Efficacy indicators for ICT addiction prevention: a case study of *Clickeando*

Indicadores de eficacia de la prevención de la adicción a las TIC: Clickeando, *estudio de caso*

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Abstract:

There are few programmes for preventing ICT addiction, and even fewer that have been scientifically validated. Preventing ICT addiction is a key part of governments' adolescent mental health policies. *Clickeando* is a school programme for universal prevention of ICT addiction in adolescents. It has been in use for fourteen years and was designed on the basis of the appropriate quality indexes for this type of programme. Since 2020, *Clickeando* has assessed its participants with the aim of linking the efforts of different preventive bodies and agents. This has enabled the present study to assess the programme's impact on its target population. The main results indicate that the programme produces changes in ICT use, principally by reducing addictive use of mobile phones by girls and boys in secondary education. Likewise, there are important behaviours in the development of addictive patterns that we suggest should be the focus of future modifications to the workshop (such as time spent on social networks or on instant messaging systems), for they are crucial for the efficacy of the intervention. The effects of Covid-19 on young people's mental health have highlighted the need for assessment protocols and preventive actions that foster healthy use of technology and that take into account age and the gender perspective in their implementation to maximise their efficacy.

Keywords: addiction, technology, ICT, mobile phones, social networks, video games, school-based prevention, prevention programme, mental health, efficacy, validation, adolescence, Covid-19, factor analysis.

Resumen:

No existen muchos programas de prevención de adicción a las TIC y menos todavía validados científicamente. Prevenir la adicción a las TIC es clave en las políticas gubernamentales de salud mental de los adolescentes. *Clickeando* es un programa escolar de prevención universal de la adicción a las TIC para adolescentes. Lleva realizándose catorce años y ha sido diseñado con base en los índices de calidad destacados para esta clase de programas. Desde 2020, *Clickeando* evalúa a sus participantes con el fin de vincular los esfuerzos de organismos y agentes preventivos, lo que ha permitido valorar los efectos del programa en su población objetivo en el presente estudio. Los principales resultados indican que el programa logra producir cambios en el uso de las TIC, principalmente a través de la disminución del uso adictivo del móvil tanto en chicas como chicos de secundaria. A su vez, existen conductas con un importante peso en el desarrollo de patrones adictivos que se sugiere tener como objetivo en futuras modificaciones del taller (como el tiempo invertido en las redes sociales o en los sistemas de mensajería instantánea), pues resultan decisivas para la eficacia de la intervención. Las secuelas del Covid-19 en la salud mental de la juventud ha puesto de relieve la necesidad de contar con protocolos de evaluación y actuaciones preventivas que fomenten el uso saludable de la tecnología. Uno y otras, además, deberán considerar la edad y la perspectiva de género en su implementación para maximizar su eficacia.

Palabras clave: adicción, tecnología, TIC, móvil, redes sociales, videojuegos, prevención escolar, programa prevención, salud mental, eficacia, validación, adolescencia, Covid-19, análisis factorial.

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1. Introduction

In the present digital age, information and communication technologies (ICT) play a central role in the psycho-social spheres (personal, social, and school) of adolescents (the age group ranging from 10 to 18 years) (Gentry & Campbell, 2002; Chóliz, 2017). As a result of the Covid-19 lockdowns, adolescents greatly increased their consumption of technology (Masaeli & Harhadi, 2021), putting them at greater risk of developing an ICT addiction (Kuss et al., 2013). In Spain, almost all young people aged from 10 to 12 years have access to a smartphone (Anderson & Jiang, 2018), while 23.5% of adolescents aged from 14 to 18 present an internet addiction, and 7.1%, a gaming addiction (GA) (Observatorio Español de las Drogas y las Adicciones, 2022).

ICT addiction is defined as a recurrent and pathological pattern of behaviour, characterised by salience, tolerance (progressive increase in time of use), withdrawal (psychological discomfort in the absence of the stimulus), avoiding dysphoric emotions, psychosocial conflicts, relapse, and difficulty controlling ICT consumption (Kuss et al., 2014). The characteristics of technology as a medium and its applications (social networks [SN], gaming, and the internet) have a high addictive potential that results in the development of symptoms similar to those of substance addictions (Soto et al., 2018).

This harm to the mental health of younger generations highlights the need to establish public policies to tackle the problems of ICT addiction, a question that predates Covid-19 (King et al., 2018). Consequently, measures should be put in place that make it possible to delay, reduce, and eliminate the impact of potentially addictive behaviours by strengthening knowledge, attitudes, and behaviours that protect adolescents' mental health (Romano & Hage, 2000). When we speak of this need, we refer to prevention, as this has shown itself to be an effective approach to the reduction of addictive ICT use among adolescents when implemented through public policies (American Psichological Association [APA], 2014; Kaess et al., 2016). Specifically, the utility of school universal prevention programmes targeted at secondary-school students has been highlighted (Gainsbury & Blaszczynski, 2011; Prats et al., 2018). However, if they are to be effective, these programmes must be specific, evidence-based and designed using defined standards; work on risk and protection factors (Berrios et al., 2020); and include instruments to assess the intervention (Throuvala et al., 2019) and early detection in users (García-Couceiro et al., 2021).

Our specific object of study is the universal ICT addiction prevention programme for secondary education *Clickeando*. This programme focusses on students aged from 10 to 14 and their school and family context (Sánchez et al., 2018). As well as the two versions for students (obligatory secondary education [ESO] and primary education), it features workshops for family members and teachers. Its principal objective is to inform, raise awareness, and modify behaviour involving misuse of technology (both excessive use and inappropriate use) such as loss of privacy or cyberbullying (Echeburúa & De Corral, 2010). Valencia's Plan Municipal de Drogodependencias (Municipal Drug Dependency Plan) has used *Clickeando* for fourteen years in educational centres. However, despite its longevity and the quality of its design, the students were not assessed in the procedure until 2020.

Therefore, the present work focuses on the population of *Clickeando* participants and on the effects of the programme. To do so, it will address two fundamental issues in the design of effective ICT addiction prevention programmes. Firstly, work on this type of prevention tends to centre on risk factors such as time of use or the age of participants (Throuvala et al., 2019). Nonetheless, gender is a risk factor that, despite its relevance in the development of social networks addition (SNA) and gaming addiction (GA) (Andreassen et al., 2016), is not usually included in the prevention actions of these programmes (Yudes et al., 2019).

