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Does Virtual Reality Increase the Success of Interventions? Comparing Non-VR and VR Virtual-PRO Programmes' Efficacy for the Prevention of Sexual Harassment Among Adolescents

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Abstract

Virtual-PRO is a bystander-based programme with a Virtual Reality (VR) component. The current study focuses on testing the effectiveness of the same programme without VR, where multimedia content is played as 2D video, to clarify the advantages of VR over traditional sources for the prevention of sexual harassment. A cluster RCT was carried out with three experimental conditions (control group, experimental VR, and experimental non-VR) and three different time points (pre-test, post-test, and follow-up), separated by three-month intervals. In the study, 847 students aged 12–17 years (M = 14.73; SD = 0.88) were randomly grouped into the experimental VR group (n = 286), experimental non-VR group (n = 268), and control group (n = 293). Linear mixed model analyses were performed using SPSS 29. At follow-up, the experimental non-VR group was found to score lower for verbal/visual victimisation, online victimisation, and moral disengagement than the control group. Moreover, hostile sexism scores remained stable in the non-VR experimental group and increased in the control group. No significant differences were found when comparing the experimental condition with and without VR for online and verbal/visual sexual victimisation, moral disengagement or sexist attitudes. The only difference found between the two experimental conditions was in intention to intervene as a bystander, for which scores increased in the experimental group with VR. The results of this study clarify the advantages of using VR as a tool to elicit attitudinal change in sexual harassment bystanders and to aid decision-making regarding the cost-benefit of universal interventions.

Keywords: sexual harassment; bystander prevention programme; virtual reality; adolescent; intervention

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Introduction

Preventing sexual harassment at the adolescent stage is a topic of growing research and social interest for several reasons. Firstly, because of the large percentage of young people who have suffered at least once sexual harassment, particularly verbal/visual and online sexual harassment being the most prevalent forms of victimisation (Vega-Gea et al., 2016). Secondly, because of the mental, physical and social consequences for the victim (Marx et al., 2019). And thirdly, it is a phenomenon that increases gender inequalities between boys and girls (Kearns et al., 2020). Sexual harassment is a social phenomenon, made up of aggressors, victims and bystanders. Regarding this premise, in recent years, interventions based on bystander models have proliferated with very positive results in terms of reducing involvement in sexual harassment and sexist attitudes and increasing proactive bystander behaviours as well. At the same time, technological advances have allowed new tools to be incorporated into intervention programmes, such as Virtual Reality (VR), with promising results (Rawski et al., 2022). However, it is still necessary to determine the benefits of incorporating VR into non-VR interventions.

The present study aims to fill this gap in research by analysing the effectiveness of the Virtual-PRO programme (Sánchez-Jiménez et al., 2024) adding an experimental condition without VR, where 360º VR videos are replaced by traditional 2D videos. Based on the results of the Virtual-PRO programme with VR, this study had two aims: 1) to test the effectiveness of Virtual-PRO without VR, and 2) to compare the effectiveness of the programme without VR to that of the programme implemented with VR. Specifically, the study sought to analyse the effect of the programme on verbal/visual and online sexual victimisation, moral disengagement, sexism, and intention to intervene as a bystander.

The study makes relevant contributions to the field of sexual harassment intervention and the use of VR. The difference between both experimental conditions was in the intention to intervene as a bystander, which increased positively in the VR condition. Using the programme with traditional audiovisual resources does not have a significant impact on fostering a view of sexual harassment as a social phenomenon for which we all share some responsibility. However, for the remaining outcomes, the programme without VR proved to be a valuable resource to use in schools. Comparing the efficacy of the two experimental conditions allows the educational community to select the most suitable resource in terms of cost-effectiveness and accessibility.

Sexual Harassment in Adolescence

Sexual harassment among adolescent peers encompasses any unwanted behaviour of a sexual nature that causes discomfort or stress and can interfere with everyday life at school (Hill & Kearl, 2011; Ortega-Ruiz et al., 2010). Sexual harassment at this age impacts victims mentally, physically and socially, with consequences ranging from loss of self-esteem to suicide attempts (Chiodo et al., 2009; Marx et al., 2019).

One of the most frequent forms of sexual harassment experienced during adolescence is verbal/visual harassment, which includes actions such as unwanted written messages and sexist comments, homophobic insults, derogatory use of certain words to refer to a person's sexual behaviour, gender identity or sexual orientation, and the unsolicited showing of body parts, among others (Vega-Gea et al., 2016). Prevalence rates for verbal/visual sexual victimisation range between 25% and 50% depending on the type of behaviour analysed (Vega-Gea et al., 2016). These verbal/visual assaults also occur in the online context. Moreover, the online context itself facilitates the emergence of new violent sexual behaviours, such as using pressure or threats to obtain intimate images or videos or publicly disseminating intimate multimedia content featuring one's peers (Reed et al., 2019; Sánchez-Jiménez et al., 2017). Some studies have found lower prevalence rates for online forms of sexual victimisation than for face-to-face forms (Hill & Kearl, 2011), whereas others report similar figures (Reed et al., 2019). These prevalence rates are moderated by gender. Girls are at greater risk of suffering sexual harassment by their peers, with victimisation rates being twice as high as those of their male counterparts for both face-to-face and online forms (Attar-Schwartz, 2013; Chiodo et al., 2009; Copp et al., 2021). In sum, sexual harassment has been postulated as a social problem related to gender inequality from adolescent years (Kearns et al., 2020). Preventing sexual harassment among adolescents poses a social and scientific challenge, and effective preventive programmes based on scientific evidence are needed.

In this regard, systematic reviews and meta-analyses suggest that programmes based on the bystander model are the most effective in preventing sexual harassment (Mujal et al., 2021; S. Park & Kim, 2023). These programmes

focus on the role of the bystander as a protagonist in the sexual harassment scene, as a figure with a great deal of power to either perpetuate the situation or assist the victims of the observed aggression. Some examples of programmes based on the bystander model are *Bringing in the Bystander* (Moynihan et al., 2015), *TakeCARE* (Jouriles et al., 2016), *Green Dot* (Coker et al., 2019), and *Coaching Boys Into Men* (Miller et al., 2020). These programmes have obtained positive long-term results in terms of increasing the proactive behaviour of bystanders and decreasing sexist attitudes and those that support or tolerate sexual harassment. They have also shown a positive impact in terms of reducing involvement in sexual harassment. Despite these promising results, however, bystander sexual harassment prevention programmes have barely been tested at all in adolescent populations (Coker et al., 2019; Miller et al., 2020), and most have been evaluated in North American populations (S. Park & Kim, 2023).

