

Effects of a prevention intervention concerning screens, and video games in middle-school students: Influences on beliefs and use

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(Received: March 25, 2019; revised manuscript received: August 2, 2019; second revised manuscript received: August 27, 2019; accepted: August 28, 2019)

Background and aims: The aim of this study was to evaluate the effects of a prevention intervention on French adolescents' Internet and video games use and on their beliefs concerning gaming and Internet Gaming Disorder (IGD), in order to adjust prevention programs further. *Methods:* The study comprised a prevention intervention group (PIG) and a control group assessed at three times – baseline, post-test, and 4-month follow-up. At baseline, a total of 434 junior high adolescents from five secondary schools were assessed ($M_{age} = 13.2$ years; $SD = 0.5$). The main outcome measures were adolescents' gaming and Internet use (amount of time spent during the week and the weekend), the number of adolescents with IGD, and beliefs about gaming and IGD. *Results:* The results showed significant effects of the prevention intervention on Internet and gaming use (at T2, time spent was significantly lower in the PIG), an important increase of IGD prevalence between baseline and follow-up in the control group, and decreased rates of IGD among adolescents in the PIG between post-intervention and follow-up. Between baseline and follow-up, the control group showed a more significant increase of minutes per day during the week and the weekend on Internet versus during the week on video games. The impact of the prevention intervention on adolescents' beliefs varied according to gender. Girls had a better understanding generally of the potential dangers of and reasons for IGD. *Discussion:* Implications for future research and prevention approaches are discussed in this study.

Keywords: Internet gaming disorder, screen, video game, prevention, adolescent

INTRODUCTION

As a pastime practiced by many individuals around the world, Internet-based activity and more specifically Internet gaming mark a cultural and generational split. Unlike other addictive disorders, it is possible that virtually every adolescent from developed countries use the Internet at least occasionally. Although this activity has several well-known benefits like emotion regulation or developing cognition (Bediou et al., 2018; Gaetan, Bréjard, & Bonnet, 2016; Russoniello, O'Brien, & Parks, 2009; Wang et al., 2017), Internet gaming also produces deleterious effects with excessive use. Indeed, it is now commonly admitted that some people develop significant problems related to Internet gaming, that their gaming has certain features of addictive disorders, and that it should be diagnosed as a disorder (Saunders et al., 2017) called Gaming Disorder (ICD-11; World Health Organization, 2018) or Internet Gaming Disorder (IGD) (DSM-5; American Psychiatric Association, 2013). IGD has been associated with many issues, including refusal of social activities, isolation, family conflicts, mood disorders, lower academic achievement or school disconnection, sleep deprivation, day–night reversal,

malnutrition, physical inactivity, and higher frequency of gaming expenses (Achab et al., 2011; Bonnaire, Liddle, Har, Nielsen, & Phan, 2019; Bonnaire & Phan, 2017; Brunborg et al., 2013; Mihara, Nakayama, Osaki, & Higuchi, 2016; Wang et al., 2014).

In a recent systematic review of epidemiological studies on IGD, the prevalence of the disorder ranged from 0.7% to 27.5% with higher prevalence among younger people (Mihara & Higuchi, 2017). The definition of IGD generates important debates and a multitude of measuring tools (Feng, Ramo, Chan, & Bourgeois, 2017), the Internet Gaming Disorder Test (Pontes, Király, Demetrovics, & Griffiths, 2014), and the the Internet Gaming Disorder Scale–Short-Form (Pontes & Griffiths, 2015) being the most widely used, and more recently the development of the first psychometric tool to assess gaming disorder using the new diagnostic framework developed by the World Health Organization (the Gaming Disorder Test; Pontes et al., 2019).

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Although a concern is that this may result in overpathologizing everyday behaviors (Billieux, Schimmenti, Khazaal, Maurage, & Heeren, 2015), it remains that the high prevalence rates of IGD highlight the presence of a problem. IGD and its ensuing issues seem inversely related to age (Wittek et al., 2016). A 2016 study that included five European countries (Germany, Estonia, Italy, Spain, and Romania) also suggested that IGD is not only on the rise (Kaess et al., 2016), but that it is present already in some 10-year olds (Wichstrøm, Stenseng, Belsky, von Soest, & Hygen, 2019). Such studies indicate that IGD among young people is an important public health concern that merits intervention. Thus, there is an emphasizing need for research into and development of preventive approaches to counteract this rising clinical phenomenon (Király et al., 2018; Saunders et al., 2017) and identify best practice guidelines across populations and regions (King et al., 2018). Nonetheless, although some attention has been given to psychological (and pharmacological) treatments (see Zajac, Ginley, Chang, & Petry, 2017 for a recent review) in some countries, prevention of IGD has received less attention in many other countries, despite potential benefits of this approach. Indeed, several authors recommended that the field should focus on enhancing its preventive efforts to help society overcome disordered gaming (Griffiths & Pontes, 2019; Pontes & Griffiths, 2019).

In their review, King et al. (2018) summarize peer-reviewed prevention studies on IGD and Internet addiction. Only 13 quantitative studies in the past decade were identified internationally, none of which were in France, despite the increasing number of requests to address this problem (Obradovic, 2017). Several recommendations emerged in the research literature reviewed, especially those based on school programs (Throuvala, Griffiths, Rennoldson, & Kuss, 2019). While some studies suggested that elementary-school-aged children should be prioritized for selective prevention interventions (Lee, 2013), most researchers also agreed that preventive interventions should focus mainly on and would be more effective for adolescents whose values and standards are in the process of developing (Vitaro & Gagnon, 2003; Vondráčková & Gabrhelík, 2016). Our literature review and clinical experience with adolescents with IGD lean toward the conclusion that junior high-school students (between 13 and 14 years old), at crossroads between recreational and excessive video game use, are an important focus group for IGD. As suggested by Werch and DiClemente (1994) about the McMos model for psychoactive substances, the early teen years are beyond the primary prevention target, but should be classified as a secondary prevention issue. Secondary prevention aims to reduce the impact of a disease or injury that has already occurred – in this case disordered gamers, whereas primary prevention aims to prevent problems or diseases before they manifest (Petry et al., 2018). Thus, the purpose of such a secondary prevention program would be to help teenagers become aware of and thereby reduce the risks associated with possible excessive video gaming. Indeed, it is probable that most teenagers in secondary school are in the precontemplation stage regarding their use habits (Werch & DiClemente, 1994) of gaming (playing for more than 6 months and not imagining to stop playing). Thus, using

techniques and messages adapted to the stage of readiness of the individual implies considering both the potential detriments and benefits of Internet and video game use. There are several ways of using video games and Internet-based activities, which are adaptive, productive, and socially significant and which increase the psychological well-being of users (Granic, Lobel, & Engels, 2014). Our intervention is oriented toward harm reduction. Indeed, our goal is not to ban or withdraw the adolescent from screens and video games, but to enhance skills and competencies associated with identifying its risk and institute protective factors (Throuvala et al., 2019).