The second is the lack of consensus regarding ICT addiction terminology (Berrios et al., 2020; King et al., 2018). Terms such as *pathological*, *problematic*, or *compulsive* use, or *abuse*, *dependency*, and *addiction* are used interchangeably in the literature to refer to the same concept. We understand that pathological use of ICT results in symptoms of addiction. Therefore, we will use the concept *addictive use* to refer to the presence of symptoms of addiction without establishing a disorder, as our methodology is based on detection and not diagnosis.

Furthermore, *ICT* is a very broad and ambiguous concept if the elements that might generate an addictive behaviour are not specified (for example, screen addiction) (Bhargava & Seshadri, 2021). In this study, ICT addiction comprises mobile phone addiction (MPA) (such as uncontrolled, inappropriate, or excessive

use that creates social, behavioural, and affective problems; Chóliz, 2010), SNA (such as compulsive and problematic use that causes a significant impairment of everyday functioning over a long period of time) (Van den Eijnden et al., 2016), and GA (such as persistent and recurrent use that displays symptoms of preoccupation, withdrawal, tolerance, lack of control, loss of interest in other activities, psychosocial consequences, deception about amount of time spent, losing opportunities or relationships, and gaming to relieve negative moods) (American Psychiatric Association [APA], 2013).

There is an international need to address ICT addiction in adolescence by means of prevention programmes of a psychosocial nature through public policies (King et al., 2018), which is part of the United Nations' sustainable development goal (SDG) 3 relating to good health and well-being. This article is the result of the desire to provide the educational community with a useful resource that makes it possible to work on this aspect that feeds the crisis in young people's mental health that we are facing: adolescents' relationship with their virtual context (Bashir & Bhat, 2017). Its main aim is to provide evidence about changes in participants' behaviour relating to ICT resulting from *Clickeando*. To do so, we will analyse (1) participants' patterns of use and prevalence of addictive behaviour towards ICT, (2) which behavioural aspects of ICT use promote addictive use, (3) what effects the workshop has on these behaviours, and (4) whether these differ between male and female participants.

2. Methodology

2.1. Participants and procedure

The sample comprised participants selected from the *Clickeando* workshop (Table 1) through purposive non-probability sampling during the 2021-2022 academic year. The design of the experiment was based on assessments before the start of the programme (pre-test) and one month after its completion (post-test). These assessments were matched by participants by means of a unique identification code that complied with both the regulations of the Ethics Committee of the Universidad de Valencia regarding personal data processing and with the rules of the Helsinki Declaration (2013).

The total sample included all of the participants from secondary education who completed the workshop and all of the questionnaires (N = 645, M_{age} = 12.36, girls = 45%, boys = 55%, year one of ESO = 74%, year 2 of ESO = 26%). A sub-sample was also selected comprising only the participants matched in the pre-post assessments (n = 322, M_{age} = 12.22, girls = 51.9%, boys = 48.1%, year 1 of ESO = 83.2%, year 2 of ESO = 16.8%).

TABLE 1. Design and structure of the *Clickeando* workshop for ESO

Elements of the programme			Structure of the programme
Prevention level	Universal: prevention prior to appearance of the problem.		Module 1: Introduction (1 hour) Week 1
Target population	Male and female students from years 1 and 2 of ESO in the centres participating in the programme.		1.1. Advantages of technology 1.2. Disadvantages of technology 1.2.1 Physical drawbacks 1.2.2 Social drawbacks 1.2.3. Technological drawbacks
Users' needs	Having knowledge and clear guidelines about the positive use and negative effects of ICT while learning to use it.		Module 2: Problems with inappropriate intra- and interpersonal use (1 hour)
Objectives	General	Preventing addictive use of ICT and risk behaviours. Promoting healthy use.	2.1. Privacy with ICT 2.2. Grooming 2.3. Sexting 2.4. Cyberbullying
	Specific	Identifying advantages and drawbacks of ICT and risk behaviours. Differentiating between good and bad uses of ICT. Improving online safety and privacy. Avoiding the negative influence of ICT in psycho-social spheres (classroom, home, and friendships). Promoting non-virtual leisure. Analysing offline effects of ICT. Improving personal competences and resources.	

Theoretical framework	Preventive treatment of behavioural addictions (Mora et al., 2015)	Module 3: ICT addiction (1 hour) Week 2
Strategies	Participatory: critical thinking, social skills, emotional management and intelligence. Informational: up-to-date knowledge of the harmful effects of ICT. Formative: identifying problem areas, how to act inside and outside ICT.	3.1. Types of ICT addiction 3.2. Identifying the signs of addiction 3.3. Process of development of the addiction 3.4. Guidelines for action
Activities	Group work through activities in class (e.g., role-playing), discussions (e.g., why do we get hooked on ICT?), or watching videos (e.g., short films on cases of ICT addiction, extracts from documentaries or music videos).	
Timeline	September: circulation of the programme to the schools and opening of the agenda. October-May: Delivery of the workshops by specialists in the centres in order of demand. June-July: analysis of data by centre, educational and community level, and preparation of reports for the bodies involved.	
Community resources	A public activity done in a space in the school centres with technological resources the enable the use of audiovisual resources.	
Assessment	The assessment is done in the first session and one month after completing the workshop. Its aims are (1) to detect cases of risk or consolidated cases, (2) to link the intervention services on the problem of ICT addiction at a school and municipal level, as much as (3) to obtain evidence about the functioning of the workshop and propose improvements to it	

Note: the outline of the characteristics of the programme is based on the descriptive format documented by Espinel and Leguizamón (2022). The content of the *Clickeando* workshop for compulsory secondary education is taken from Sánchez et al. (2018).

2.2. Instruments

2.2.1. TecnoTest (Marcos & Chóliz, 2021)

ICT addiction screening instrument comprising twenty-four dichotomous questions (yes/no). This test consists of four scales comprising six items that detect whether an ICT addiction behaviour (mobile phone, SN, and gaming) is independently present (α_{mobile} = .92, α_{SN} = .72, α_{gaming} = .81). Each scale determines the degree of addiction by adding three items with predictive value (mobile phone: 3, 4, 20; SN: 5, 7, 14; gaming: 6, 8, 19). The final scores define cases of non-problematic behaviour (0), problematic behaviour (1), risk behaviour (2), and addictive behaviour (3) in relation to the different forms of ICT.

