations in the victims' online behavior: Cybervictims may generally spend more time online, thus being at an increased risk for exposure to bullying, as well as for the development of PIU [18]. On the other hand, victims of traditional bullying may strive to escape their real-world distress by seeking refuge in the online-world. Generally, researchers propose that PIU may be used as a maladaptive coping strategy to reduce negative emotions and avoid dealing with problems [19–21]. As shown in one study, particularly traditional victims reported using the Internet to feel better when they are in a bad mood, and to feel liked and included by others [18]. However, research comparing traditional and cybervictimization regarding PIU has yielded mixed results. For instance, Boniel-Nissim and Sasson [22] found a direct association between cybervictimization and PIU, but not for traditional victimization. Instead, traditional victimization was indirectly linked to PIU through cybervictimization. The authors posit that victims of traditional bullying are more likely to be cyberbullied and thus, show higher levels of PIU. Other research suggests that PIU is associated with both victimization forms independently [23,24]. One study found that both victims of traditional and cyberbullying reported increased levels of PIU, but the highest levels were observed for those who were victimized in both contexts [18].

To date, cross-sectional data have been used, limiting conclusions on causal relationships. According to a recent review [25] and a meta-analysis [26], there remains a paucity of longitudinal studies on the association between bullying victimization and PIU. Furthermore, these earlier studies mostly used broad definitions for PIU. However, diagnostic criteria for "Internet Gaming Disorder" (IGD) and "Gaming Disorder" were newly included in the latest editions of the Diagnostic and Statistical Manual of Mental Disorders [27] and the International Classification of Diseases [28]. Both diagnoses refer to recurrent problematic use of online or offline games within the past 12 months. According to DSM-5, at least five of nine criteria must be met: (i) preoccupation with gaming; (ii) withdrawal symptoms; (iii) tolerance; (iv) loss of control; (v) loss of interest in other activities; (vi) continued gaming despite negative consequences; (vii) deceiving others regarding the scope of gaming; (viii) gaming to escape negative feelings; and (ix) functional impairment. A meta-analysis on IGD in adolescents found a pooled prevalence of 4.6% [29]. For Germany, studies suggest prevalence rates between 2.7% and 14.4% [30–32].

The DSM-5 states that IGD requires further research, and this includes investigating risk factors of IGD, or more broadly, problematic Internet gaming (PIG). Therefore, in our study, longitudinal data are used to draw conclusions on bullying victimization as a risk factor for PIG. The first aim is to examine whether trajectories of traditional and cybervictimization independently predict changes in PIG (T2-T1). Second, associations between the emergence, termination, continuation, and absence of traditional and/or cybervictimization and changes in PIG are explored. Finally, the influence of gender, school type, and age on these relationships is investigated.

Methods

Study population and sample description

This longitudinal study used data from the evaluation of the Olweus Bullying Prevention Program in Germany [33]. The evaluation was conducted by the Department of Child and Adolescent Psychiatry, University Hospital Heidelberg, and was funded by the Baden-Wuerttemberg Foundation (_Baden-Wuerttemberg Stiftung_). Secondary schools were informed about the program and had the option to enroll in the study (details on the recruitment procedure: [33]). In total, 23 schools participated in the program in two waves (13 starting in 2015, 10 starting in 2016), and students were asked to complete three annual online surveys (July 2015 to July 2018). They were in grades 5 to 13, corresponding to the following age groups: grades 5–7 = 11–13 years; grades 8–9 = 14–15 years; and grades 10–13 = 16–18 years. The first section of each survey was an obligatory component of the program and was necessary for the program evaluation, whereas the second section was part of accompanying research and was optional. Students who continued with the second section were asked to generate an individual code which allowed us to associate the repeated assessments with the same student whilst ensuring anonymity. To do so, a matching procedure was applied (see "Statistical analysis"). Most students took part in the survey and completed both survey sections.