Another recommended approach would be using interactive and visual materials to enhance self-reflection rather than employing authoritarian anti-gaming messages (Joo & Park, 2010). Providing information about negative consequences of risk behaviors is ineffective. Instead, interactive interventions should aim to change attitudes as well as develop personal skills (with use of Internet and gaming, with coping with stress and emotions, etc.; Vondráčková & Gabrhelík, 2016). Enhancing self-reflection rather than transmitting anti-gaming messages is a more productive goal for prevention programs that does not focus on reducing individual-level use to its lowest possible point, nor imposing unnecessary restrictions upon healthy users (King et al., 2018). Helping gamers think about their motives, expectations, and reasons for repeated use of online games (King & Delfabbro, 2014) could be a key mechanism for preventive programs. By exploring these factors, each gamer “*could enhance individual self-control and reflection on their own needs, resulting in functional, responsible gaming behavior as well as in the establishment of alternative coping strategies for everyday life*” (Wegmann & Brand, 2018, p. 533). These elements are in line with the idea of social and emotional skill development, a protective factor from developing mental health issues (Catrinel & Mircea, 2010). Promotion of positive youth development is a promising direction for prevention intervention (Shek & Yu, 2016). These perspectives are not only oriented to individuals who present IGD symptoms already, but also to individuals who experience problems without fulfilling all the criteria. This is a core aspect of early intervention (Wegmann & Brand, 2018). Finally, another recommendation is to integrate clinical measures of IGD into prevention programs and not consider the use of Internet and gaming time reduction as main outcome (Throuvala et al., 2019).

Overall, the primary aim of this study is to evaluate a prevention intervention based on the development of psychosocial skills. Psychosocial skills include *social skills* (e.g., communication, resistance and negotiation, empathy, group collaboration, and advocacy), *cognitive skills* (e.g., decision-making and problem-solving, critical thinking and self-evaluation, and influence of the media and peers), and *emotional skills* (e.g., emotion regulation, stress management, and time management). This study seeks to assess its impact on French adolescents’ beliefs of gaming and IGD but also on their gaming and Internet use behaviors. Understanding teenagers’ beliefs and knowledge about video games and IGD will help to adjust future prevention programs better. Theory of Reasoned Action (Ajzen & Fishbein, 1980) shows that beliefs (i.e., positive

and negative perceptions of a particular behavior) influence attitudes, which in turn shape intentions in terms of behaviors. For example, research on gambling indicates that teenagers' attitudes are an important predictor of their gambling behavior (Moore & Ohtsuka, 1999). The second aim of this study is to investigate gender differences. Previous studies on parenting styles and restrictive mediation seem to differ according to the gender of the child (Bonnaire & Phan, 2017; Choo, Sim, Liao, Gentile, & Khoo, 2015; Wallenius & Punamäki, 2008), thus it may be that prevention interventions will have different impacts on boys and girls. Because factors associated with Internet addiction differ by gender, prevention intervention should also fit boys' and girls' different needs.

This pilot effectiveness study serves as a first step to design further prevention programs according to the adolescents' needs (boys and girls). It also evaluates the possibility of this type of intervention in France.

METHODS

Participants and procedure

Five Parisian suburban schools agreed to participate in the study. Each school comprised between four and five classrooms of 4th grade (junior high-school students between 13 and 14 years olds). In each school, two classrooms were

randomly selected to participate in the prevention intervention. All participants were self-selected; inclusion or exclusion criteria were based on informed consent from parents and teenager, and the Game Addiction Scale (GAS) completely filled (Lemmens, Valkenburg, & Peter, 2009). At baseline, a total of 434 secondary-school pupils from 20 classrooms ($M_{age} = 13.2$ years; $SD = 0.5$) were included. The control group (CG) was formed with participants (pupils of the other classrooms) who did not participate in the prevention intervention (see Figure 1 for recruitment procedure).

At the beginning of the school year (between October and November 2016), all the students who agreed to participate in the study and from whom we did not receive parental refusal completed the questionnaire concerning their use and their beliefs (T0). The questionnaire was completed again (T1) just after the prevention session, but only by the adolescents who benefited from the prevention intervention, which took place between November and December. From March to April, all adolescents from both prevention and CGs completed the questionnaire for a third time (T2). The time between T1 and T2 was 4 months to detect maintenance of effects. All evaluations (T0, T1, and T2) and the prevention sessions occurred on the same day in each school to avoid contamination via sharing questions among pupils.

Prevention intervention

The prevention intervention lasted 90 min (see Appendix). The aims were to: (a) increase awareness about the time

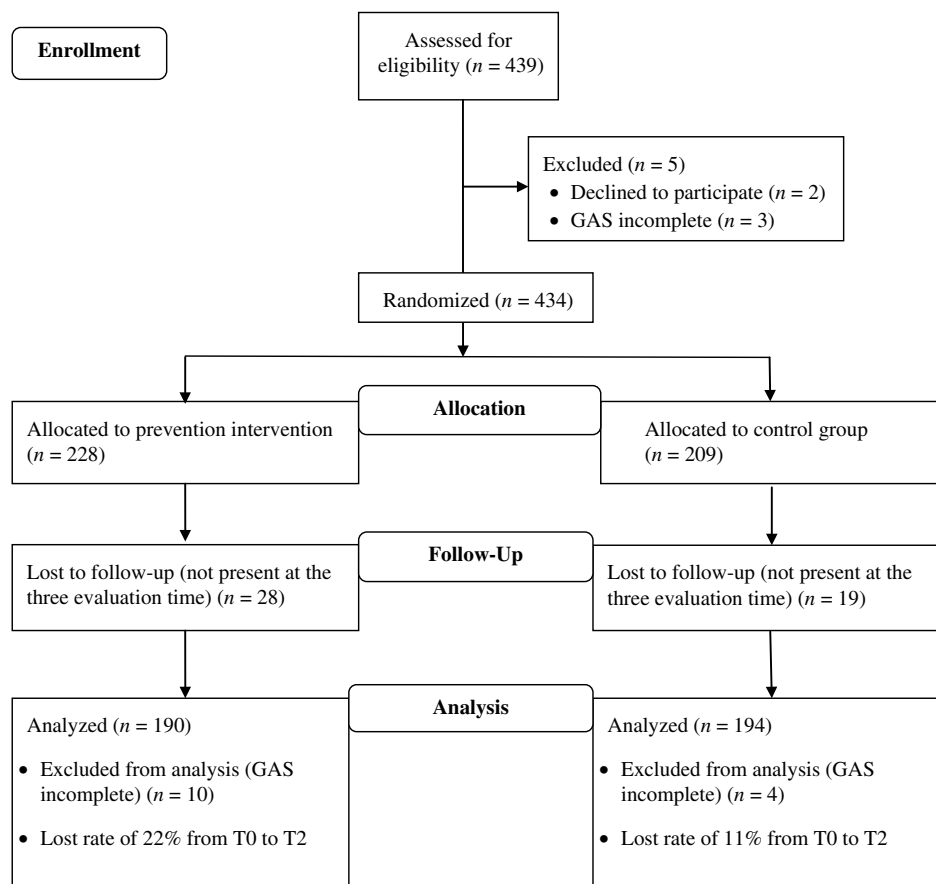


Figure 1. The CONSORT flow diagram of the selection process. GAS: Game Addiction Scale