2.2.2. Ad hoc battery on technology use pattern

This included seven ordinal items to assess weekly frequency of use of SN and gaming, and time spent using them. The frequency item comprised five response levels (1 = Never, 2 = 1-2 times a week, 3 = 3-4 times a week, 4 = 5-6 times a week, 5 = Daily). The time of use was measured on the basis of two different items (time during the week and at the weekend) with a five-point Likert scale (1 = I do not use them, 2 = <1 hour, 3 = 1-2 hours, 4 = 2-3 hours, 5 = ≥ 3 hours).

The last item assessed the time taken to respond to instant messaging (IM) on apps like WhatsApp in different situations (at home, in class, social settings, in bed, and while eating) on a four-point scale (1 = I answer immediately; 2 = I wait a bit, but I try to answer as soon as possible; 3 = I wait as long as I need to answer; 4 = I never answer in this situation). The responses to these items were inverted and added up to give a total score that assessed compulsive use of instant messaging (the faster the response, the more addictive behaviour towards the mobile phone) of up to 20 points (Luján-Barrera & Denís, 2021). The total reliability of the ad hoc scale was α = .769.

Finally, the age, gender (male/female), school, year group, cycle, and nationality of the participants were also recorded.

2.3. Statistical analysis

This study used univariate statistics in SPSS Statistics 28 such as descriptive statistics, frequencies, and *t*-tests between groups and within subjects. We also

calculated the effect size (Cohen's *d* : small ≥.2, medium ≥.5, or large ≥.8). Multivariate analyses were done using IBM SPSS Amos 28 to create factorial model for ICT addiction. For the factor analysis, we used the maximum likelihood estimation method (MLE) and the comparative fit indexes (*CFI* ≥.9–.95) (Van de Schoot et al., 2012), root mean square error of approximation (*RMSEA* <.06–.08) (Kline, 2010), maximum likelihood indexes (χ^2 and χ^2/df), Akaike information criterion (AIC), and Bayesian information criterion (BIC). These last three indicate better fit when their value is lower (Killian et al., 2019). The standardised factor loadings (λ_e) and explained variance (R^2) were also used to analyse the influence of the indicators (λ_e >0.4) within and between the models (Stevens, 2002).

3. Results

3.1. Study of the sample before the programme

3.1.1. General pattern of ICT use

With regards to mean ICT consumption before the programme, the participants used SN for 1-2 up to 2-3 hours per week (school time and holidays). They were online, at least, 5-6 days a week. The exception was gaming, for they played on average only 2-3 days for 1 hour from Monday to Friday and, at least, 1-2 hours on weekends.

In general, the form of ICT with the greatest degree of addiction was the mobile phone: 52.7% had problematic behaviour; 13.5%, risk behaviour; and 3.7%, addictive behaviour (only 28.2% did not display problems). Secondly, there was gaming (normal usage: 70.4%, problematic: 22.6%, risk: 5.3%, addictive: 1.7%), and finally SN (normal: 79.1%, problematic: l 5%, risk: 4.5%, addictive: 1.4%). Clear gender differences were apparent in addictive use of SN (greater in the case of girls) and gaming (greater in the case of boys) (Table 2), while no significant differences were observed regarding use of mobile phones.

With regards to use habits, both genders displayed high SN use, with a mean daily connection of 2 up to 5-6 hours during the week and 3 hours at weekends. However, girls displayed significantly higher addictive behaviour towards SN. As in the general results, addictive use of MP is predominant over other forms of ICT.

TABLE 2. Differences between groups by gender in the initial pattern of use of ICT.

Variables	*M (SD)* Girls (*n* = 290)	Boys (*n* = 355)	*t (df)*	*p*	*CI*	*d*
SN frequency	3.93 (1.379)	3.95 (1.396)	.109 (643)	913	-.204-.228	.009
Gaming frequency	2.16 (1.316)	3.3 (1.304)	10.996 (643)	***	.936-1.344	.87
SNS time DW	2.83 (1.173)	2.82 (1.175)	-.085 (643)	.933	-.190-.175	-.162
SNS time WE	3.61 (1.285)	3.72 (1.29)	1,12 (643)	.263	-.086-.341	-.089
Gaming time DW	1.72 (.985)	2.42 (1.287)	7.78 (640.375)	***	.520-.872	.6
Gaming time WE	2.43 (1.325)	3.94 (1.053)	15.733 (545.72)	***	1.319-1.695	1.274
Compulsive WhatsApp use	10.78 (2.71)	11.12 (3.09)	1.482 (639.725)	.139	-.116-.793	.116
Addictive use of mobile phone	.98 (.795)	.92 (.736)	-.906 (643)	.365	-.173-.064	-.072
Addictive use of SN	.34 (.669)	.23 (.561)	-2.18 (564.829)	*	-.204-(-.011)	-.176
Addictive use of gaming	.31 (.623)	.44 (.696)	2.537 (637.698)	*	.03-.234	.199

Note: SN: social networks; DW: during the week; WE: weekend; IM: instant messaging. *M*: mean; *df*: degrees of freedom; *CI*: confidence interval; *d*: effect size. *Sig.* (two tail): p <.05 (*), p <.01 (**), p <.001 (***).

3.1.2. Definition of the factorial model for measuring addictive behaviour towards ICT

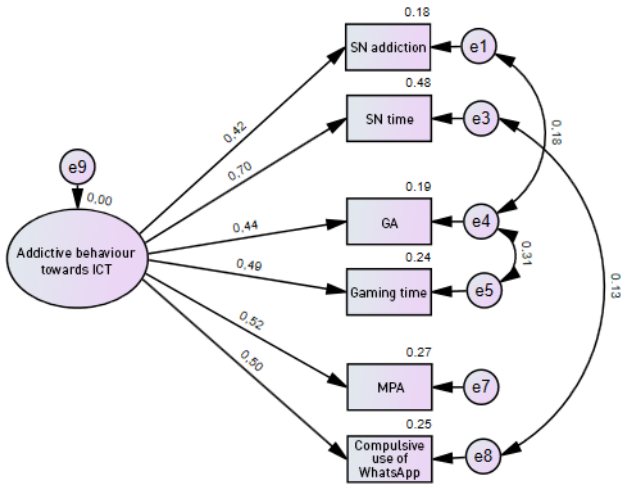
During the development of the factorial model for measuring participants' ICT addiction (Figure 1), two more models were tried, shown in Table 3. The first model had a structure with one general factor (ICT addiction) comprising three first-order factors (MPA, SNA, and GA). The first of these comprised the total score from the TecnoTest for the addictive use of MP and compulsive use of IM indicator. The second consisted of the total addictive SN use score and the indicators of time (during the week and weekends) and weekly frequency. And the third comprised the same indicators relating to gaming (total score, time, and frequency). After rejecting this model for lack of fit, a second model was tested eliminating the items that were less representative of addictive use (frequency and time of use at weekends), which also did not adequately fit despite being more parsimonious. Lastly, all of the indicators were maintained and all of the first-order factors were eliminated (MPA, SNA, and GA); thus, a single factor model with satisfactory fit was established.