The Emerging Role of Virtual Reality as an Ally for Interpersonal Violence Interventions

The technological advances of recent years have made it possible for intervention programmes to expand the resources available to them. One of the newest and most recently incorporated resources is virtual reality (VR). In a safe, immersive environment, VR enables exposure to situations similar to those experienced in real life (Fromberger et al., 2018). Studies suggest that these immersive experiences are more realistic than even face-to-face experiences using role-playing (Jouriles et al., 2009) and foster a greater change in social attitudes than the use of written texts or 2D videos (see the meta-analysis by Nikolaou et al., 2022). VR has been tested for the treatment of different physical and psychological disorders (Cárdenas-López & De La Rosa-Gómez, 2011; Kim et al., 2018), as well as for skills training. Regarding this, VR has been shown to be an effective tool not only for increasing emotion recognition in domestic offenders (Seinfeld et al., 2018) and social competence in people with schizophrenia (K. M. Park et al., 2009), but also for developing empathy towards victims of sexual harassment in young men (Ventura et al., 2020). Specifically, some researchers have found VR to be a valuable tool for increasing empathy towards victims of sexual harassment in interventions with a male population (Neyret et al., 2020; Ventura et al., 2021). VR has also proven to be effective in reducing sexual victimisation in women with experiences of this kind, through the programme *My Voice, My Choice,* which features immersive virtual environments (Rowe et al., 2015).

Some studies have used VR as an additional tool in bullying prevention programmes, with one example being the *Stand Up: Virtual Reality to Activate Bystanders Against Bullying* programme, implemented with adolescents (Ingram et al., 2019). This programme was found to have a direct impact on increasing empathy and an indirect impact on face-to-face bullying (e.g., annoyance and threats). It also increased participants' sense of belonging to the school and strengthened their intention to intervene as a bystander. It was not, however, effective in reducing relational bullying and cyberbullying (Ingram et al., 2019).

Despite promising results, incorporating VR into intervention programmes involves a large investment of both financial and personnel resources (Jouriles et al., 2009, 2016; Sánchez-Jiménez et al., 2024), which is why it is first necessary to specifically analyse the advantages of VR in comparison with the use of traditional strategies. Some studies have already attempted to do this in different intervention contexts. For example, in a physical rehabilitation intervention, Kim et al. (2019) failed to find a more positive effect of VR compared to a traditional intervention. Meanwhile, Herrera et al. (2018) improved attitudes and helpfulness towards homelessness in people who completed a VR perspective-taking task, although this positive change was also reported when the information was presented in a traditional way (written and visual information).

In the field of sexual harassment, Ventura et al.'s (2021) study with Mexican university students compared one group viewing first-person 360° videos of everyday sexual harassment situations for this population (e.g., harassment on the Underground or in the library) with another group in which the same stories were presented in written form. The study concluded that experiencing the stories in 360° videos was more effective than narrative stories, as participants in the first condition reported increased empathy and a greater sense of unity and perspective towards a female victim of sexual harassment. Similarly, Jouriles et al. (2011) compared whether VR role-playing had the same impact as face-to-face role-playing on female American college students in a programme in which participants were exposed to increasingly severe sexual harassment scenes. The results of this study support the advantages of VR role-playing over traditional role-playing, as participants in the VR condition experienced a greater sense of immersion and a stronger emotional impact. Moreover, VR role-playing was found to foster more adaptive responses to sexual harassment in women who had been sexually victimised.

Other studies add some nuances to these results. One example is the study by McEvoy et al. (2016), which used three experimental conditions (a customised VR condition, a non-customised VR condition, and a video condition

with human actors). The authors found that empathy towards a victim of bullying was higher after viewing video scenarios than after viewing VR scenarios with avatars and concluded that the effectiveness of VR may be increased by ensuring photorealistic graphics, some interactive elements and an accurate representation of the actors. The study also demonstrated that video can be a useful resource in interventions. In sum, McEvoy et al. (2016) concluded that the two experimental conditions must be equivalent in order to compare whether VR is more effective than more traditional resources. Rawski et al. (2022) make progress in this respect and compare two experimental conditions: a 2D video condition and a VR practice condition in a training for bystander intervention dealing with sexual harassment in the work environment. These authors examined different strategies that bystanders could implement to stop the aggression. The results showed that participants in both experimental conditions would act similarly, with no differences in stopping the situation indirectly (such as by removing the victim) or directly (by confronting the aggressor). The difference found between VR and 2D videos was to report the harassment to an authority figure, which was less chosen by VR participants (Rawski et al., 2022). As the authors themselves discuss, this finding could indicate that VR makes the resources developed more realistic and invites participants to reflect more on the consequences of their actions and the complexity of intervening in a sexual harassment situation.

Few interventions exist that are designed to prevent sexual harassment among adolescents, and this number is even smaller in Spain. Moreover, given the promising results that have been obtained with VR, it is necessary to determine the benefits of incorporating VR into non-VR interventions. Given the paucity of studies that have compared the effect of a VR versus a non-VR intervention (McEvoy et al., 2016), the present study attempted to fill this gap using the Virtual-PRO programme.

Virtual-PRO

Virtual-PRO is a pioneering programme in the prevention of sexual harassment among adolescents in Spain that includes a VR component (Sánchez-Jiménez et al., 2024). It is a universal psychoeducational programme based on the bystander model (Latané & Darley, 1970) and is designed to prevent sexual harassment through the active action of bystanders following five steps: 1) improving awareness of sexual harassment; 2) fostering its interpretation as an emergency; 3) assuming the responsibility to act; 4) knowing how to act effectively and safely, and 5) putting the skills learned into practice. The programme explicitly incorporates content linked to socio-moral variables that justify aggression and interfere with bystanders' behaviour, such as moral disengagement, a key mechanism in explaining aggressive behaviour (Gini et al., 2013) and bystanders' decision-making (Gini et al., 2022). Virtual-PRO focuses on these socio-moral variables linked to personal responsibility and bystanders' decision-making, as well as on the attitudes and justifications that support passivity in the face of sexual harassment. It comprises six curricular modules, each lasting one hour and covering the following contents: awareness of sexual harassment, changing attitudes that support or tolerate sexual harassment (social-moral reasoning and gender-based beliefs), empathy towards the victim, personal responsibility as a bystander, knowledge, the practice and consequences of specific bystander actions, and coping as a victim. All contents are dealt with from a gender perspective, taking the differences between boys and girls into account in terms of prevalence, experience, consequences and associated factors. All six modules include a diverse range of activities and resources, including large group discussions, role-playing, decision-making games, and individual insights.