Overall, 26,788 assessments were conducted over three years, and 19,009 assessments included data from the first and the second survey section. Of these assessments, 11,828 could be matched to individual codes generated by the participants. These codes were associated with 4,927 students. Only data of students with complete information regarding traditional victimization, cybervictimization, and PIG for two consecutive assessments were analyzed (N = 4,390; Table 1; for a flow chart see Figure A1). Of these 4,390 adolescents, 2,405 (54.78%) were

Table 1
Prevalence of bullying victimization and Internet Gaming Disorder (IGD) as well as mean scores, standard deviation (SD), Interquartile Range (IQR), and range of problematic Internet gaming (PIG) and the Strengths and Difficulties Questionnaire (SDQ) (N = 4,390)

	First assessment		Second assessment	
	n	%	n	%
Traditional victimization only	752	17.13	625	14.24
Cybervictimization only	70	1.59	63	1.44
Both forms of victimization	203	4.62	161	3.67
Non-involved	3,365	76.65	3,541	80.66
IGD	328	7.47	343	7.81
	M (SD)	*IQR*	Range	*M (SD)*	*IQR*	Range
PIG	1.31 (1.81)	0; 2	0; 9	1.23 (1.88)	0; 2	0; 9
SDQ	10.51 (5.23)	7; 14	0; 36	10.43 (5.29)	7; 14	0; 36

IGD = Internet Gaming Disorder; IQR = Interquartile range; M = Mean; PIG = Problematic Internet gaming; SD = Standard deviation; SDQ = Strengths and Difficulties Questionnaire

female and 1,717 (39.11%) attended A-level schools (=*Gymnasium*: comparable to secondary/high school for grades 5 through 12 or 13, more academic, and is required for enrolment at university; as opposed to B-level schools = *Realschule/Werkrealschule/Gemeinschaftsschule*: comprises part of general or practical secondary/high school education, generally for grades 5 through 9 or 10, and allows for the option to commence vocational training, but is insufficient for enrolment at university). At first assessment, the majority (n = 2,628; 59.86%) attended grades 5–7, 1,326 (30.21%) students attended grades 8–9, and 436 (9.93%) participants were in grades 10–13.

Study Procedures

The study was conducted in accordance with the Declaration of Helsinki, and was approved by the ethics committee of the Medical Faculty of the University of Heidelberg (S-341/2014) and the respective school authorities. Further, the study was registered at a World Health Organization trial registry (Deutsches Register Klinischer Studien; DRKS00008202). All students and their caregivers were informed about the study by leaflet, and students were additionally informed in class by the research team. All participating students provided informed consent. Caregivers had the opportunity to contact the research team to clarify questions and to object to their child's participation (opt out). At the beginning of each survey, students received standardized instructions from their teachers. The surveys were conducted during class hours (approximately 45 minutes). The first, obligatory section of each survey consisted of the German version of the Olweus Bullying Questionnaire-Revised [34], and the second optional section consisted of questionnaires on mental health, such as PIG. Therefore, only students who completed both sections were included in our study.

Measures

Victimization by traditional bullying and cyberbullying. Bullying experiences were assessed by the Olweus Bullying Questionnaire-Revised [34]. This widely used questionnaire has been reported to be a reliable measure (Cronbach's alpha = 0.80–0.90) [35,36]. Of its 57 items, one global and nine specific items regarding traditional victimization (Cronbach's alpha = 0.87) and one global and three specific items regarding cybervictimization were analyzed (Cronbach's alpha = 0.81; see Tables A1 and A3). The frequency of victimization within the past three months was assessed on a five-

point scale (see Tables A2 and A4). Following the common cut-off, participants were classified as victims of traditional or cyberbullying if they indicated "two or three times a month" or more, on at least one of the items for either traditional or cybervictimization.