TABLE 3. Indexes of fit of the development of the factorial model of addictive behaviour towards ICT.

Models	χ^2	***df***	$\chi^2/_{df}$	***p***	***CFI***	*RMSEA*	*AIC*	*BIC*
1	199.101	29	6.866	.001	.933	.095	251.101	367.302
2	40.165	6	6.694	.001	.945	.094	70.165	137.204
3	20.725	6	3.454	.002	.976	.062	50.725	132.763

Note: χ^2: likelihood ratio index; *df*: degrees of freedom; *CFI*: comparative fit index; *RMSEA*: root mean square error of approximation; *AIC*: Akaike information criterion; *BIC*: Bayesian information criterion.

FIGURE 1. Factorial model for measuring addictive behaviour towards ICT.



The results of the model were consistent with the descriptive statistics of the sample. All of the indicators obtained adequate factorial saturations (λ_e <.4) and a considerable predictive value (R^2 <.2). Addictive use of MP was the addictive behaviour with the highest factorial weight (λ_e = .52) and predicted the greatest percentage of the variance (R^2 = .27), while addictive use of SN and gaming explained between 18% and 19% of the variance each. Nonetheless, time spent using SN was the most influential (λ_e = .7) and explanatory indicator (R^2 = .48) of addictive behaviour towards ICT.

The results of the unidimensional model indicate that, more than speaking of ICT addiction separately, the model represents a common construct of addictive use by participants of ICT, something that is coherent given the relationships between covariances across the indicators.

3.2. Study of the sample after the programme

3.2.1. Analysis of the effects of the *Clickeando* programme

The participants changed some behaviours relating to ICT following the programme (Table 4). In relation to mobile telephones, compulsive and addictive use of IM fell significantly. In the case of SN, after the programme, the participants reduced the number of weekly connections to SN, but not their time or addictive behaviour. No change in habits or addictive use of gaming was seen either.

However, the results did differ by gender. Addictive use of MP fell significantly in both groups, especially among boys. In fact, the boys displayed less compulsive use of IM after the programme. However, they did not display any change in use of SN, while the girls reduced their time and frequency. Furthermore, the boys did not change their behaviours in relation to gaming, while the girls did display significant changes after the workshop (increased frequency and reduced addictive use).

TABLE 4. Changes in indicators of use and abuse by participants after the programme in general and by gender.

Variables	Groups	*M (SD)*		*t (df)*	*p*	*CI*	*d*
		Pre	Post				
SN frequency	G	4.02 (1.34)	3.84 (1.38)	3.238 (318)	***	.07-.287	.181
	A	4.07 (1.26)	3.89 (1.32)	2.76 (191)	**	.053-.322	.199
	O	3.89 (1.44)	3.79 (1.47)	1.25 (176)	.106	-.059-.262	.094
Gaming frequency	G	2.62 (1.41)	2.71 (1.33)	-11.77 (314)	.069	-.213-.03	-.084
	A	2.01 (1.26)	2.21 (1.27)	-2.691 (188)	**	-.348-(-.054)	-.196
	O	3.27 (1.26)	3.27 (1.18)	0 (176)	.5	-.165-.165	0
SN time DW	G	2.77 (1.07)	2.73 (1.07)	.844 (316)	.2	-.055-.137	.047
	A	2.81 (1.05)	2.7 (1.06)	1.891 (190)	*	-.005-.225	.137
	O	2.7 (1.14)	2.75 (1.15)	-.798 (174)	.213	-.179-.076	-.06
SN time WE	G	3.58 (1.23)	3.52 (1.22)	1.287 (307)	.1	-.036-.172	.073
	A	3.54 (1.19)	3.42 (1.16)	1.824 (184)	*	-.01-.259	.134
	O	3.61 (1.29)	3.6 (1.32)	-.082 (167)	.467	-.15-.138	-.006
Gaming time DW	G	1.9 (1.08)	2.03 (1.13)	-2.341 (313)	**	-.234-(-.02)	-.132
	A	1.56 (.87)	1.65 (.920)	-1.441 (188)	.076	-.201-.031	-.105
	O	2.29 (1.18)	2.37 (1.23)	-.99 (174)	.162	-.24-.08	-.075
Gaming time WE	G	3.1 (1.41)	3.06 (1.41)	.918 (305)	.180	-.056-.154	.052
	A	2.37 (1.34)	2.28 (1.26)	1.326 (182)	.093	-.045-.231	.098
	O	3.88 (1.01)	3.86 (1.05)	.340 (171)	.367	-.112-.158	.026
Compulsive WhatsApp use	G	10.56 (2.734)	10.11 (2.68)	3.904 (290)	***	.223-.677	.229
	A	10.62 (2.5)	10.37 (2.66)	1.643 (177)	.051	.051-.556	.123
	O	10.45 (2.98)	9.9 (2.89)	3.162 (160)	***	.198-.858	.249
Addictive mobile phone use	G	.88 (.695)	.7 (.686)	4.866 (313)	***	.104-.246	.275
	A	.9 (.682)	.76 (.734)	3.107 (187)	***	.052-.235	.227
	O	.85 (.696)	.64 (.643)	3.949 (175)	***	.102-.307	.298
Addictive SN use	G	.24 (.535)	.20 (.505)	1.513 (315)	.066	-.013-.102	.085
	A	2.9 (.599)	.25 (.553)	1.051 (185)	.147	-.038-.124	.077
	O	.21 (.507)	.16 (.45)	1.288 (179)	.1	-.027-.127	.096
Addictive gaming use	G	.3 (.558)	.25 (.526)	1.377 (313)	.085	-.02 -.116	.078
	A	.25 (.562)	.19 (.489)	1.771 (186)	*	-.007-.124	.13
	O	.34 (.612)	.33 (.599)	.208 (175)	.418	-.096-.119	.016

Note: G: general; A: girls, O: boys; SN: social networks; DW: during the week; WE: weekend. *M*: mean; *df*: degrees of freedom; *CI*: confidence interval; *d*: effect size. *Sig.* (single tail): $p < .05$ (*), $p < .01$ (**), $p < .001$ (***).