Moreover, one of the main features of Virtual-PRO is the creation of relevant multimedia content adapted to the target population for use during the intervention. This multimedia content consists of three scenarios showing 1) different scenes of everyday sexual harassment perpetrated by adolescents in a high school (e.g., obscene messages in the bathroom), 2) a scene depicting homophobic and gender-based sexual harassment, and 3) a scene depicting online sexual harassment (non-consensual sharing) and face-to-face verbal/visual harassment. Specifically, the first scenario is designed to raise awareness about sexual harassment; the second scenario is targeted at taking personal responsibility and knowing the consequences of specific actions as a bystander; and the third scenario is focused on coping strategies as a victim. The three scenarios begin with a video. In the first video, the viewer is passive, while the second and third scenarios are interactive. The participants decide as bystanders or as victims to continue with the outcome of the story. In the second scenario, the participants, as bystanders, could decide between doing nothing, laughing, joining the aggressors, and stopping the aggression. In the third scenario, the participants, as victims, could decide between doing nothing, talking with family, talking with friends, and confronting the aggressor.

Virtual-PRO With VR

The three videos are presented as 360º scenarios in three of the six modules using Oculus Quest 2 devices. The immersive experiences take place in the classroom, and all students view them individually yet simultaneously. The remaining activities (e.g., discussion after the experience) take place in the same way in the class group and incorporate both collective and individual dynamics. After viewing each scenario, the realism, emotional impact, and/or embodiment were assessed with a questionnaire embedded in the headset application (see results in Sánchez-Jiménez et al., 2024). For example, participants perceived the scenarios as quite realistic (M = 3.68 out of 5, SD = 1.10).

The impact of Virtual-PRO has been evaluated in a Spanish adolescent population with promising results (Sánchez-Jiménez et al., 2024). Analyses have shown positive results in the modification of beliefs and attitudes, as well as in changes in bystanders' intention to intervene and sexual harassment victimisation in the medium term. Specifically, the programme had a protective effect on participating boys and girls, preventing their levels of hostile sexism from increasing over the course of the school year and reducing levels of moral disengagement. Regarding the effect on bystanders, Virtual-PRO increased intention to intervene proactively. The programme also reduced the frequency of involvement in verbal/visual and online sexual victimisation.

Virtual-PRO Without VR

Following the recommendations of previous studies (McEvoy et al., 2016; Rawski et al., 2022), both experimental conditions should be as similar as possible. The program without VR had the same structure as the program with VR, except that the scenarios were presented as flat videos (2D). This solution was feasible because in the VR condition, participants did not see their own bodies in any of the scenarios. The 2D videos were played on the classroom projectors in the classrooms where the intervention was conducted and were therefore viewed by all students at the same time. This decision was made based on the characteristics of the classrooms and the school rules prohibiting the use of mobile or computer devices. In the videos that allow for decision-making (scenarios 2 and 3), participants wrote down their personal decisions, and then the consequences of each of the available options were shown on the screen one by one.

The Present Study

Based on the results of Virtual-PRO with VR, this study had two aims: 1) to test the effectiveness of Virtual-PRO without VR, and 2) to compare the effectiveness of the programme without VR with that of the programme implemented using VR. Specifically, the study sought to analyse the effect of the programme on verbal/visual and online sexual victimisation, moral disengagement, sexism, and intention to intervene as a bystander.