Problematic Internet gaming. PIG was assessed by nine items based on the nine diagnostic criteria for IGD ([27]; Cronbach's alpha = 0.78; see Table A5). These items referred to the past 12 months ("yes" = 1, "no" = 0). Sum scores (range: 0–9) were computed with higher scores indicating greater severity of PIG. Following the DSM-5 and previous research [23,31,32], students with sum scores of five or more were considered as having IGD.

Psychopathology. Psychopathology was assessed by the widely used Strengths and Difficulties Questionnaire (SDQ; short-version; 11–16 years; [37]) which consists of five scales with five items each ("not true" = 0, "somewhat true" = 1, "certainly true" = 2). The total difficulties score was calculated by adding the scores of four scales (range: 0–40). The reliability found in our study (Cronbach's alpha = 0.77) aligns with prior research on the total difficulties score (Cronbach's alpha = 0.78–0.80; [37,38]).

Statistical Analysis

Longitudinal data were assigned to one individual using a similarity matching procedure. This allowed for the matching of data despite typing errors in the self-generated codes. The following criteria were applied: (1) same school and gender were indicated; (2) the school grade in the later assessment was not lower than the grade in the earlier assessment; and (3) the Levenshtein distance of the codes did not exceed 2.

Participants were included in the analyses if they had at least two consecutive assessments with complete information regarding traditional victimization, cybervictimization, and PIG. Incomplete datasets (n = 537; 10.9%; [39]) were deleted. A proportion of students (n = 1,927) had three consecutive assessments with complete information. For these students, only their first two assessments were analyzed. Changes from their second to their third assessment were not additionally included since this would have violated the assumption of independent data. The change in PIG was calculated by subtracting the sum score at T1 from the sum score at T2. Three linear regression models were compared. Model 1 included three predictors: Trajectories of traditional and cybervictimization (four predictor categories

Table 2

Sample sizes per subgroup for victimization by traditional bullying and cyberbullying

Traditional victimization	Cybervictimization			
	No-No	No-Yes	Yes-No	Yes-Yes
No-No	2,972	36	47	5
No-Yes	302	55	10	8
Yes-No	450	11	72	11
Yes-Yes	242	49	71	49

each: emergence [No-Yes], termination [Yes-No], continuation [Yes-Yes], absence [No-No]), as well as the sum score of PIG at T1. The latter was added as a predictor, since changes in PIG (T2-T1) are investigated and greater changes are more likely for very high or very low initial scores. Model 2 examined influences of other variables and included six predictors: Alongside the three predictors of model 1, gender (boy, girl), school type (A-level, B-level), and grade group at the first assessment (grades 5−7, 8−9, 10−13) were added. Model 3 examined potential moderators and included 12 predictors: Alongside the three predictors of model 1 and the three additional predictors of model 2, interactions of gender, school type, and grade group with the trajectories of traditional and cybervictimization were investigated. These three nested models were compared using likelihood ratio tests. Effects were calculated considering the observed distribution of the covariates. To investigate how the different victimization trajectories affected changes in PIG, average adjusted predictions were calculated.

To check for a systematic loss of participants, assessments at T1 of the sample that were included in this study were compared to the assessments that were excluded with respect to gender, school type, grade group, traditional victimization, cybervictimization, PIG, and psychopathology. Psychopathology was included since mental health issues have been found to be associated with systematic loss [40]. Stepwise mixed-effects logistic regression was used with random effects for school and class within school, minimizing Bayes Information Criterion. Level of significance was $\alpha = 0.05$, and the data were analyzed using Stata 17.0 [41].

Results

Model selection and effects

Three linear regression models were compared (see "Statistical analysis"; see supplementary material for the regression equations). Likelihood-ratio tests revealed that model 2 was significantly better in predicting changes in PIG compared to model 1 ($\chi^2_{(4)} = 326.79$, $p < .001$), while model 3 was significantly better than model 2 ($\chi^2_{(24)} = 68.73$, $p < .001$), and therefore, results of model 3 will be reported.