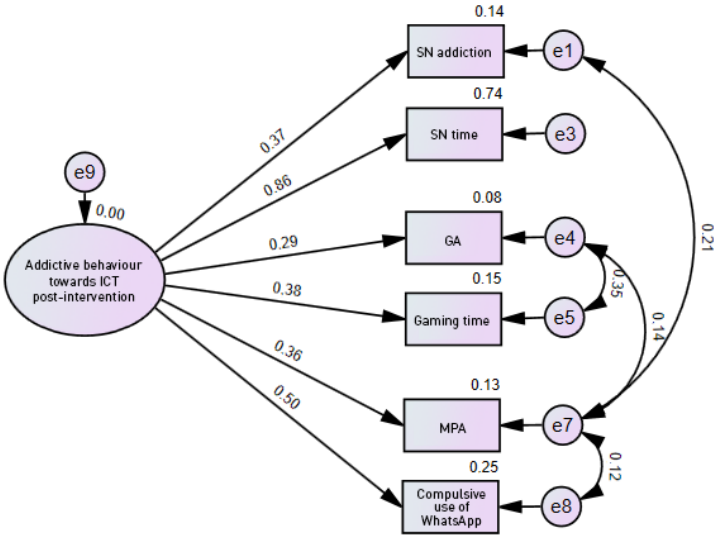
3.2.2. Factorial model of the intervention on addictive behaviour towards ICT

The factorial model of the addictive behaviour prior to the programme also adequately fitted the measurements taken after the programme (Figure 2) (χ^2 = 13.712, df=5, $\chi^2/_{df}$ = 2.742, p = .018, CFI = .984, $RMSEA$ = .052, AIC = 45.712, BIC = 117.22).

When comparing the pre- and post-models, changes in ICT use indicators are observed after the programme. Firstly, in all of the indicators of addictive ICT use, the factorial saturation reduces (mobile phone: $\Delta\lambda_e$ = .16; SN: $\Delta\lambda_e$ = .05; gaming: $\Delta\lambda_e$ = .15) as does explained variance (mobile: ΔR^2 = .14; SN: ΔR^2 = .04; gaming: ΔR^2 = .11). Secondly, the influence of gaming time also reduced ($\Delta\lambda_e$ = .09; ΔR^2 = .09), but that of SN increased its predictive value by 74% ($\Delta\lambda_e$ = .16; ΔR^2 = .26). Finally, compulsive IM use maintains its values compared with the pre model (λ_e = .5; R^2 = .25).

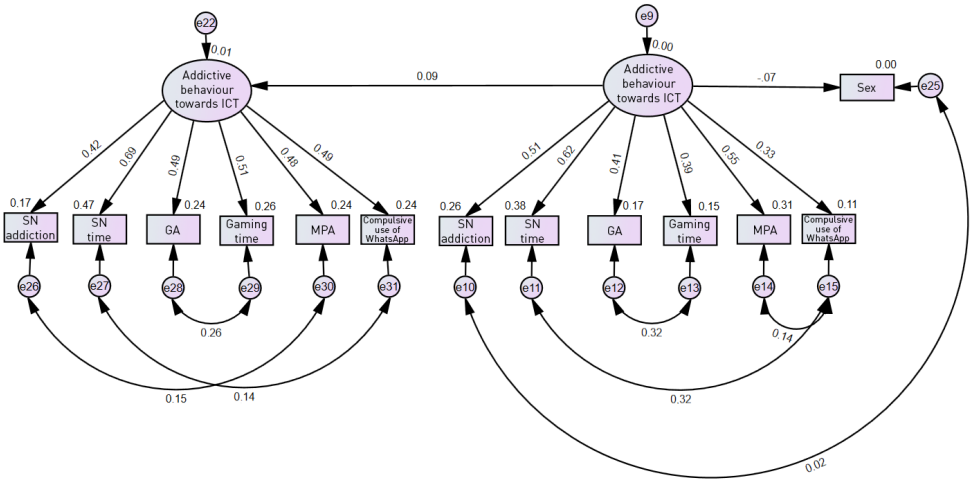
The significant reduction after the programme in scores for addictive use of MP appears to mean that this indicator loses influence for explaining addictive behaviour towards ICT. In fact, as there were no changes in SN time after the programme, this variable seems to be of relevance.

FIGURE 2. Factorial model of addictive behaviour towards ICT after the programme.



Given the gender differences observed in the t-tests, we included this variable and addictive behaviour prior to the workshop in the model (Figure 3). The path analysis of changes in addictive behaviour of the programme, despite its adequate fit (χ^2 = 162.523, df = 57, $\chi^2/_{df}$ = 2.851, p = .001, CFI = .915, $RMSEA$ = .054, AIC = 230.523, BIC = 382.478), indicated that gender (λ_e = -.07, R^2 = 0) and addictive behaviour prior to the programme (λ_e = .09, R^2 = .01) did not influence subsequent addictive behaviour.

FIGURE 3. Factorial model of addictive behaviour towards ICT after the programme by gender and prior addictive behaviour.



When including these variables in the model, we observed that the factorial loadings of the different indicators were balanced. However, these variables were eliminated from the model as they did not fulfil the minimum requirements to be integrated into the model ($\lambda_e > .4$; $R^2 > .2$). Consequently, this factorial model was rejected for interpreting addictive behaviour towards ICT after the programme.

4. Discussion

The *Clickeando* programme focuses on adolescents who have not yet developed an ICT addiction. However, as these users are the ones who use these technologies the most (especially since Covid-19) and are the most vulnerable to their addictive effects, prevention programmes should include methodologies that make it possible to detect the presence of signs of addiction, the behaviours that promote it, and also to establish what effects the programme has on addictive use of ICT and whether these differ by gender.