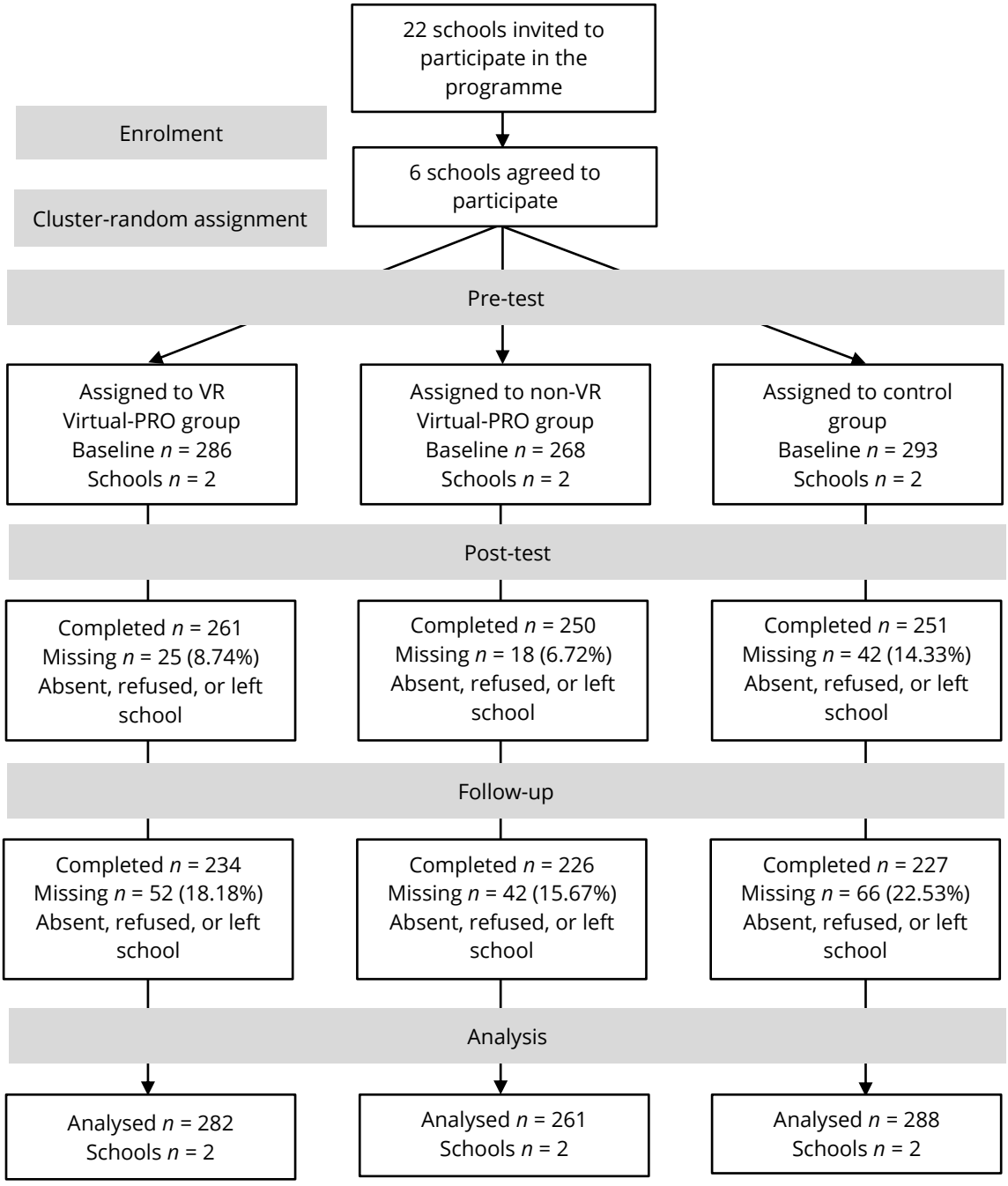
Given that previous programmes based on the bystander model (Mujal et al., 2021; S. Park & Kim, 2023), as well as the programme itself (Sánchez-Jiménez et al., 2024), have been found to be effective in terms of changing attitudes and behaviours, in the present study, we expected the programme implemented without VR to return similar results-reducing sexist attitudes, decreasing sexual victimisation and increasing intention to intervene as a bystander (Coker et al., 2019; Miller et al., 2020). As Virtual-PRO emphasises the socio-moral reasoning underlying support for certain sexual aggressions and, consequently, the inhibition of helping behaviour, we expected to observe a reduction in levels of moral disengagement following its implementation. Testing the impact of incorporating VR into traditional interventions should be mandatory, as this is a resource that involves high financial and personnel costs. Although previous studies have highlighted the virtues of VR in interventions in terms of increased realism and the stronger emotional impact of situations and skills training (Jouriles et al., 2009; 2011), little research has been conducted using a methodological design that allows authors to compare the impact of VR with that of other programmes with equivalent experimental conditions (McEvoy et al., 2016). The second aim of the present study is, therefore, exploratory in nature.

Methods

Experimental Design and Procedure

A cluster randomised controlled trial (RCT) was carried out with three experimental conditions (control group, experimental VR, and experimental non-VR) and three-time points (pre-test, post-test, and follow-up), separated from baseline by intervals of 3 and 6 months, respectively.

Figure 1. *Flowchart of Participant Recruitment and Retention in the Study.*



The experimental VR group received the original version of the programme, that is, with the VR scenarios. The second experimental group (non-VR) received the programme without VR. The third group (control group) did not engage in any sexual harassment intervention during the assessment period. However, the group was waitlisted for future implementations.

The research team sought the participation of public compulsory secondary schools in Seville (Spain). Six of the total number of schools invited (n = 22) agreed to participate (Figure 1). The school management team and teachers were informed of the study's aims and were responsible for informing the families in order to obtain their permission for their children to participate. Two schools were randomly assigned to each group (control,

experimental VR and experimental non-VR). Both assessment and programme implementation were conducted during school hours in the presence of the student's teacher. Authorised participants were informed about the purpose of the study, conditions and the voluntary nature of participation. Students were also required to provide their own informed consent at the three collection points. Furthermore, they could leave the programme at any time during the implementation without any justification. Each student was assigned an alphanumeric code to respect pseudonymisation for data matching. The study was approved by the Andalusian Ethical Coordination Committee for Biomedical Research (code: 1757-N-20).

Sample Size and Participants

We estimated the sample size necessary to analyse the efficacy of the intervention, assuming a confidence level of 95%, a statistical power of 90%, a conservative effect size (*d*) of .10 due to the universal nature of the intervention (Connolly et al., 2015), and assuming an experimental mortality rate of 10% (Sánchez-Jiménez et al., 2024). The estimated sample was 684 participants (at least 228 adolescents by experimental condition).

At pre-test, participants were 847 students aged 12–17 years (*M* = 14.73; *SD* = 0.88) from the last two years of compulsory secondary education (see Table 1 for participants' information). In this sense, the sample size of the study was sufficient to detect small effects; however, it was not excessively large. Additionally, we used a 95% confidence level and reported the effect size to manage Type 1 error. The effect sizes observed in the study align with those typically seen in universal interventions, where the effect size is usually small, as noted in Conolly's study.

Table 1. *Characteristics of the Participants.*

Variable	*N*	%
Education level		
3rd grade	506	59.70
4th grade	341	40.30
Gender		
Boys	404	47.80
Girls	427	50.50
Both	6	0.70
Either	8	0.90
Prefer not to answer	2	0.10
Experimental condition		
VR group	286	33.80
Non-VR group	268	31.60
Control group	293	34.60

Attrition Analysis

Of the total, 77% participated at all three-time points (*n* = 652), 13% participated at pre-test and post-test (*n* = 110), 4.1% participated at pre-test and follow-up (*n* = 35), and the remaining 5.9% only completed the pre-test (*n* = 50). Attrition was mainly due to students' non-attendance at school on the day on which data was collected, although the team tried to find alternative days for these participants to complete the assessments. Figure 1 shows the breakdown for each experimental condition. Regarding the attrition analyses, differences were found in moral disengagement (*p* = .003), hostile (*p* = .004) and benevolent (*p* = .004) sexism (see Table 2). Specifically, students who only participated at T1T2 had higher means than those who participated at all three-time points, although the effect size was small.