Main effects of traditional victimization and cybervictimization. Overall, this multiple linear regression model showed significant results ($F(35, 4,354) = 49.00$, $p < .001$) with significant main effects for traditional victimization ($F(3, 4,354) = 20.59$, $p < .001$) and cybervictimization ($F(3, 4,354) = 7.55$, $p < .001$). Thus, the trajectories of both victimization forms independently predicted changes in PIG (see first research question).

Effects of victimization trajectories. Average adjusted predictions were calculated to investigate the changes in PIG depending on the victimization trajectories, i.e., whether the victimization newly emerged (No-Yes), terminated (Yes-No), continued (Yes-Yes), or was absent (No-No) (see second research question; Table 2).

According to these predictions, PIG significantly increased if both traditional and cybervictimization emerged, as well as if only traditional victimization or only cybervictimization emerged (Table 3). The increase in PIG after the emergence of both victimization forms was significantly larger than the increase after the emergence of only traditional victimization ($t = 4.52$, $p < .001$) or only cybervictimization ($t = 6.81$, $p < .001$).

A significant decrease in PIG was found if both traditional and cybervictimization terminated. PIG did not significantly change if only traditional victimization or only cybervictimization terminated, while the victimization continued in the other context. The decrease in PIG after the termination of both victimization forms did not significantly differ from the nonsignificant decrease after the termination of only traditional victimization ($t = -0.48$, $p = .635$), but did significantly differ from the

Table 3

Margins (standard error = SE), t- and p-values, and 95% Confidence Intervals (CI) of changes in problematic Internet gaming (PIG) regarding the trajectories of traditional and cyberbullying victimization

	Margin (SE)	t	p	95% CI
Emergence of victimization (No-Yes)				
Traditional only	0.39 (0.08)	4.77	<.001	0.23−0.55
Cyber only	0.40 (0.13)	3.01	.003	0.14−0.66
Both	0.99 (0.14)	7.27	<.001	0.72−1.26
Termination of victimization (Yes-No)				
Traditional only	−0.14 (0.21)	−0.65	.515	−0.56−0.28
Cyber only	0.12 (0.13)	0.93	.354	−0.13−0.38
Both	−0.25 (0.13)	−1.96	.049	−0.50−0.00
Continuation of victimization (Yes-Yes)				
Traditional only	0.25 (0.09)	2.88	.004	0.08−0.42
Cyber only	−0.22 (0.21)	−1.04	.299	−0.62−0.19
Both	0.23 (0.20)	1.15	.248	−0.16−0.62
Additive effects of victimization				
New cybervictimization (No-Yes), continuous traditional victimization (Yes-Yes)	0.85 (0.14)	6.04	<.001	0.57−1.12
New traditional victimization (No-Yes), continuous cybervictimization (Yes-Yes)	0.37 (0.22)	1.71	.088	−0.06−0.80

Table 4
Margins and contrast (standard error = SE), t- and p-values, and 95% Confidence Intervals (CI) of changes in problematic Internet gaming (PIG) regarding gender, school type, and grade group

	Margin/Contrast (SE)	t	p	95% CI
Gender				
Boys	0.42 (0.04)	11.52	<.001	0.34–0.49
Girls	−0.48 (0.03)	−14.81	<.001	−0.54–[−0.41]
Boys versus girls	0.89 (0.05)	17.56	<.001	0.79–0.99
School type				
A-level	−0.16 (0.04)	−4.14	<.001	−0.24–[−0.08]
B-level	−0.03 (0.03)	−1.15	.250	−0.09–0.02
B-level versus A-level	0.12 (0.05)	2.44	.015	0.02–0.23
Grade group				
5−7	0.02 (0.03)	0.61	.539	−0.04–0.08
8−9	−0.20 (0.04)	−4.94	<.001	−0.29–[−0.12]
10−13	−0.28 (0.09)	−3.24	.001	−0.44–[−0.11]
8−9 versus 5−7	−0.22 (0.05)	−4.36	<.001	−0.32–[−0.12]
10−13 versus 5−7 s	−0.29 (0.09)	−3.20	.001	−0.47–[−0.11]
8−9 versus 10−13	0.07 (0.09)	0.76	.450	−0.11–0.26

nonsignificant increase after the termination of only cybervictimization ($t = -3.48$, $p = .001$).