Of the 8 billion people in the world today, 7.33 billion have a smartphone (Taylor, 2023), 4.8 use SN (Petrosyan, 2023), and more than 2.5 billion play video games (Clement, 2023). Only a few ICT users will develop an addiction to these systems (Kuss & Griffiths, 2017; Naskar et al., 2016). Nonetheless, when we do not seek to diagnose addiction but rather to detect symptoms of it, the figures increase considerably (Sussman et al., 2011). In fact, the results show us that 18.5% of participants display symptoms of SNA, 24.3%, of GA, and 71.1%, of MPA. These incidences make it possible to understand the impact on and needs for action of a given population (King et al., 2018). *Clickeando* assumes that different online activities are done using mobile phones, which appears to be realistic with regards to the needs of the target population.

Accordingly, path analysis enabled us to define how workshop participants express addictive behaviour towards ICT, the relationship between the variables that comprise it, and how doing the programme modified them. This process made it possible to assess changes in addictive use of ICT, rectifying the impacts of the lack of an agreed definition of the concept in literature on prevention (King et al., 2018). In contrast with the classic literature (Griffiths, 1995), addictive behaviour towards ICT was defined in one dimension. This representation of the construct resembled the conceptualisation from the model of Davis (2001), who holds that problematic internet use includes general use (mobile phones) and specific use (SN and video games). This way of understanding addictive ICT use is coherent with the *Clickeando* intervention.

So much so that the model indicated that the symptoms of MPA, SNA, and GA, best explained addictive behaviour. Nonetheless, the time indicators (SN, gaming, and IM response speed) were more influential than the symptoms in the expression of addictive behaviour, given that the model was obtained on the basis of a universal preventive intervention; that is to say, from a population in which occurrence of the problem would not be expected. When comparing the two factorial models (pre and post), we observe that the influence of all of the indicators of addictive use (especially MP) reduces notably, except for SN time and compulsive use of IM. The reduction in the variance explained by the indicators (symptoms of MPA, SNA, and GA and gaming time) shows the variables on which the programme has had an effect. Similarly, the SN time indicator gained explanatory weight in the post model, and so *Clickeando* does not appear to be effective in reducing this behaviour, something shown by the within subject *t*-tests. In relation to these analyses, a reduction in compulsive use of IM was observed that was not reflected in the factorial model, something that could be explained by the change of messaging system used by the participants (the chat functions of the SN instead of WhatsApp).

These results lead us to think that, despite the criticism of prevention based on reducing time of use (Throuvala et al., 2019), SN time seems to be a fundamental variable in the development of addictive behaviour towards ICT. The participants reported a mean daily connection of up to two hours just in SN, which is close to the maximum daily digital leisure time suggested by Spain's Ministry of Health (Cartanyà-Hueso et al., 2021). Time spent on different forms of ICT during the week is time not spent on other healthier or more necessary activities. When these habits affect the social and educational spheres or the individual's health, they are referred to as *interference*, which is a symptom of addiction. Consequently, these results reflect the importance of incorporating activities or techniques in the programme that effectively reduce SN use time be strengthening protective factors (Ma et al., 2011).

In turn, the fact that the indices of prevalence of ICT addiction differ between boys and girls (SN and gaming, respectively) underlines the need to develop preventive strategies that take gender into account (Yudes

et al., 2019; Zhao et al., 2020). Although gender is an important risk factor in these technological addictions (Andreassen et al., 2016), it was not observed to influence the effects of the programme. In this sense, the programme seems to be effective at reducing the pattern and addictive use of MP in both genders (although not so much in addictive use of SN and gaming). Besides, as prior addictive use was not found to influence the results of the workshop, the effects of the addictive behaviour seem to improve in mild cases (something that would be coherent with the universal perspective of the programme). In future, it would be recommendable to include work on gaming in the specific content of the workshop, as well as assessing other indicators of SN use that might warn of unobserved changes.

Despite the evidence-based results and suggestions, such as the proposals to improve the efficacy of *Clickeando* (e.g., techniques and activities aimed at controlling SN during the week) or even of other workshops with the same aim (e.g., the usefulness of factor analysis for assessing interventions), we should note some characteristics of the study that limit the generalisation of its results, many of which are shared by other studies on this type of prevention programmes (Throuvala et al., 2019). In relation to the experimental procedure, the non-random sampling procedure, the lack of a control group, analysis of specific aspects of the workshop or characteristics of the participants (mediating and moderating variables of the programme), as well as of the analysis itself (lack of variables measuring positive use of ICT or the use of categorical or ordinal variables) are all of note.

On the contrary, the main strengths of this study include its sample size and the validity of its factorial model, which makes it possible to generalise the representation of addictive behaviour towards ICT, as well as the effects of the programme, in the population of participants in *Clickeando* from year 1 of compulsory secondary education. On the basis of the study performed, we suggest future studies that expand the assessment period to ensure the maintenance of the changes, multi-group analyses and multiple regressions to analyse the influence of gender, study of the effect of the programme on other age populations (primary school) or other preventive agents (teachers and family), as well as joint assessment of these agents to identify the effects of the programme at a multisystemic level.

In conclusion, the results of this research indicate that the *Clickeando* workshop is effective at reducing addictive use of ICT through information and changes to attitudes and behaviour relating to mobile phones in adolescents who are starting compulsory secondary education. Based on the needs of the educational community, research is striving to develop preventive methodologies following the impact of Covid-19 on excess use of ICT by adolescents. Thus, with this work, we provide evidence about the validity of *Clickeando* to help to continue to improve young people's mental health through training in the healthy use of ICT.

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Notes

The different versions of the *Clickeando* programme (students and families) and the respective teacher guides can be accessed on the website of the Plan Municipal de Drogodependencias of the City Council of Valencia. These documents are found in the "talleres preventivos" section of "prevención escolar": https://www.valencia.es/es/-/prevencion-escolar

References

American Psychiatric Association (2013). *Diagnostic and statistical manual of mental disorders, DSM-5.* American Psychiatric Publishing.