Table 2. *Attrition Analysis in Relation to the Study Variables.*

	T1	T1T2	T1T3	T1T2T3			
	M (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*F*	*p*	η^2
Verbal/visual sexual victimisation	1.42 (0.57)	1.41 (0.58)	1.29 (0.45)	1.44 (0.52)	0.95	.414	.003
Online sexual victimisation	1.19 (0.37)	1.32 (0.58)	1.18 (0.29)	1.26 (0.40)	1.66	.173	.006
Moral disengagement	1.80 (0.49)	1.90 (0.60)	1.75 (0.55)	1.71 (0.51)	4.21	.006	.015
Benevolent sexism	2.50 (1.00)	2.49 (1.04)	2.34 (1.32)	2.19 (0.84)	5.05	.002	.018
Hostile sexism	2.21 (1.25)	2.28 (1.14)	1.82 (0.87)	1.94 (0.90)	5.14	.002	.018
Bystanders' intention to intervene	0.78 (1.15)	0.71 (1.11)	0.75 (1.09)	0.75 (1.10)	0.05	.987	<.001

Instruments

Verbal/Visual Sexual Harassment Victimisation

The validated Spanish version of the Sexual Harassment Survey (AAUW, 1993; Ortega-Ruiz et al., 2010; Vega-Gea et al., 2016) was used to assess verbal/visual sexual harassment victimisation. The scale consists of six items related to insults, jokes and the unsolicited showing of visual material of a sexual nature (e.g., *Spreading rumours about someone else's sexual behaviour*). Participants were asked to state on a 5-point Likert-type scale (from 1 = *never* to 5 = *every day*) the extent to which they had experienced each type of sexual assault in the past two months. Internal consistency was good (α_{T1} = .69, α_{T2} = .71, α_{T3} = .77).

Online Sexual Harassment Victimisation

The Peer Sexual Cybervictimisation Scale (Sánchez-Jiménez et al., 2017) was used to measure online sexual harassment victimisation. This scale was developed for the Spanish adolescent population and comprises 12 items (e.g., *Threatening to spread compromising personal (sexual) photos or videos on the social media*). Participants were asked to state on a 5-point Likert-type scale (from 1 = *never* to 5 = *every day*) the extent to which they had experienced each type of sexual assault in the last two months. The internal consistency was good (α_{T1} = .85, α_{T2} = .90, α_{T3} = .91).

Sexist Attitudes

The Spanish validated measure of the Inventory of Ambivalent Sexism in Adolescents (De Lemus et al., 2010) was used to assess hostile sexism (beliefs that women are inferior to men; e.g., *Girls actually seek to have more power than boys, under the guise of asking for "equality")* and benevolent sexism (beliefs that women are weak/delicate compared to men and in need of protection; e.g., *Girls should be loved and protected by boys*). Each scale comprises 10 items rated on a 6-point Likert-type scale (from 1 = *I strongly disagree* to 6 = *I strongly agree*). The internal consistency was adequate for both hostile sexism (α_{T1} = .86, α_{T2} = .88, α_{T3} = .88) and benevolent sexism (α_{T1} = .77, α_{T2} = .83, α_{T3} = .81).

Moral Disengagement

We used the Spanish adaptation for adolescents of the Moral Disengagement Scale by Bandura et al. (1996); Sánchez-Jiménez and Muñoz-Fernández (2021). Moral disengagement refers to the use of justifications to alleviate discomfort and cognitive dissonance when behaving immorally. This scale measures participants' agreement with 14 arguments that justify immoral behaviours, including the use of violence. Responses are given on a 5-point Likert-type scale (from 1 = *I strongly disagree* to 5 = *I strongly agree*). An example item is, *Some high school classmates are hateful*. *Hitting them is just a way to teach them a lesson.* The internal consistency was good (α_{T1} = .77, α_{T2} = .82, α_{T3} = .83).

Bystander intention to intervene in sexual harassment

An adaptation of the stories created by Taylor et al. (2011) was used to measure intention to intervene in sexual harassment situations. The instrument comprises three written situations involving sexual harassment: verbal/visual (a boy student makes a homophobic insult to another boy student), physical (a boy student makes intimate touching to a girl student), and online (a boy student spreads intimate and sexual information about his partner in a group conversation). After each situation, participants are asked if they, as bystanders, would try to help if the victim were not their friend. The two response options are Yes (coded as 1) and No (coded as 0). Total scores are calculated by summing the scores for each of the three scenarios. The internal consistency was good ($KR\text{-}20_{T1}$ = .81, $KR\text{-}20_{T2}$ = .83, $KR\text{-}20_{T3}$ = .86).

Programme Adherence and Satisfaction

At the end of each session, participants completed a worksheet asking how much they enjoyed the activities following a Likert-scale ranged from 1 = *I would not say I liked this session* to 5 = *I liked it very much*. The programme adherence was coded at each session (0 = *not present*; 1= *present*).

Analysis Plan

Linear mixed model (LMM) analyses were performed using SPSS 29 to fulfil the study aims. This analysis allows the inclusion of fixed and random effects for cluster nested data (non-independent) compared to simple linear regressions. The study variables were included as dependent variables. Time, experimental condition (control vs non-VR Virtual-PRO; non-VR Virtual-PRO vs VR Virtual-PRO) and time interacting with the experimental condition were included as fixed effects of the model. We also controlled for the effect of gender (Attar-Schwartz, 2013; Copp et al., 2021) by including it as a fixed effect. To this end, only participants who identified as either boys or girls were considered, due to the low number of participants who selected labels associated with a non-binary identity or chose not to respond (1.6%). For this reason, the final sample was smaller than the initial sample (Figure 1). The random effects of the model accounted for within-individual and within-classroom measurements. Effect sizes were estimated as standardised effect sizes in a mixed model.

Results

Program Adherence

In the VR condition, 78.1% (n = 215) of participants attended five or more sessions. In the non-VR condition, 74.6% (n = 196) of participants attended five or more sessions. However, the mean participation in the VR (M = 5.02, SD = 1.44) and non-VR (M = 4.92, SD = 1.37) groups was similar, $t(536) = 0.75$, p = .403.

Baseline Equivalence

Table 3 presents the descriptive data. Pre-test differences between the groups were found only for benevolent sexism (p = .050, d = 0.08) and hostile sexism (p = .001, d = 0.20). See Tables 4, 5, and 6 for more information about inter-group differences. In both cases (benevolent and hostile sexism), the control group had slightly higher means than the non-VR experimental group. However, the effect size was either null (benevolent sexism) or small (hostile sexism).