spent in front of different screens and about the increase in the number of screens present in their daily life; (b) increase reflection about individual “life priorities” (i.e., homework, sport, and interpersonal interaction); (c) raise awareness about the consequences of excessive use of video games on sleep, school investment, and family; and (d) reinforce protective factors like positive use and self-control, and help them think of ways to change their use or reduce negative consequences. Overall, the prevention intervention aimed to increase knowledge and skills development among adolescents. Prevention programs that increase knowledge are more effective if they are combined with a skill-based approach (Hawks, Scott, McBride, Jones, & Stockwell, 2002). It was a one shot action: one prevention intervention during the academic year. For some researchers, there is insufficient evidence to suggest that long-term programs are more effective than short-term ones (Cuijpers, 2002; Gottfredson & Wilson, 2003). Here, the French institutions that agreed to participate in the study did not want the prevention intervention to take too much time from their curriculum.

The intervention was conducted by a prevention officer in an interactive way for the purpose of the adolescents to confront their different beliefs with one another and to understand the varying motivations for using the different screens and video games. The prevention officer asked the questions to the whole class (writing the answers on the board) and asked questions that promoted group dynamics, which means exchanges between teenagers to find common proposals. In the subject area of adolescent drug abuse prevention, the literature shows that interactive programs are more effective than non-interactive programs (Botvin & Griffin 2007; Springer et al. 2004; Tobler et al., 2000). In schools, interactive programs are found to be at least twice as effective as lecture-style programs (Hawks et al., 2002).

Measures

Gaming and Internet use. The questionnaire included four questions about use: amount of time spent on Internet (MSN, Facebook, YouTube, etc.) from Monday to Friday after school, and during the weekend.

Several dichotomous questions (“Yes” or “No” answers) were asked: Do you sleep less to spend more time playing video games? Do you spend more time playing video games than seeing your friends? Do you think that time spent playing video games has an impact on your school marks? Do you think that time spent playing video games affects the time spent with your family?

The questionnaire also incorporated the short version of the GAS, French validation (Khazaal et al., 2016), to evaluate addictive gaming (Lemmens et al., 2009). This 7-item scale is one of the most frequently used instruments for measuring IGD in adolescents (e.g., “Have you thought all day long about playing video games?”). As recommended by Lemmens et al. (2009), four “validated” items (responses indicating sometimes or more) correspond to addictive use of video games.

Gaming beliefs. The participant was asked to rank the following four propositions (products or behaviors) in order of increasing danger for schooling and health:

tobacco > alcohol > cannabis > video games; cannabis > alcohol > tobacco > video games; alcohol > cannabis > tobacco > video games; video games > cannabis > alcohol > tobacco.

The participant was asked to name the type of game that leads to the most dependence (only one answer): shooting games, strategy games, role-playing games, simulation games, management games, and no opinion.

Several dichotomous questions (“Yes” or “No” answers) were asked: Do you think that video games can have negative consequences on education? Do you think that video games can have negative consequences on family time? Do you think that video games can have negative consequences on physical health (e.g., malnutrition and back problems)? Do you think that video games can have negative consequences on mental health (e.g., depression)?

Internet gaming disorder beliefs. One dichotomous question (“Yes” or “No” answers) was asked: Do you think that we can become addicted to video games? The last three questions allowed for selection of multiple answers.

1. If you think video games can have negative consequences, what do you think they are? Possible response selections: eating problems, sleep problems, vision problems, withdrawal into a virtual world, lack of exercise, conflicts with parents/family, conflicts with friends, loss of the notion of time, lack of school investment, and aggressivity.
2. In your opinion, what could lead a person to become addicted on video games? Possible response selections: family problems, poor school performance, lack of friends, lack of self-confidence, bad self-image, difficulty making friends, and coincidence.
3. How would you define someone who is addicted on video games? Possible response selections: number of hours played, bad marks, saying no to all outings, only talking about video games, a person who cannot stop playing, playing instead of fulfilling one’s obligations (e.g., homework, sport, etc.), playing all the time.

Statistical analyses

All statistical analyses were carried out with SPSS software (version 20; New York, NY, USA). Univariate analyses were conducted: the CG and the intervention group were compared. Baseline (T0) and follow-up (T1 and T2) differences between the two groups were tested.

Next, gender differences were analyzed. A one-way analysis of variance was used to assess mean differences in continuous variables. For categorical data, differences in percentages were compared using the χ^2 test. The p value < .05 was used as a test of significance. To test the effect sizes, Cohen’s d for the continuous variables and ϕ^2 or Cramer’s V for the categorical data were calculated. Because of baseline differences between the two groups (prevention intervention and control) in time spent on Internet (during the week and the weekend) and video game (during the week and the weekend), we conducted an analysis of covariance with the prescore as a covariate. All the prescores were centered and used as a covariate.

Ethics

The study procedures were carried out in accordance with the Declaration of Helsinki. The study was approved by all school principals. Active consent was given by the adolescents and passive consent was obtained from the adolescents' parents (parents were informed by letter about the study and could refuse their child's participation by returning the consent). All participants gave their written informed consent. The ethics committee of Paris Descartes University (CERES) approved the study (IRB number: 2013360001072) and it was the subject of a declaration to the CNIL (treatment number 73).