American Psychological Association. (2014). Guidelines for prevention in psychology. *American Psychologist, 69* (3), 285-296. https://doi.org/10.1037/a0034569

Anderson, M., & Jiang, J. (2018, 31 de mayo). Teens, social media and technology 2018. *Pew Research Center*. https://www.pewresearch.org/internet/2018/05/31/teens-social-media-technology-2018/

Andreassen, C. S., Billieux, J., Griffiths, M. D., Kuss, D. J., Demetrovics, Z., Mazzoni, E., & Pallesen, S. (2016). The relationship between addictive use of social media and video games and symptoms of psychiatric disorders: A large-scale cross-sectional study. *Psychology of Addictive Behaviors*, *30* (2), 252-262. https://doi.org/10.1037/adb0000160

Bashir, H., & Bhat, S. A. (2017). Effects of social media on mental health: A review. *International Journal of Indian Psychology*, *4* (3), 125-131. https://doi.org/10.25215/0403.134

Berrios, B., Pérez, B., Sánchez, F., & Pantoja, A. (2020). Análisis del programa educativo "Cubilete" para la prevención de adicciones a TIC en adolescentes. Caso específico de juegos de azar y apuestas online [analysis of the "Cubilete" educational program for the prevention of ICT addictions in adolescents. Specific case of gambling and online betting]. *Revista Española de Orientación y Psicopedagogía (REOP)*, *31* (1), 26-42. https://doi.org/10.5944/reop.vol.31.num.1.2020.27289

Bhargava, R., & Seshadri, S. (2021). Screen use and behavioral addiction: Making the «porridge» healthy. *Indian Journal of Social Psychiatry*, *37* (3), 245-247. https://doi.org/10.4103/ijsp.ijsp_272_21

Cartanyà-Hueso, À., Lidón-Moyano, C., & Martínez-Sánchez, J. M. (2021). Tiempo y uso de pantallas en niños y adolescentes: revisión y comparación de las guías de cinco instituciones sanitarias [Time and use of screens in children and adolescents: a review and comparison of the guidelines of five health care institutions]. *Boletín de Pediatría*, *61* (257), 174-179. https://sccalp.org/uploads/bulletin_artcle/pdf_version/1639/BolPediatr2021_61_174-179.pdf

Chóliz, M. (2010). *Mobile phone addiction in adolescence: Evaluation and prevention of mobile addiction in teenagers*. Lambert Academic Publishing.

Chóliz, M. (2017). Prevención de las adicciones tecnológicas en la adolescencia [Preventing technological addictions in adolescence]. *Padres Y Maestros / Journal of Parents and Teachers,* (369), 53-59. https://doi.org/10.14422/pym.i369.y2017.008

Clement, J. (2023, 14 November). *Number of video gamers worldwide 2017-2027*. Statista. https://www.statista.com/statistics/748044/number-video-gamers-world/

Echeburúa, E., & De Corral, P. (2010). Adicción a las nuevas tecnologías y a las redes sociales en jóvenes: un nuevo reto [Addiction to new technologies and to online social networking in young people: A new challenge]. *Adicciones*, *22* (2), 91-95. https://doi.org/10.20882/adicciones.196

Espinel, S. P., & Leguizamón, M. C. (2022). Adicción a Internet en tiempos de COVID-19. Programa de prevención [Internet addiction in COVID-19 times. Prevention program]. *Revista Virtual Universidad Católica del Norte*, (67), 191-216. https://www.doi.org/10.35575/rvucn.n67a8

Gainsbury, S., & Blaszczynski, A. (2011). A systematic review of Internet-based therapy for the treatment of addictions. *Clinical Psychology Review*, *31* (3), 490-498. https://doi.org/10.1016/j.cpr.2010.11.007

García-Couceiro, N., Gómez, P., Kim-Harris, S., Burkhart, G., Flórez-Menéndez, G., & Rial, A. (2021, 19 May). El modelo SBIRT como estrategia de prevención de las adicciones con y sin sustancia en adolescentes [SBIRT model as a prevention strategy against addiction with and without substance in teenagers]. *Revista Española de Salud Pública*, (95), e202105065. https://www.sanidad.gob.es/biblioPublic/publicaciones/recursos_propios/resp/revista_cdrom/VOL95/C_ESPECIALES/RS95C_202105065.pdf

Gentry, J. H., & Campbell, M. (2002). *Developing adolescents: A reference for professionals*. American Psychological Association. https://www.apa.org/pi/families/resources/develop.pdf

Griffiths, M. (1995). Technological addictions. *Clinical Psychology Forum*, (76), 14-19. https://doi.org/10.53841/bpscpf.1995.1.76.14

Kaess, M., Parzer, P., Brunner, R., Koenig, J., Durkee, T., Carli, V., Wasserman, D., Hoven, C. W., Sarchiapone, M., Bobes, J., Cosman, D., Värnik, A.Resch, F., & Wasserman, D. (2016). Pathological internet use is on the rise among European adolescents. *Journal of Adolescent Health*, *59* (2), 236-239. https://doi.org/10.1016/j.jadohealth.2016.04.009

Killian, M. O., Cimino, A. N., Weller, B. E., & Hyun Seo, C. (2019). A systematic review of latent variable mixture modeling research in social work journals. *Journal of Evidence-Based Social Work*, *16* (2), 192-210. https://doi.org/10.1080/23761407.2019.1577783

King, D. L., Delfabbro, P. H., Doh, Y. Y., Wu, A. M., Kuss, D. J., Pallesen, S., Mentzoni, R., Carragher, N., & Sakuma, H. (2018). Policy and prevention approaches for disordered and hazardous gaming and Internet use: An international perspective. *Prevention Science*, *19* (2), 233-249. http://doi.org/10.1007/s11121-017-0813-1

Kline, R. B. (2010). Promise and pitfalls of structural equation modeling in gifted research [Promesas y obstáculos en el modelo de ecuaciones estructurales en superdotados]. In B. Thompson, & R. F. Subotnik (Eds.), *Methodologies for conducting research on giftedness* (pp. 147-169). American Psychological Association. https://doi.org/10.1037/12079-007

Kuss, D. J., Van Rooij, A. J., Shorter, G. W., Griffiths, M. D., & Van de Mheen, D. (2013). Internet addiction in adolescents: Prevalence and risk factors. *Computers in Human Behavior*, *29* (5), 1987-1996. http://dx.doi.org/10.1016/j.chb.2013.04.002

Kuss, D. J., Shorter, G. W., Van Rooij, A. J., Van de Mheen, D., & Griffiths, M. D. (2014). The Internet addiction components model and personality: Establishing construct validity via a nomological network. *Computers in Human Behavior*, *39*, 312-321. http://dx.doi.org/10.1016/j.chb.2014.07.031

Kuss, D. J., & Griffiths, M. D. (2017). Social networking sites and addiction: Ten lessons learned. *International journal of environmental research and public health*, *14* (3), 311. https://doi.org/10.3390/ijerph14030311