Further, PIG significantly increased if traditional victimization continued while no cybervictimization was reported. In contrast, no significant change was found if cybervictimization continued while no traditional victimization was reported, or if traditional as well as cybervictimization continued.

To investigate any additive effect of bullying, the emergence of cybervictimization in addition to continuous traditional victimization was compared to the absence of cybervictimization, while traditional victimization continued. If traditional victimization continued, the additional emergence of cybervictimization showed a significant increase in PIG. Similarly, as reported earlier, continuous traditional victimization in the absence of cybervictimization revealed a significant increase. However, the increase after newly emerging cybervictimization was significantly larger ($t = 4.53$, $p < .001$). Conversely, if cybervictimization continued, the additional emergence of traditional victimization showed no significant changes in PIG.

Main and moderating effects of gender, school type, and grade group. Regarding the covariates (see third research question), significant main effects were found for gender ($F(1, 4,354) = 308.41$, $p < .001$), school type ($F(1, 4,354) = 5.94$, $p = .015$), and grade group ($F(2, 4,354) = 12.16$, $p < .001$). Boys showed a significant increase in PIG, whereas girls showed a significant decrease; and a comparison revealed significant gender differences (Table 4). A-level students showed a significant decrease, whereas B-level students showed no significant changes; again, with significant differences between the school types. Students in grades 5−7 at their first assessment showed no changes in PIG, whereas students in grades 8−9 and 10−13 showed significant decreases. Compared to grade group 5−7, PIG significantly decreased for grade groups 8−9 and 10−13. However, no significant differences were found between grade groups 8−9 and 10−13.

Significant interaction effects were found between traditional victimization and gender ($F(3, 4,354) = 6.90$, $p < .001$) and cybervictimization and gender ($F(3, 4,354) = 2.74$, $p = 0.042$). Of particular interest were the emergence compared to the absence (No-Yes vs. No-No), and the termination compared to the continuation (Yes-No vs. Yes-Yes) of victimization. Therefore, only interaction effects between these victimization trajectories

and gender, school type, and grade group were investigated in more detail (Figure 1).

When the emergence of victimization was compared to its absence, boys showed a significantly larger increase in PIG than girls (traditional victimization: $t = 3.65$, $p < .001$, 95% confidence interval [CI] = 0.29−0.96; cybervictimization: $t = 2.40$, $p = .017$, 95% CI = 0.12−1.18). When the termination of victimization was compared to its continuation, no significant gender differences were found (traditional victimization: $t = -1.72$, $p = .086$, 95% CI = −0.75−0.05; cybervictimization: $t = -1.29$, $p = .196$, 95% CI = −1.59−0.33).

Further, a significant interaction effect was found between traditional victimization and school type ($F(3, 4,354) = 3.04$, $p = .028$). When the emergence of traditional victimization was compared to its absence, B-level students showed a significantly larger increase in PIG than A-level students ($t = 2.31$, $p = .021$, 95% CI = 0.06−0.80). In contrast, no significant differences between the school types were found when the termination of traditional victimization was compared to its continuation ($t = 0.98$, $p = .326$, 95% CI = −0.23−0.68). Furthermore, no significant interaction effects were found between cybervictimization and school type ($F(3, 4,354) = 2.25$, $p = .081$), traditional victimization and grade group ($F(6, 4,354) = 1.10$, $p = .359$), and cybervictimization and grade group ($F(6, 4,354) = 1.70$, $p = .118$).