Table 3. *Descriptive Statistics of the Study Variables by Experimental Condition at Pre-Test, Post-Test and Follow-Up.*

		Control			Non-VR			VR		
		Pre-test	Post-test	Follow-up	Pre-test	Post-test	Follow-up	Pre-test	Post-test	Follow-up
Verbal/visual sexual victimisation	*n*	288	246	222	259	245	219	282	257	230
	M	1.48	1.46	1.52	1.37	1.45	1.40	1.43	1.45	1.40
	SD	(0.56)	(0.51)	(0.60)	(0.45)	(0.60)	(0.59)	(0.55)	(0.53)	(0.50)
Online sexual victimisation	*n*	287	246	222	258	244	219	281	256	230
	M	1.28	1.25	1.29	1.24	1.28	1.23	1.25	1.29	1.21
	SD	(0.43)	(0.39)	(0.52)	(0.41)	(0.53)	(0.44)	(0.44)	(0.53)	(0.40)
Moral disengagement	*n*	288	246	222	260	245	219	281	257	230
	M	1.79	1.74	1.77	1.68	1.75	1.70	1.76	1.77	1.71
	SD	(0.57)	(0.61)	(0.59)	(0.51)	(0.60)	(0.60)	(0.50)	(0.53)	(0.55)
Benevolent sexism	*n*	288	245	222	259	243	219	281	257	230
	M	2.32	2.31	2.34	2.24	2.26	2.20	2.23	2.20	2.18
	SD	(0.95)	(0.95)	(0.91)	(0.87)	(1.03)	(0.94)	(0.89)	(0.94)	(0.88)
Hostile sexism	*n*	288	245	222	259	243	219	281	257	230
	M	2.12	2.21	2.26	1.92	2.07	1.97	1.99	2.05	1.99
	SD	(1.05)	(1.10)	(1.07)	(0.89)	(0.98)	(0.94)	(0.94)	(0.98)	(0.97)
Bystanders' intention to intervene	*n*	278	244	221	259	241	219	271	256	229
	M	0.86	0.70	0.62	0.75	0.61	0.63	0.60	0.63	0.72
	SD	(1.14)	(1.09)	(1.04)	(1.13)	(1.05)	(1.07)	(0.98)	(1.05)	(1.16)

The Efficacy of the Non-VR Virtual-PRO

Concerning verbal/visual and online sexual victimisation (Table 4), significant time-group interaction effects were found from post-test to follow-up for both variables. Looking at the post-test and follow-up means (Table 3), a decrease in scores for verbal/visual victimisation (d = 0.07) and online victimisation (d = 0.12) is observed in the non-VR experimental group, while in the control group, scores for both forms of victimisation increased. The small effect sizes suggest that while the program may have a positive effect, the changes are modest.

Table 4. *Mixed Model Predicting Outcomes Linked to Sexual Victimisation.*

	Verbal/visual sexual victimisation			Online sexual victimisation		
Control vs Non-VR	*df*	*B (SE)*	*p*	*df*	*B (SE)*	*p*
Intercept	52.29	1.43 (0.05)	< .001	1469	1.26 (0.03)	< .001
T1	965.92	−0.03 (0.04)	.336	1469	0.14 (0.03)	.616
T2	963.69	0.05 (0.04)	.173	1469	0.05 (0.03)	.064
Gender (boys)	546.95	−0.06 (0.04)	.126	1469	−0.07 (0.03)	.032
Group (control group)	50.37	0.09 (0.06)	.138	1469	0.06 (0.04)	.171
T1 by group (control group)	975.93	0.01 (0.05)	.861	1469	−0.02 (0.04)	.678
T2 by group (control group)	967.26	−0.10 (0.05)	.046	1469	−0.10 (0.04)	.016
Residual variance		0.14 (0.01)	< .001		0.09 (0.004)	< .001
Subject: random intercept		0.15 (0.01)	< .001		0.11 (0.01)	< .001
Classroom: random intercept		0.01 (0.004)	.102		0.00 (0.00)	[a]
Non-VR vs VR	*df*	*B (SE)*	*p*	*df*	*B (SE)*	*p*
Intercept	54.31	1.45 (0.04)	< .001	59.43	1.26 (0.04)	< .001
T1	977.38	0.02 (0.03)	.508	971.11	0.03 (0.03)	.213
T2	970.49	0.03 (0.03)	.314	964.02	0.07 (0.3)	.011
Gender (boys)	533.67	−0.06 (0.04)	.130	537.93	−0.07 (0.03)	.034
Group (non-VR)	33.38	−0.02 (0.06)	.785	33.76	0.004 (0.04)	.929
T1 by group (non-VR)	975.61	−0.06 (0.05)	.233	969.88	−0.02 (0.04)	.632
T2 by group (non-VR)	970.86	0.02 (0.04)	.749	963.34	−0.01 (0.04)	.705
Residual variance		0.13 (0.01)	< .001		0.08 (0.004)	< .001
Subject: random intercept		0.16 (0.01)	< .001		0.13 (0.01)	< .001
Classroom: random intercept		0.004 (0.004)	.320		0.001 (0.003)	.644

Note. [a]This covariance parameter is redundant. Statistics and confidence intervals cannot be calculated.

Regarding sexist attitudes and moral disengagement, Table 5 reveals a trend for hostile sexism and moral disengagement in the interaction between time and group from post-test to follow-up. The post-test and follow-up means (Table 3) indicated a decrease in moral disengagement scores (d = 0.04) in the non-VR experimental group, whereas scores increased in the control group. Hostile sexism scores remained stable in the non-VR experimental group and increased in the control group (d = 0.09). No effects were found for benevolent sexism. Again, the effect sizes were small. Therefore, differences between the groups (particularly regarding moral disengagement) should be interpreted with caution.