RESULTS

Comparison of the prevention intervention group (PIG) vs. the control group (CG)

At baseline (T0), despite randomization, there were significant differences between the two groups (see Table 1). While there were no significant differences at T0, at T2, there were significantly more IGD gamers in the CG group ($\phi_c = 0.11$; $p = .027$) and more adolescents who played video games instead of seeing friends ($\phi_c = 0.15$; $p = .013$). In the PIG, the number of IGD gamers decreased by half between T1 and T2 ($\phi_c = 0.15$; $p = .052$). At T2, the minutes spent on Internet during the week [$F(2) = 17.68$; $p < .001$; $d = 0.09$] and the weekend [$F(2) = 6.90$; $p = .001$; $d = 0.10$], and the minutes spent on video game during the week [$F(2) = 18.57$; $p < .001$; $d = 0.42$] and the weekend [$F(2) = 31.06$; $p < .001$; $d = 0.05$] were significantly lower in the PIG group in comparison with the CG. Between T0 and T2, the number of minutes spent on Internet during the week increased by 39.4 min (+12.1%) in the CG, whereas it increased by 17.2 min (+5.7%) in the PIG. Furthermore, the number of minutes spent on Internet during the weekend increased by 46 min (+13%) in the CG, whereas it increased by 37.2 min (+11.7%) in the PIG, and the number of minutes spent on video games during the week increased by 35.3 min (+30%) in the CG, whereas it increased by 27.7 min (+22.9%) in the PIG. At T2, in the PIG, there was a significant increase of perceived risk associated with excessive gaming [e.g., they were more likely to think that video games could generate vision problems ($\phi_c = 0.27$; $p < .001$) or conflicts with friends ($\phi_c = 0.19$; $p < .001$)]. Furthermore, new awareness about risk factors of IGD development emerged in the PIG group. Finally, the PIGs were more likely to think that not being able to stop playing video game is a characteristic of a person presenting IGD ($\phi_c = 0.10$; $p = .039$).

Gender comparison

At baseline (T0), there were significant differences between boys and girls (see Table 2). Just after the prevention program (T1), girls spent more time on Internet during the week and the weekend ($d = 0.35$; $p = .018$ and $d = 0.31$; $p = .040$, respectively), whereas boys spent more time playing video games during the week and the weekend ($d = 0.54$; $p < .001$ and $d = 0.82$; $p < .001$, respectively).

There were more IGD gamers among the boys ($\phi_c = 0.22$; $p = .003$). There were more boys who thought that gaming had no impact on physical and mental health ($\phi_c = 0.20$; $p = .006$ and $\phi_c = 0.15$; $p = .041$, respectively). There were more girls who thought that video games could generate several problems [e.g., conflicts with parents ($\phi_c = 0.25$; $p < .001$) or lack of school investment ($\phi_c = 0.21$; $p = .003$)]. There were more girls who thought that family problems ($\phi_c = 0.16$; $p = .022$) and lack of self-confidence ($\phi_c = 0.16$; $p = .023$) were reasons for developing IGD that playing instead of fulfilling one's obligations and playing all the time were characteristics of a person presenting IGD ($\phi_c = 0.16$; $p = .024$ and $\phi_c = 0.16$; $p = .023$, respectively).

After the prevention program (T2), girls spent more time on Internet during the week ($d = 0.32$; $p = .030$), whereas boys spent more time playing video games during the week and the weekend ($d = 0.60$; $p < .001$ and $d = 0.63$; $p < .001$, respectively). There were more boys who thought that gaming had no impact on physical and mental health ($\phi_c = 0.20$; $p = .006$ and $\phi_c = 0.23$; $p = .002$, respectively) and that video games could not generate IGD ($\phi_c = 0.21$; $p = .004$). There were still more girls who thought that video games could generate several problems. Furthermore, there were still more girls who thought that family problems and lack of self-confidence were reasons for developing IGD. Both in boys and girls, several changes occurred between T0 and T2 in their representations about IGD.

DISCUSSION

This study examined the effects of a unique secondary prevention intervention on adolescent beliefs about gaming and IGD. It also analyzed its effects on Internet gaming and Internet use behaviors and examined gender differences.

Analyses showed a significant effect of the intervention on the time spent on Internet and gaming. The main effect concerned the number of adolescents presenting with IGD. Indeed, at 4-month follow-up, the prevalence of IGD was higher in the CG. Moreover, the number of IGD adolescents in the PIG decreased by half between post-intervention and follow-up, while it remained stable in the CG. In terms of time spent on Internet and video games during the week and the weekend, while an increase was observed in both groups, the increase was higher in the CG. Furthermore, at T2, time spent on Internet and video games were significantly lower in the PIG. This result could suggest a better ability to organize daily time during the week among adolescents from the PIG. Gender comparisons also confirm previous findings (Mihara & Higuchi, 2017) in that video game use, prevalence of IGD, and rise of IGD are all higher among boys. Our results are in line with two comparable studies on secondary students in Korea and Germany indicating a lower increase in amount of excessive gaming in the PIG compared to CG (Joo & Park, 2010; Walther, Hanewinkel, & Morgenstern, 2014). However, the study by Walther et al. (2014) found differences in time spent per day on video games but not on Internet. Beyond the fact that the measure of gaming time was different in this study, the relevance of this unique outcome measure could also be questioned. As previously

Table 1. Comparison between the prevention intervention group and the control group

	Prevention Intervention Group (PIG; n = 190)						Control group (CG; n = 194)						PIG vs. CG			
	T0		T1		T2		T0		T1		T2		T0	T2		
	n/mean	%/SD	n/mean	%/SD	n/mean	%/SD	n/mean	%/SD	n/mean	%/SD	n/mean	%/SD	T0 vs. T2	T0 vs. T2		
Gender	97	51.1	88	45.6												
Girls	93	48.9	106	54.4												
Boys																
Gaming use																
Nb min/day Internet M-F	283.0	447.2	284.5	352.4	300.2	414.9	NS	NS	NS	286.1	369.8	325.5	429.9	NS	NS	<0.001
Nb min/day Internet WE	280.7	330.3	265.5	255.9	317.9	530.8	NS	NS	NS	307.1	362.2	353.1	434.4	NS	NS	0.001
Nb min/day VG M-F	92.1	182.6	120.6	221.2	119.8	208.3	NS	NS	NS	153.6	272.6	188.9	367.3	NS	NS	<0.001
Nb min/day VG WE	161.5	208.9	176.4	258.3	177.8	381.9	NS	NS	NS	225.9	332.6	213.1	346.9	NS	NS	<0.001
Less sleep for play																
Yes	40	20.9	43	22.8	36	19.1	NS	NS	NS	53	27.5	49	25.3	NS	NS	NS
No	114	59.7	95	50.3	101	53.7				113	58.5	107	55.2			
Non-gamer	37	19.4	51	27.0	51	27.1				27	14.0	38	19.6			
Playing instead of seeing friends																
Yes	34	17.9	31	16.4	19	10.1	NS	NS	NS	32	16.6	35	18.1	NS	NS	.013
No	123	64.7	107	56.6	117	62.2				133	68.9	124	64.2			
Non-gamer	33	17.4	51	27.0	52	27.7				28	14.5	34	17.6			
Addictive gamers (GAS)																
Yes	16	8.7	20	10.7	10	5.6	NS	NS	0.053	NS	24	12.6	23	NS	NS	.027
No	168	87.3	167	89.3	170	94.4				166	87.4	167	87.9			
Gaming beliefs																
Most dangerous for education																
Tobacco > Alcohol >	9	4.9	23	12.2	12	6.5	0.006	0.012	NS	NS	14	7.3	10	NS	NS	NS
Cannabis > Video game																
Cannabis > Alcohol >	105	55.6	76	40.2	105	56.5				92	48.2	93	48.7			
Tobacco > Video game																
Alcohol > Cannabis >	24	12.7	26	13.8	19	10.2				28	14.7	31	16.2			
Tobacco > Video game																
Video game > Cannabis >	51	27.0	64	33.9	50	26.9				57	29.8	57	29.8			
Alcohol > Tobacco																
Most dangerous for health																
Tobacco > Alcohol >	22	11.7	37	19.4	33	17.5	0.031	NS	NS	NS	30	15.7	29	NS	NS	NS
Cannabis > Video game																
Cannabis > Alcohol >	120	63.8	10	56.5	111	58.7				115	60.2	123	64.4			
Tobacco > Video game																
Alcohol > Cannabis >	32	17.0	22	11.5	29	15.3				33	17.3	28	14.7			
Tobacco > Video game																
Video game > Cannabis >	14	7.4	24	12.6	16	8.5				13	6.8	11	5.8			
Alcohol > Tobacco																