Check for systematic loss. To check for systematic loss at T2, data at T1 were investigated. As reported above, 4,390 assessments with T1 and T2 data were matched with a participant's self-generated code and were included in the analyses of this study, while 5,644 assessments were not matched with an individual code. We considered these assessments to be conducted at T1. Since these assessments had no data at T2, they were excluded from our analyses. Therefore, the analysis to check for systematic loss compared 4,390 assessments (included = yes, data at T1 and T2 available) with 5,644 assessments (included = no, only data at T1 available) regarding the predictors gender, school type, grade group, traditional victimization, cybervictimization, PIG, and psychopathology. The dichotomous variable "included" served as outcome variable. The model treated the data grouped by school and class within school. No significant differences were found between the included and excluded assessments regarding traditional victimization, cybervictimization, and PIG. However, differences could be found regarding gender (boys: Odds Ratio
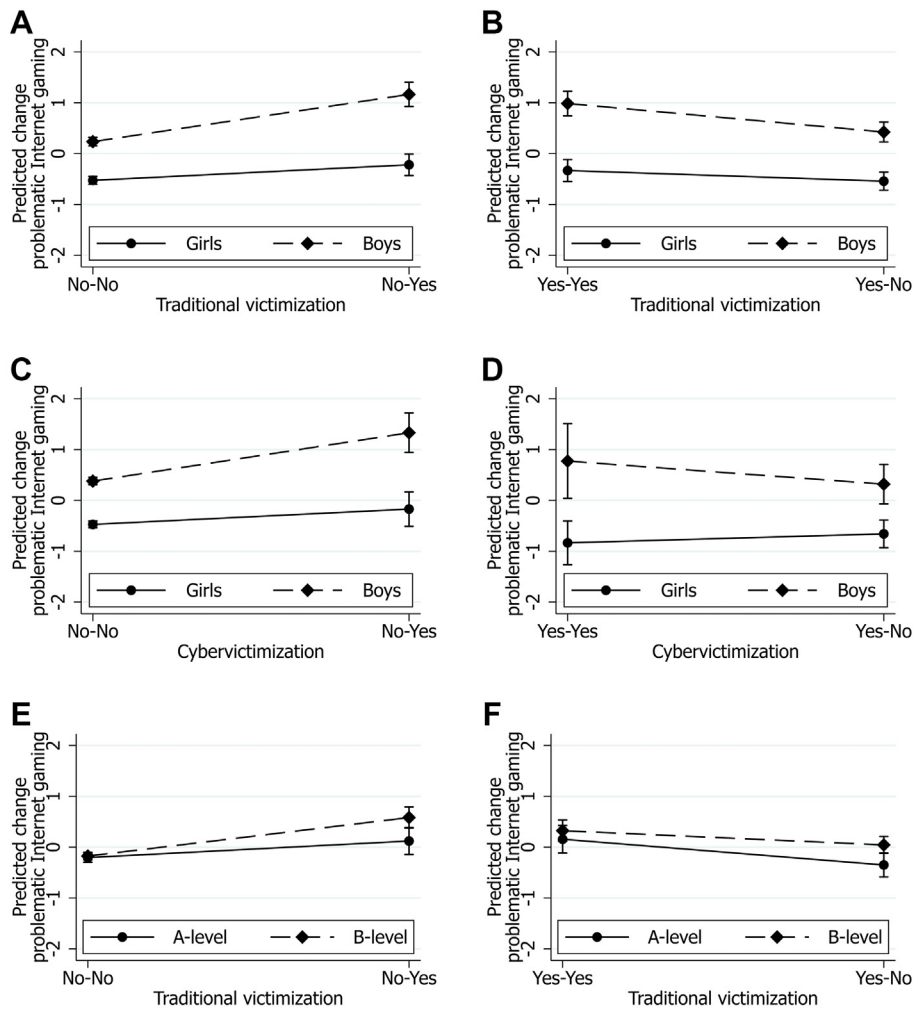
Figure 1. Interaction effects between traditional victimization and gender (A, B), cybervictimization and gender (C, D), and traditional victimization and school type (E, F) regarding the emergence (A, C, E) and termination of bullying victimization (B, D, F); illustrated are margins and 95% Confidence Intervals.