Table 5. *Mixed Model Predicting Outcomes Linked to Moral Disengagement and Sexist Attitudes.*

	Moral disengagement			Benevolent sexism			Hostile sexism		
Control vs Non-VR	*df*	*B (SE)*	*p*	*df*	*B (SE)*	*p*	*df*	*B (SE)*	*p*
Intercept	47.34	1.52 (0.05)	< .001	38.71	2.02 (0.08)	< .001	46.14	1.54 (0.07)	< .001
T1	950.78	−0.04 (0.03)	.160	938.80	0.01 (0.05)	.911	935.61	−0.10 (0.05)	.030
T2	947.52	0.03 (0.03)	.905	932.90	0.02 (0.05)	.682	929.68	0.05 (0.05)	.292
Gender (boys)	540.90	0.40 (0.04)	< .001	531.68	0.42 (0.07)	< .001	525.31	0.97 (0.07)	< .001
Group (control group)	42.91	0.11 (0.06)	.065	34.40	0.19 (0.09)	.050	38.35	0.32 (0.08)	< .001
T1 by group (control group)	959.14	0.04 (0.04)	.422	946.34	−0.09 (0.07)	.233	942.58	−0.07 (0.07)	.325
T2 by group (control group)	950.52	−0.08 (0.04)	.062	935.90	−0.09 (0.08)	.255	932.30	−0.13 (0.07)	.056
Residual variance		0.11 (0.01)	< .001		0.31 (0.01)	< .001		0.27 (0.01)	< .001
Subject: random intercept		0.18 (0.01)	< .001		0.54 (0.04)	< .001		0.55 (0.04)	< .001
Classroom: random intercept		0.004 (0.004)	.261		0.01 (0.01)	.416		< 0.001 (.01)	.020
Non-VR vs VR	*df*	*B (SE)*	*p*	*df*	*B (SE)*	*p*	*df*	*B (SE)*	*p*
Intercept	62.41	1.57 (0.04)	< .001	1482	1.96 (0.07)	< .001	53.64	1.59 (0.07)	< .001
T1	978.29	0.02 (0.03)	.417	1482	0.03 (0.05)	.490	965.39	−0.04 (0.05)	.407
T2	971.02	0.04 (0.03)	.183	1482	0.01 (0.05)	.885	958.43	0.02 (0.05)	.737
Gender (boys)	539.23	0.34 (0.04)	< .001	1482	0.47 (0.07)	< .001	532.60	0.84 (0.06)	< .001
Group (non-VR)	37.44	−0.02 (0.05)	.687	1482	0.03 (0.08)	.668	32.19	0.01 (0.09)	.889
T1 by group (non-VR)	976.36	−0.07 (0.04)	.112	1482	−0.03 (0.07)	.689	964.49	−0.07 (0.07)	.324
T2 by group (non-VR)	971.01	−0.01 (0.04)	.801	1482	0.01 (0.07)	.841	958.09	0.04 (0.07)	.589
Residual variance		0.11 (0.005)	< .001		0.27 (0.01)	< .001		0.26 (0.01)	< .001
Subject: random intercept		0.16 (0.01)	< .001		0.53 (0.04)	< .001		0.47 (0.04)	< .001
Classroom: random intercept		0.004 (0.004)	.311		0.00 (0.00)	[a]		0.01 (0.01)	.254

Note. [a]This covariance parameter is redundant. Statistics and confidence intervals cannot be calculated.

As for the intention to intervene as a bystander, no significant effect was found between time and experimental condition (Table 6).

Table 6. *Mixed Model Predicting Outcomes Linked to Bystanders' Intention to Intervene.*

		Bystanders' intention to intervene	
Control vs Non-VR	*df*	*B (SE)*	*p*
Intercept	1455	0.78 (0.08)	< .001
T1	1455	0.15 (0.08)	.062
T2	1455	−0.003 (0.08)	.969
Gender (boys)	1455	0.01 (0.10)	< .001
Group (control group)	1455	0.01 (0.10)	.932
T1 by group (control group)	1455	0.08 (0.11)	.483
T2 by group (control group)	1455	0.07 (0.12)	.529
Residual variance		0.76 (0.04)	< .001
Subject: random intercept		0.40 (0.04)	< .001
Classroom: random intercept		0.00 (0.00)	[a]
Non-VR vs VR	*df*	*B (SE)*	*p*
Intercept	72.14	0.89 (0.08)	< .001
T1	984.52	−0.11 (0.08)	.152
T2	981.16	−0.08 (0.08)	.295
Gender (boys)	530.83	−0.33 (0.07)	< .001
Group (non-VR)	48.42	−0.12 (0.11)	.280
T1 by group (non-VR)	981.37	0.26 (0.11)	.018
T2 by group (non-VR)	979.90	0.08 (0.11)	.709
Residual variance		0.73 (0.03)	< .001
Subject: random intercept		0.38 (0.04)	< .001
Classroom: random intercept		0.01 (0.01)	.304

Note. [a]This covariance parameter is redundant. Statistics and confidence intervals cannot be calculated.

Does VR Improve the Efficacy of Virtual-PRO?

Comparative results for the two experimental conditions are shown in Tables 4, 5 and 6. No significant differences were found between the experimental condition with and without VR for online and verbal/visual sexual victimisation, moral disengagement or sexist attitudes. However, differences were found between the two conditions in intention to intervene as a bystander (Table 6). The interaction between time and experimental group was significant in the comparison from post-test to follow-up (Table 3); scores for intention to intervene remained stable in the non-VR experimental group and increased in the VR experimental group with a small effect size (d = 0.07).

Additionally, the differences between the two programmes' versions in terms of participants' satisfaction and choices in both interactive scenarios have been explored.

As Table 7 shows, satisfaction with the programme was high in both groups (above 4), although the average satisfaction of the VR participants was higher. Looking specifically at the three activities linked to the three scenarios, in all cases, the VR experimental group showed higher satisfaction than the non-VR experimental group.

Table 7. *Mean Comparisons of Satisfaction With the Virtual-PRO Programme and With VR Activities by Experimental Condition.*

	Satisfaction *M* (*SD*)		*t* (*df*)	*p*	Cohen's *d*
	RV	Non-RV			
Programme	4.38 (0.60)	4.25 (0.65)	2.17 (518.61)	.031	0.19
Scenario 1	4.56 (0.71)	4.29 (0.88)	3.45 (374.36)	<.001	0.34
Scenario 2	4.62 (0.71)	4.36 (0.89)	3.43 (427.04)	<.001	0.32
Scenario 3	4.49 (0.79)	4.33 (0.95)	1.93 (421.29)	.027	0.18

Regarding decision-making within the interactive scenarios, Table 8 shows the options selected by the participants in both experimental groups. The groups showed no differences in terms of decision-making as bystanders, $\chi^2(3) = 5.26$, $p = .154$, $\eta^2 = .11$, being the most selected option to stop the aggressors. The groups did show significant differences in acting as victims, $\chi^2(3) = 8.61$, $p = .035$, $\eta^2 = .14$. Specifically, the difference was found in the option to talk to the family that was the option the participants in the VR experimental condition chose the most. In turn, this option was in third place in terms of frequency in the non-VR experimental group, only ahead of the option of doing nothing.