Luján-Barrera, A., & Denís, M. (2022). Adicción al móvil e impulsividad: ¿cuánto tardas en responder un mensaje de WhatsApp? [Mobile addiction and impulsivity: How long does it take to answer a WhatsApp message?]. *Informació psicològica*, (123), 24-38. https://doi.org/10.14635/IPSIC.1924

Ma, H. K., Chu, M. K., & Chan, W. W. (2011). Construction of a teaching package on promoting prosocial internet use and preventing antisocial internet use. *The Scientific World Journal*, *11*, 2136-2146. https://doi.org/10.1100/2011/672898

Marcos, M., & Chóliz, M. (2021). TecnoTest: desarrollo de una herramienta de screening de adicciones tecnológicas y juego [Tecnotest: A screening tool for technological addictions and gambling disorder]. *Adicciones*, *35* (3), 235-248. https://doi.org/10.20882/adicciones.1380

Masaeli, N., & Farhadi, H. (2021). Prevalence of internet-based addictive behaviors during COVID-19 pandemic: A systematic review. *Journal of Addictive Diseases*, *39* (4), 468-488. https://doi.org/10.1080/10550887.2021.1895962

Mora, F., Dolengevich, H., & Quintero, J. (2015). Protocolo de tratamiento de las adicciones sin sustancia psicoactiva [Treatment protocol for addictions without psychoactive substances]. *Medicine - Programa de Formación Médica Continuada Acreditado*, *11* (86), 5157-5160. https://doi.org/10.1016/j.med.2015.09.006

Naskar, S., Victor, R., Nath, K., & Sengupta, C. (2016). "One level more:" A narrative review on internet gaming disorder. *Industrial Psychiatry Journal*, *25* (2), 145-154. https://doi.org/10.4103/ipj.ipj_67_16

Observatorio Español de las Drogas y las Adicciones. (2022). *Informe sobre trastornos comportamentales 2022: juego con dinero, uso de videojuegos y uso compulsivo de internet en las encuestas de drogas y otras adicciones en España EDADES y ESTUDES [Behavioural disorders report 2022: Gambling, video game use and compulsive internet use in surveys on drugs and other addictions in Spain EDADES and ESTUDES]*. Ministerio de Sanidad. Delegación del Gobierno para el Plan Nacional sobre Drogas. https://pnsd.sanidad.gob.es/profesionales/sistemasInformacion/sistemaInformacion/pdf/2022_Informe_Trastornos_Comportamentales.pdf

Petrosyan, A. (2023, 25 de octubre). *Worldwide digital population 2023*. Statista. https://www.statista.com/statistics/617136/digital-population-worldwide/

Prats, M. Ángel, Torres-Rodríguez, A., Oberst, U., & Carbonell, X. (2018). Diseño y aplicación de talleres educativos para el uso saludable de internet y redes sociales en la adolescencia: descripción de un estudio piloto [Design and application of educational workshops for the healthy use of the internet and online social networks in adolescents: Description of a pilot study]. *Pixel-Bit. Revista de Medios y Educación*, (52), 111-124. https://doi.org/10.12795/pixelbit.2018.i52.08

Romano, J. L., & Hage, S. M. (2000). Prevention: A call to action. *The Counseling Psychologist*, *28* (6), 854-856. https://doi.org/10.1177/001100000028600

Sánchez, L., Benito, R., Serrano, A., Benavent, R. A., & Bueno, F. J. (2018). *Programa de prevención del uso problemático de internet y redes sociales. "Clickeando" [Programme for the prevention of problematic use of the internet and social networks. "Clickeando"]*. Unidad de Prevención Comunitaria en Conductas Adictivas (UPCCA-València); Plan Municipal de Drogodependencias y Otros Trastornos Adictivos (PMD); Concejalía de Sanidad, Salud y Deportes. Ayuntamiento de Valencia.

Soto, A., De Miguel, N., & Pérez-Díaz, V. (2018). Abordaje de adicciones a nuevas tecnologías: una propuesta de prevención en contexto escolar y tratamiento de rehabilitación [An approach to addiction to new technologies: a proposal for prevention in the school environment and rehabilitation treatment]. *Papeles del Psicólogo*, *39* (2), 120-126. https://doi.org/10.23923/pap.psicol2018.2867

Stevens, J. P. (2002). *Applied multivariate statistics for the social sciences* (4th ed.). Lawrence Erlbaum Associates. https://psycnet.apa.org/record/2001-18534-000

Sussman, S., Lisha, N., & Griffiths, M. (2011). Prevalence of the addictions: a problem of the majority or the minority? *Evaluation & the Health Professions*, *34* (1), 3–56. https://doi.org/10.1177/0163278710380124

Taylor, P. (2023). *Forecast number of mobile users worldwide 2020-2015*. Statista. https://www.statista.com/statistics/218984/number-of-global-mobile-users-since-2010/

Throuvala, M. A., Griffiths, M. D., Rennoldson, M., & Kuss, D. J. (2019). School-based prevention for adolescent internet addiction: Prevention is the key. A systematic literature review. *Current Neuropharmacology*, *17* (6), 507-525. https://doi.org/10.2174/1570159X16666180813153806

Van de Schoot, R., Lugtig, P., & Hox, J. (2012). A checklist for testing measurement invariance. *European Journal of Developmental Psychology*, *9* (4), 486-492. https://doi.org/10.1080/17405629.2012.686740

Van den Eijnden, R. J., Lemmens, J. S., & Valkenburg, P. M. (2016). The social media disorder scale. *Computers in human behavior*, *61*, 478-487. https://doi.org/10.1016/j.chb.2016.03.038

Yudes, C., Rey Peña, L., & Extremera Pacheco, N. (2019). Ciberagresión, adicción a internet e inteligencia emocional en adolescentes: un análisis de diferencias de género [Cyberbullying, internet addiction and emotional intelligence in adolescents: A gender difference analysis]. *Voces de la Educación*, (2) 27-44. https://www.revista.vocesdelaeducacion.com.mx/index.php/voces/article/view/210

Zhao, H., Li, X., Zhou, J., Nie, Q., & Zhou, J. (2020). The relationship between bullying victimization and online game addiction among Chinese early adolescents: The potential role of meaning in life and gender differences. *Children and Youth Services Review, 116*, 105261. https://doi.org/10.1016/j.childyouth.2020.105261

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