[OR] = 0.55, 95% CI = 0.49−0.60, p < .001), school type (B-level: OR = 0.31, 95% CI = 0.18−0.56, p < .001), grade group (compared to 5−7: 8−9: OR = 0.46, 95% CI = 0.36−0.58, p < .001; 10−13: OR = 0.15, 95% CI = 0.10−0.22, p < .001), and psychopathology (OR = 0.97, 95% CI = 0.96-0.98, p < .001). Therefore, the sample analyzed in this study proportionally consisted of more girls, more A-level students, and younger students. Potential explanations could be that boys and B-level students show less socially desirable and eager behaviors than girls or A-level students. Older students may have priorities other than participating in surveys. To address these biases, gender, school type, and grade group were included as covariates. Differences found regarding psychopathology can be disregarded, since the OR is close to 1.

Discussion

Bullying is a widespread and concerning phenomenon among adolescents. Consistent with a recent study [1], our study found the highest mean prevalence for traditional victimization only (15.69%) and the lowest for cybervictimization only (1.52%). For the relatively new IGD [27], the current study found a mean prevalence of 7.64%, aligning with the range found in other German studies [30−32]. Our aim was to gain better insight into the relationships between these two psychologically and societally relevant phenomena.

For this purpose, the first research question was whether trajectories of traditional and cybervictimization independently predict changes in PIG (T2-T1). Results revealed that indeed, the trajectories of both forms predicted changes. This is consistent with cross-sectional studies suggesting that both forms were associated with PIU [24] and may increase the risk of IGD [23]. The second research question explored how the different trajectories of traditional and cybervictimization (emergence, termination, continuation, absence) affected changes in PIG. Regarding the emergence, students whose bullying experiences began only offline, only online, or in both contexts simultaneously showed a significant increase in PIG. This increase was largest if both victimization forms newly emerged concurrently. These findings suggest an additive effect of problematic behavior if bullying victimization begins not only in one, but in multiple contexts. Consistently, previous research reported that victims who were concurrently bullied in both contexts showed the

highest levels of PIU [18] and generally experienced more mental health issues [1,3]. Regarding the termination of victimization, PIG only decreased significantly if the victimization stopped offline as well as online, but not if it stopped in only one context while it continued in the other. This highlights the importance for anti-bullying programs to target bullying in both contexts. In line with previous longitudinal research [17], the finding that PIG increases if victimization emerges and decreases if the victimization terminates, suggests a causal link. This may support the hypothesis that gaming serves as a way to escape into another world if the burden of the "real" world weighs too heavily, and only reduces once the "real" world is perceived to be more bearable [20,21]. Regarding the continuation of victimization, PIG significantly increased if traditional victimization persisted over the period of one year, while no cybervictimization was reported concurrently. In contrast, no significant change was found if cybervictimization continued while traditional victimization was absent, or if traditional as well as cybervictimization persisted. This suggests that victims who are exclusively bullied offline over a longer period of time may be at greater risk of getting lost in gaming than victims who are additionally or exclusively bullied online. Thus, victims of long-term traditional bullying might use gaming as a maladaptive coping strategy to find release from the harms of the offline world [18]. On the other hand, victims of persistent cyberbullying might attempt to end their digital humiliation by avoiding the online world entirely, and therefore, also Internet games. However, due to a small sample size of victims of continuous cyberbullying, this finding should be interpreted with some caution.