Table 1. (Continued)

	Prevention Intervention Group (PIG; n = 190)						Control group (CG; n = 194)						PIG vs. CG		
	T0		T1		T2		T0		T1		T2		T0	T2	
	n/mean	%/SD	n/mean	%/SD	n/mean	%/SD	n/mean	%/SD	n/mean	%/SD	n/mean	%/SD	T0 vs. T2	T0	T2
Characteristics of a IGD gamer															
Number of hours spent playing	108	56.5	113	55.9	99	51.8	NS	NS	100	51.5	111	57.2	NS	NS	NS
Poor school results	38	19.9	39	19.3	35	18.3	NS	NS	25	12.9	31	16.0	NS	NS	NS
Saying no to all outings	70	36.6	92	45.5	94	49.2	0.046	NS	83	42.8	95	49.0	NS	NS	NS
Only talking about video games	119	62.3	116	57.4	116	60.7	NS	NS	110	56.7	122	62.9	NS	NS	NS
Cannot stop playing	129	67.5	146	72.3	147	77.0	NS	NS	126	64.9	131	67.5	NS	NS	0.039
Playing instead of fulfilling his obligations	129	67.5	137	67.8	127	66.5	NS	NS	136	70.1	119	61.3	NS	NS	NS
Playing all the time	132	69.1	142	70.6	144	75.4	NS	NS	135	69.6	138	71.1	NS	NS	NS

Note. Nb min/day Internet M-F: number of minutes per day on Internet from Monday to Friday after school; Nb min/day Internet WE: number of minutes per day on Internet during the weekend; Nb min/day VG M-F: number of minutes per day playing video games from Monday to Friday after school; Nb min/day VG WE: number of minutes per day playing video games during the weekend; VG: video games; Shoot games: shooting games; RP games: role-playing games; Sim games: simulation games; Manag games: management games; SD: standard deviation; NS: not significant.

highlighted (Throuvala et al., 2019), setting Internet time reduction cannot be a primary outcome variable, although less so for gaming (Andrisano et al., 2016; de Leeuw, de Bruijn, de Weert-van Oene, & Schrijvers, 2010; Walther et al., 2014). Focusing only on time spent online does not address sufficiently the individual's/gamer's experience. The most important factor is not necessarily the time spent on Internet or gaming but rather the fact that it undermines other areas of the subject's life such as homework, sleep time, etc. This means that other assessments need to be included in future studies.

In this study, in comparison with gaming time, time spent on Internet was much higher during the week and the weekend. As highlighted by Walther et al. (2014), while Internet gaming is a well-defined activity that can easily be reported, Internet use is much more heterogeneous. de Leeuw et al. (2010) also noted that time spent online is contextual and not generalized. Assessment of online activities is very complex and poses a challenge in the design of prevention programs. There is evidence suggesting that the time individuals spend online should not be the defining variable in excessive or addictive use because time spent online is specifically focused (Griffiths & Szabo, 2014; Pontes, Szabo, & Griffiths, 2015). Thus, it seems important to investigate further the amount of time spent on each specific Internet activity: e.g., social networks, YouTube (especially time spent on watching gaming videos), watching films or TV shows, researching on the Internet for school homework, etc. Furthermore, gender differences seem important because in the two groups, girls spent more time on the Internet than boys. As boys and girls use the Internet differently [i.e., girls tend to spend more time chatting, whereas boys play interactive games (Bernardi & Pallanti, 2009)], gathering more data about these activities is essential.

Overall, it can be said that the prevention intervention had an impact on adolescents' beliefs regarding IGD. Indeed, there was a significant increase in perceptions of risks associated with excessive use of video games, of the factors related to IGD, and of the characteristics of an IGD gamer.

Some representations changed in both boys and girls. In this respect, data highlighted that: (a) girls generally had better understanding about the potential dangers of and reasons for excessive gaming; (b) the prevention intervention had a greater impact in some aspects for girls; and (c) changes related to the prevention intervention did not always persist over time. Indeed, girls reported more negative consequences than boys and pointed to etiological factors not mentioned by boys, including family conflict, lack of self-confidence, or poor self-image. Thus, to promote psychosocial skills, it seems important to involve girls in interactive prevention programs, which are more effective than lecture programs (Springer et al., 2004). Future studies should also identify specific ways to enhance psychosocial skills in boys. Furthermore, the duration of the prevention program is an important consideration, given the encouraging results of studies of longer duration (Mun & Lee, 2015; Shek & Sun, 2010).

This study has several limitations as well as implications for future research. First, despite randomization, there were

Table 2. Gender comparison in the prevention intervention group
Prevention Intervention Group (PIG; n = 190)

	Prevention Intervention Group (PIG; n = 190)															
	T0				T1				T2							
	♀ (n = 97)	%/SD	n/mean	♂ (n = 93)	♀ (n = 97)	%/SD	n/mean	♂ (n = 93)	♀ (n = 97)	%/SD	n/mean	♂ (n = 93)				
Gaming use																
Nb min/day Internet M-F	257.1	368.8	311.1	519.1	NS	343.8	406.8	221.8	272.4	0.018	364.0	498.0	235.0	292.6	0.030	NS
Nb min/day Internet WE	287.8	323.3	273.4	340.5	NS	302.8	279.8	225.2	221.8	0.040	282.1	299.2	346.4	693.2	NS	NS
Nb min/day VG M-F	36.9	52.2	150.1	242.9	<0.001	64.2	172.3	181.3	251.0	<0.001	61.8	196.7	182.0	205.4	<0.001	NS
Nb min/day VG WE	67.5	89.6	262.5	248.4	<0.001	79.7	191.0	277.3	280.8	<0.001	64.4	180.0	295.9	491.2	<0.001	NS
Less sleep for play																
Yes	12	12.4	28	30.1	<0.001	13	13.4	30	32.6	<0.001	15	15.5	20	22.7	<0.001	0.021
No	52	53.6	62	66.7		39	40.2	56	60.9		33	34.0	66	75.0		
Non-gamer	33	34.0	3	3.2		45	46.4	6	6.5		49	50.5	2	2.3		
Playing instead of seeing friends																
Yes	9	9.3	25	27.2	<0.001	8	8.2	23	25.0	<0.001	4	4.1	15	17.0	<0.001	0.010
No	58	59.8	65	70.7		43	44.3	64	69.6		43	44.3	71	80.7		NS
Non-gamer	30	30.9	2	2.2		46	47.4	5	5.4		50	51.5	2	2.3		
Addictive gamers (GAS)	5	5.4	11	12.2	NS	4	4.2	16	17.6	0.003	3	3.2	7	8.2	NS	NS
Gaming beliefs																
Most dangerous for education																
Tobacco > Alcohol >	8	8.3	1	1.1	NS	16	16.3	7	7.7	0.015	8	8.5	4	4.4	NS	NS
Cannabis > Video game																
Cannabis > Alcohol >	48	50.0	56	60.9		29	29.6	47	51.6		49	52.1	54	60.0		
Tobacco > Video game																
Alcohol > Cannabis >	11	11.5	13	14.1		16	16.3	10	11.0		7	7.4	12	13.3		
Tobacco > Video game																
Video game > Cannabis >	29	30.2	22	23.9		37	37.8	27	29.7		30	31.9	20	22.2		
Alcohol > Tobacco																
Most dangerous for health																
Tobacco > Alcohol >	12	12.5	10	11.0	NS	23	23.5	14	15.1	0.046	18	18.8	15	16.7	NS	NS
Cannabis > Video game																
Cannabis > Alcohol >	59	61.5	60	65.9		46	46.9	62	66.7		50	52.1	58	64.4		
Tobacco > Video game																
Alcohol > Cannabis >	20	20.8	12	13.2		15	15.3	7	7.5		21	21.9	8	8.9		
Tobacco > Video game																
Video game > Cannabis >	5	5.2	9	9.9		14	14.3	10	10.8		7	7.3	9	10.0		
Alcohol > Tobacco																
Impact on education																
Yes	41	42.7	40	43.0	<0.001	39	39.4	40	42.6	<0.001	32	33.0	35	38.9	<0.001	NS
No	32	33.3	50	53.8		30	30.3	49	52.1		28	28.9	51	56.7		
Non-gamer	23	24.0	3	3.2		30	30.3	5	5.3		37	38.1	4	4.4		

(Continued)

Table 2. (Continued)
Prevention Intervention Group (PIG; n = 190)

	T0			T1			T2			♀	♂							
	♀ (n = 97)	♂ (n = 93)		♀ (n = 97)	♂ (n = 93)		♀ (n = 97)	♂ (n = 93)										
		n/mean	%/SD		n/mean	%/SD		n/mean	%/SD			n/mean	%/SD					
Impact on family time																		
Yes	41	42.3	40	43.5	0.001	48	48.5	44	46.3	<0.001	31	32.0	34	38.2	<0.001	0.05	NS	
No	35	36.1	48	52.2		22	22.2	47	49.5		30	30.9	52	58.4				
Non-gamer	21	21.6	4	4.3		29	29.3	4	4.2		36	37.1	3	3.4				
Impact on physical health																		
Yes	82	85.4	54	59.3	<0.001	87	88.8	71	73.2	0.006	84	86.6	63	70.0	0.006	NS	NS	
No	14	14.6	37	40.7		11	11.2	26	26.8		13	13.4	27	30.0				
Impact on mental health																		
Yes	76	78.4	56	61.5	0.012	85	85.9	72	74.2	0.041	81	83.5	57	63.3	0.002	NS	NS	
No	21	21.6	35	38.5		14	14.1	25	25.8		16	16.5	33	36.7				
Beliefs about IGD																		
Internet gaming disorder?																		
Yes	82	84.5	70	76.1	NS	90	90.0	80	87.0	NS	89	92.7	70	77.8	0.004	NS	NS	
No	15	15.5	22	23.9		9	9.1	12	13.0		7	7.3	20	22.2				
Type of VG associated with addiction																		
Shoot games	15	15.5	29	31.2	0.010	23	22.8	42	41.6	0.004	21	21.6	34	37.4	0.018	NS	NS	
Strat games	7	7.2	7	7.2	NS	8	7.9	12	11.9	NS	7	7.2	16	17.6	0.030	NS	0.039	
RP games	25	25.8	22	23.7	NS	34	33.7	33	32.7	NS	21	21.6	31	34.1	0.041	NS	NS	
Sim games	6	6.2	12	12.9	NS	10	9.9	24	23.8	0.008	12	12.4	18	19.8	NS	NS	NS	
Manag games	17	17.5	9	9.7	NS	14	13.9	13	12.9	NS	14	14.4	12	13.2	NS	NS	NS	
Without opinion	26	26.8	18	19.4	NS	25	24.8	7	6.9	0.001	29	29.9	14	15.4	0.018	NS	NS	
Risks associated with gaming use																		
Food problems	31	32.0	22	23.7	NS	76	75.2	59	58.4	0.011	61	62.9	45	49.5	0.044	<0.001	<0.001	
Sleep problems	88	90.7	71	76.3	0.007	92	91.1	82	81.2	0.042	94	96.9	77	84.6	0.003	NS	NS	
Vision problems	85	87.6	64	68.8	0.002	90	89.1	79	78.2	0.036	93	95.9	70	76.9	<0.001	0.037	NS	
Withdrawal into a virtual world	63	64.9	40	43.0	0.002	64	63.4	47	46.5	0.016	68	70.1	52	57.1	0.045	NS	0.038	
Lack of exercise	53	54.6	42	45.3	NS	58	57.4	59	58.4	NS	58	59.8	61	67.0	NS	NS	0.003	
Conflicts with parents/family	59	60.8	37	39.8	0.004	86	85.1	64	63.4	<0.001	71	73.2	41	45.1	<0.001	0.046	NS	
Conflicts with friends	25	25.8	19	20.4	NS	51	50.5	40	39.6	NS	43	44.3	30	33.0	NS	0.007	0.039	
Loss of time concept	59	60.8	41	44.1	0.021	75	74.3	62	61.4	0.035	78	80.4	56	61.5	0.004	0.003	0.018	
Lack of school investment	79	81.4	56	60.2	0.001	86	85.1	68	67.3	0.003	87	89.7	61	67.0	<0.001	NS	NS	
Aggressivity	60	61.9	49	52.7	NS	75	74.3	64	63.4	NS	67	69.1	53	58.2	NS	NS	NS	
Reasons for the addiction																		
Family problems	47	48.5	28	30.1	0.010	68	67.3	52	51.5	0.022	61	62.9	45	49.5	0.044	0.043	0.007	