To investigate additive effects, two groups of victims were compared: Those who continuously experienced bullying victimization in one context and additionally newly experienced victimization in the respective other context, and those who were continuously bullied in only one context. Results showed that the increase in PIG was larger if cybervictimization newly emerged in addition to persistent traditional victimization, compared to the increase of continuous traditional victimization only. This may suggest that the negative effects worsen if traditional victimization extends to the online world. Such an extension of bullying to the cyberspace could have been triggered by the worldwide temporary school closures due to the COVID-19 pandemic, as some research suggests that cybervictimization increased during lockdown [42]. Since generally higher rates of IGD were found among adolescents during the pandemic, victims may be particularly at risk for the development of PIG [43]. Therefore, especially in a post-COVID-19 era, anti-bullying programs need to not only address bullying at school, but also in cyberspace, in order to prevent even higher rates of PIG.

The third research question concerned the role of gender, school type, and age as moderators. For boys and B-level students, the emergence of traditional victimization was associated with a stronger increase in PIG than for girls or A-level students, compared to the absence of victimization. For boys, this finding also applied for the emergence of cybervictimization. However, if the victimization terminated compared to if it continued, no significant differences in the change of PIG were found between the two genders or school types. Further, age was not found to be a moderator. This suggests that boys are especially at risk of developing PIG if their bullying experiences begin online or offline, and that B-level students may be particularly at risk if their bullying experiences begin offline. These findings support previous research [44,45], wherein generally, studies have reported that boys [23,29] and B-level students [16] appear to be more prone to PIU. Similarly, our study found that being male may be a risk factor for developing PIG, while being an A-level student and getting older may serve as protective factors. Therefore, efforts in preventing PIG should focus on boys and B-level students, particularly after they become victims of bullying.

Strengths, limitations, and future directions

One major strength of our sample is that it included longitudinal data of almost 4,400 adolescents. This allowed us to track a large number of individual trajectories over the course of one year. However, despite this large sample, some subsamples were rather small, and therefore, some findings should be interpreted with some caution. Future research could conduct studies using even larger samples and assess students over a longer period of time. Another limitation concerns recruitment: Since the included schools voluntarily participated in a prevention program, the data may not be representative. The representativeness could also be limited by the loss of data during the study and the analyses. A check for systematic loss showed that boys, B-level students, and older students were more likely to be lost from T1 to T2. Thus, the analyzed sample was biased regarding gender, school type, and age. Since PIG seems to be more prevalent in boys [23,29] and B-level students [16], the effects regarding PIG may be underestimated in this study. We addressed these biases by including the aforementioned variables as covariates. However, future studies should aim to further investigate and replicate our findings in more representative samples. Furthermore, only self-reports were used in the current study. However, victims often refrain from speaking openly about their experiences, and similarly, one diagnostic criterion for IGD is deceiving others regarding gaming. Thus, self-reports appear to be the most suitable measure for these constructs. Nevertheless, future studies could include more objective electronic measurements (e.g., gaming time). In addition, other addictive Internet applications such as problematic social media use appear to be associated with bullying, particularly in girls [46]. Although these applications are not included in the diagnostic manuals, their similarities and differences compared to PIG in victims (e.g., regarding bullying forms, gender) could be the subject of future studies.

Conclusions and Implications

Our findings suggest that PIG might be yet another aversive consequence of traditional and cybervictimization, and the consequences appear to aggravate in the presence of both. However, if bullying victimization is terminated offline and online concurrently, PIG decreases. Therefore, anti-bullying programs should focus on both forms to effectively counter these harmful consequences. Alongside interventions to prevent newly emerging bullying and to stop perpetrators, these programs should provide victims with a variety of adaptive strategies to cope with their emotional distress. Instead of escaping into the gaming world, victims (especially boys and B-level students) could, for instance, be encouraged to seek support from their parents or teachers [22,23]. These strategies may be particularly important in a post-COVID-19 era, as PIG appears to generally be on the rise [43], and they may help victims to receive the support they so urgently need.

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Supplementary Data

Supplementary data related to this article can be found at 10.1016/j.jadohealth.2023.03.013.

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