Poor school results	38	39.2	34	36.6	NS	45	44.6	45	44.6	NS	45	46.4	40	44.0	NS	NS
Lack of friend(s)	59	60.8	55	59.1	NS	74	73.3	70	69.3	NS	72	74.2	65	71.4	NS	0.046
Lack of self-confidence	49	50.5	30	32.3	0.011	51	50.5	35	34.7	0.023	43	44.3	23	25.3	0.006	NS
Bad self-image	39	40.2	20	21.5	0.005	40	39.6	31	30.7	NS	41	42.3	28	30.8	NS	NS
Difficulty making friends	50	51.5	38	40.9	NS	57	56.4	51	50.5	NS	55	56.7	50	54.9	NS	0.039
Chance	28	28.9	30	32.3	NS	24	23.8	25	24.8	NS	31	32.0	39	42.9	NS	NS
Characteristics of a IGD gamer																
Number of hours spent playing	60	61.9	48	51.6	NS	61	60.4	52	51.5	NS	53	54.6	44	48.4	NS	NS
Poor school results	17	17.5	21	22.6	NS	19	18.8	20	19.8	NS	15	15.5	20	22.0	NS	NS
Saying no to all outings	37	38.1	32	34.4	NS	46	45.5	46	45.5	NS	46	47.4	47	51.6	NS	0.018
Only talking about video games	64	66.0	54	58.1	NS	61	60.4	55	54.5	NS	59	60.8	56	61.5	NS	NS
Cannot stop playing	68	70.1	60	64.5	NS	75	75.2	70	69.3	NS	77	79.4	68	74.7	NS	NS
Playing instead of fulfilling his obligations	69	71.1	60	64.5	NS	76	75.2	61	60.4	0.024	66	68.0	60	65.9	NS	NS
Playing all the time	65	67.0	66	71.0	NS	78	78.0	64	63.4	0.023	75	77.3	68	74.7	NS	NS

Note. Nb min/day Internet M-F: number of minutes per day on Internet from Monday to Friday after school; Nb min/day Internet WE: number of minutes per day on Internet during the weekend; Nb min/day VG M-F: number of minutes per day playing video games from Monday to Friday after school; Nb min/day VG WE: number of minutes per day playing video games during the weekend; VG: video games; Shoot games: shooting games; Strat games: strategic games; RP games: role-playing games; Sim games: simulation games; Manag games: management games; SD: standard deviation; NS: not significant; ♀: female; ♂: male.

baseline differences between the two groups on several measures. As suggested by Walther et al. (2014), it is possible that additional differences existed between the two groups that were not assessed, an aspect that reduces the internal validity of the study. The use of self-reported data (which could underestimate the time spent on the Internet or video games) remains a critical issue in empirical study (Throuvala et al., 2019) as well as social desirability biases (Andrisano et al., 2016). A momentary assessment (behavioral tracking) could be an alternative for a more accurate assessment of the time spent on various online activities. Furthermore, some questions were specifically designed for the study to reflect on the content of the prevention intervention; this may undermine the validity of some assessments.

Another limitation was the number of prevention sessions. It was a unique intervention, so even if the results are contrasted in the literature (Cuijpers, 2002; Gottfredson & Wilson, 2003) and this study showed promising results, a repetition of the method both during the year and over several years could yield more solid conclusions. For example, the 3-year prevention program by Shek and Sun (2010) showed significant positive benefits for youth development and changes in self-restraint using the computer.

The difficulties of engaging this type of research and this type of prevention intervention in France highlight the need for greater involvement of the French Ministry of Education in the promotion of healthy use of Internet and video games. Over the past 2 years, some French school staff have been trained in the early identification of IGD to encourage referrals to specialized addiction treatment centers. This involvement must extend to the entire territory. Thus, one goal of this pilot effectiveness prevention intervention assessment study was to evaluate the possibility of this type of intervention in France.

An important limitation of this study is that it includes only adolescents. The inclusion of parents in a prevention program enables the address of familial influences on gaming use, and thereby may increase the prevention program's effectiveness (Schneider, King, & Delfabbro, 2017). This being said, a preventive intervention would be very relevant for parents, allowing them to increase their knowledge of video games and sense of personal effectiveness as a parent by providing advice on how to monitor the use of video games (e.g., playing times, using a connection management system like "Log Me In," etc.). Simply providing a guide with advice and strategies for regulating video gaming is insufficient (Krossbakken et al., 2018). A large number of empirical studies and meta-analyses have demonstrated the effectiveness of parenting support programs based on a psychoeducational approach (Kaminski & Valle, 2008). Several studies also recommended including the community, school, or work environment in prevention interventions (Throuvala et al., 2019; Vondráčková & Gabrhelík, 2016). Here, again, it is necessary to evaluate the effectiveness of such combined prevention programs. Finally, the prevention of addiction among students in France is conducted by external institutions, a costly endeavor in terms of time and money. Effectiveness may also increase if France were to adopt a prevention program similar to those used in Germany that allows teachers to oversee external interventions.

CONCLUSIONS

Despite its limitations, this study provided encouraging conclusions regarding the impact of a single prevention intervention. Digital technologies are practically omnipresent and will continue to mesh with our daily lives. It is therefore essential to encourage healthy use and to prevent excessive use that may cause significant harm or disrupt individual functioning. In this study, the time spent on Internet and video games increased during the school year. Relevant stakeholders need to work together in the public interest to help children and adolescents become aware of potential harm and develop sufficient psychosocial skills to maintain a healthy use of Internet-related activities. Parents must be aware of potential harms and taught best parenting practices concerning digital technologies. There is a need for greater empirical evaluation of prevention approaches as well as use of up-to-date knowledge for defining and promoting best prevention practices. Given the strong habitual nature of the disorder, the effectiveness of prevention initiatives is dependent on significant evidence-based delivery approaches and more longitudinal designs to target attitudes and behaviors consistently. In addition, it is important to consider carefully the aims vis-a-vis the duration of the intervention.

Excessive screen time may pose a significant psychosocial problem for a certain groups of children and adolescents. Difficulties in school are often the first signal of IGD. School staff are limited in effecting early intervention, despite recognizing the necessity. Similarly, although some schools in France already organized conferences/debates on video games for parents, attendance was low and parents present are generally already informed about and involved in monitoring their child's video game use. Developing prevention programs will enhance school staff skills and early diagnoses of excessive use. In this way, children and adolescents will receive the help they need and the programs will contribute to raise awareness among parents about the importance of screen use education.

Funding sources: None.

Authors' contribution: CB drafted the first version of the manuscript. All authors have corrected and made suggestions to this first draft. It was sent back and forth with corrections several times between CB and the other authors. All authors agreed to the final version of the manuscript.

Conflict of interest: The authors declare no conflict of interest.

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APPENDIX: TRANSLATION OF THE PREVENTION INTERVENTION CONTENT

00:00 – PRESENTATION

Presentation of the prevention officer, the “Young Consumer Consultation” service and the theme of the intervention. This introduction time allows for the creation of a climate of trust and establishes the foundations of the speech’s credibility. This credibility is necessary to ensure the success of the prevention program.

During this time, the health care center is presented to the teenagers and they are briefly informed about its functioning. Thus identified, the referral work that can be carried out by the teaching team a posteriori is facilitated.

00:05 – QUESTIONS AND INTERACTIONS WITH THE TEENAGERS

The teenagers are asked to answer these questions: what are the different screens they use and what are the differences between these screens? Nowadays, there are 10 screens per household on average.

This part provides an introduction to the topic. By providing information, the speaker seems more reliable. It is also a moment that allows the group to take a step back and contextualize screen use. Information related to the increase in the number of screens per household allows them to become aware of the external stressors that they may face and cannot always avoid. The work on the screen differentiation then makes it possible to get them to think about the different uses of the screens and what that implies in the short and medium term.

00:15 – PROMOTION OF HEALTHY SCREEN USE

The prevention officer asks the teenagers to list the positive aspects of screens/video games.

To solidify the trust relationship with the teenagers, the program begins by asking them to make the most comprehensive list possible of the positive aspects of screens and video games. Since it is the teenagers who write the list, these interactions show them that the speaker (and the consultation service by extension) does not perceive the screens and video games, Internet . . . as a world that should be avoided. It is not taking a negative stance against screens as something evil that must be fought, but rather as a universe rich with possibilities, shared by several generations and upon, which we can establish a conversation.

It appears from the classes in which this program has already taken place that the following ideas are mentioned: Play, De-stress, Relax, Share, Exchange, Inquire, Discover, Work, Learn, Keep in touch, Listen to music/movies, Have fun . . .

A time is taken to reread the list, and remember that at the beginning of any use there is a positive intention. Therefore, a user’s first intention when starting a video game or checking a Facebook page is a positive one and comes from this list.

00:30 – EXCESSIVE USE: DEFINITION

Excessive use? What is it?

Notions discussed: Habit × Frequency × Quantity.

Excessive use depends on the context and the consequences (health, social, work, and economic).

During this time, it is demonstrated that words are sometimes misleading. Teenagers are invited to express themselves freely on their representations of the notion of excessive use. Teenager participation is important during this time, as the prevention officer emphasizes the different representations mentioned and emphasizes that one must take all the criteria into consideration and not make hasty judgements.

Through the teenagers’ answers and examples concerning excessive use, the prevention officer shows his compassionate and non-judgmental position, while simultaneously consolidating an expert position that can guide and frame the exchanges. The notions, the context, and the consequences will serve as a guideline for the rest of the intervention.

Funnel diagram: This diagram makes it possible to visualize and summarize the elements previously discussed. It allows to visually anchor the invasion of an activity in a person’s life.

00:50 – MY OWN SCREEN AND VIDEO GAMES TIME

The teenagers are asked to complete the following questionnaire on time spent on screens (see tables below).

A time of reflection is taken on the time spent each day in front of the screens.

The difficulty faced by the young people to complete the table is used by the prevention officer as an educational experience, about the loss of the notion of time in front of screens, which is a very common issue.

The table allows everyone to take a step back on their overall use of screens.

1:05 – EXCESSIVE USE: WHAT ARE THE CONSEQUENCES?

Here, the prevention officer asks the teenagers to list the negative aspects of screens/video games.

This time is interactive since once again, it is the teenagers who fill the list of negative (unwanted) effects of screens and video games. The prevention officer helps the students develop their ideas and for the notions mentioned, the prevention officer provides technical and practical information. For example, if the impact on health or vision is mentioned, a brief explanation will be given as well as advice (recommendations) to reduce this risk.

It appears from the classes in which this program has already been implemented that the following ideas are mentioned: Stress, Isolation, Food, Health, Lack of activity, Feeling nervous, Waste of time, Loss of the notion of time, No life, Family relations . . .

	Monday to Friday	Saturday and Sunday
Screens		
TV or Cinema		
Video game or computer		
Online Gaming		
Social networks		
YouTube		
Other activities		
Sports or cultural activities		
Activities with friends without screens		
Activities with the family (meals, games, ...)		
School work + any private lessons		
Other		

The prevention officer helps the teenagers think about the link between positive and negative aspects. How does our use of screens go from positive to negative?

This part serves to remind teenagers that the negative consequences are not disconnected from the initial aspirations of a positive use. This time helps to reinforce students' skills and to question them about the means they can use to modify, limit, or avoid the transition from positive to negative use.

In order to stay in touch with teens' lives, the prevention officer will use relevant examples that will reflect real-life situations.

1:20 – AWARENESS OF UNWANTED EFFECTS

How much time do we spend in front of the screens? What is the impact on daily life?

The teenagers are asked to fill out a sleep questionnaire: all teenagers write down their bedtime, the time they wake up, and the amount of time they rest.

What is the impact of activities carried out before falling asleep?

To take a step back from the use and to check that certain key information have been correctly captured (e.g., that playing time is not the only determinant), the presenter goes back to the time spent in front of the screens. The prevention officer discusses data from the general population.

The questions regarding sleep brings to their attention an important aspect of the impact their screen use can have, on something like sleep, something that the student can easily perceive and modify individually. The goal is to bring the teenager to increased awareness of their behavior and the effect it can have.

The three rules of the Internet: undecidable/eternal/public.

This last informative part allows the group to address issues concerning the private life of the teenagers and their relation with intimacy. It is also a way of trying to get them to look ahead and to anticipate unwanted consequences that can emerge from what were positive practices at the outset. This part makes it possible, as a final note, to remind them that they have a large amount of control of their lives (real and virtual) and that there are people to listen to them, to advise them, to guide them, and to protect them.