Table 8. *Options Chosen in the Scenarios With a Decision-Making Activity According to the Experimental Condition.*

	n (% percentage within group)	
	VR	Non-VR
Scenario 2: Decision-making as a bystander		
Doing nothing	55 (23.2%)	43 (20%)
Laughing	4 (1.7%)	1 (0.5%)
Joining the aggressors	3 (1.3%)	0 (0%)
Stopping the aggression	175 (73.8%)	171 (79.5%)
Scenario 3: Decision-making as a victim		
Doing nothing	7 (3%)	11 (5.6%)
Talking with friends	56 (23.8%)	56 (28.4%)
Talking with family	89 (37.9%)	50 (25.4%)
Confronting the aggressor	83 (35.3%)	80 (40.6%)

Discussion

VR is currently being used more and more frequently as a tool for preventing and intervening in sexual harassment among young people. Several studies have shown promising results using VR technology to address sexual victimisation and related issues (Rowe et al., 2015; Sánchez-Jiménez et al., 2024; Ventura et al., 2021). However, there is still ongoing debate about how effective VR is compared to traditional methods such as role-playing (Jouriles et al., 2009), videos (McEvoy et al., 2016), and written texts (Nikolaou et al., 2022). Continuing this line of research is essential, given the high human and economic cost of incorporating VR into psychoeducational interventions, especially those of a universal nature. The study was conducted to evaluate the effectiveness of Virtual-PRO for preventing sexual harassment among adolescents both with and without VR technology to address this gap in the extant research. The study compared the results of a group that participated in the programme without VR with those of a control group that did not participate in any intervention, and those of a third group that engaged in the original VR version of the programme.

The results regarding the efficacy of non-VR Virtual-PRO are interesting and contribute to the debate on whether or not VR enhances interpersonal violence prevention (Xue et al., 2021). After the first implementation of the programme using the VR condition, positive results were found regarding reductions in moral disengagement, sexism, and face-to-face and online sexual victimization, along with increases in intention to intervene as bystanders (Sánchez-Jiménez et al., 2024). The results regarding the efficacy of the non-VR condition were similar, although with a smaller effect size. The most significant changes occurred in the reduction of face-to-face and online sexual victimisation, thereby confirming that the programme, regardless of the version implemented,

equips students with strategies to deal with sexual harassment in both contexts (Coker et al., 2019; Herrera et al., 2018). The effects of the non-VR programme on moral disengagement and sexism did not reach statistical significance. Conversely, the direction of the changes observed indicates that the non-VR condition still impacts the moral component inherent to sexual harassment and may slightly modify attitudes and beliefs that support male superiority over women (Ferragut et al., 2016; Morelli et al., 2016). However, the non-VR version did not increase the intention to intervene as a bystander in comparison with the control group. Changes in this variable were found when the two experimental conditions were compared. Results showed that the VR version of Virtual-PRO increased participants' intention to intervene when the victim was not a friend more than the non-VR programme, with this being the only significant difference found between the two experimental conditions. A previous study found similar results when comparing the use of VR and role-playing methods in an intervention with victims of sexual harassment (Jouriles et al., 2011). The authors concluded that presenting the content through VR causes an emotional impact and a sense of immersion and embodiment that is superior to that experienced using traditional methods (Jouriles et al., 2009). Consequently, VR manages to mobilise bystanders more than non-VR methods, as a recent meta-analysis has shown (S. Park & Kim, 2023). In our study, we did not control for the realism and emotional impact of the scenarios in both experimental conditions, so we cannot be sure that these variables are responsible for the greater impact of VR. However, satisfaction with the programme was measured and, specifically, with viewing the scenarios. In this study, the activities with VR scenarios were rated higher than the same activities without VR. This suggests the need to further explore the benefits of VR for the prevention of interpersonal violence and the mechanisms associated with these benefits.

Overall, the results also suggest that using the programme with traditional audiovisual resources does not have a significant impact on fostering a view of sexual harassment as a social phenomenon where we all share some responsibility. We can speculate that implementation conditions could be influencing these results. Participants in the non-VR condition watched the videos in 2D together with their peers. Also, they did not immediately see the consequences of their actions compared to the VR condition when there was a decision-making task. This fact could explain the lesser impact of the non-VR scenarios regarding bystander intention to intervene. Future studies should consider alternatives for the way audiovisual information is presented and may wish to explore further whether changes in intention to intervene as a bystander are mediated by other variables, such as sexist attitudes or moral disengagement. Also, incorporating qualitative feedback or testimonials from participants regarding their experiences with Virtual-PRO, especially the VR condition, would provide a more comprehensive understanding of its impact.

This study has certain limitations and areas that should be improved in future editions of the programme. One limitation is linked to the generalisation of the results. Virtual-PRO and its multimedia materials are designed for adolescents in the later years of compulsory secondary education in Spain, so it may be risky to generalise the results reported here to other demographics and age groups. Nonetheless, this study responds to two important needs. Firstly, it addresses the scarcity of sexual harassment prevention programmes developed for adolescents in Spain. Secondly, it underscores the importance of taking socio-cultural contexts into account when designing preventive programmes and identifying the mechanisms of change (Overton, 2010). The second limitation is related to the follow-up measure. In this study, the effects of the programme were assessed three months after implementation. Future studies may wish to measure long-term effects and incorporate booster activities if necessary (Coker et al., 2020; Foshee et al., 2004).

Conclusions and Practical Implications

The results confirm that Virtual-PRO is effective in modifying sexual victimisation and marginally reduces moral disengagement and hostile sexism, although it fails to modify the intention to intervene as bystanders. The findings of this study validate the effectiveness of the Virtual-PRO programme with traditional multimedia resources in terms of reducing sexual victimisation and changing the attitudes and beliefs that perpetuate gender disparities, inequality and violence. These results contribute to existing research on the effectiveness of sexual harassment prevention programmes for adolescents that are based on bystander models. Additionally, the effectiveness of this updated version of the programme confirms the theoretical model supporting it and its methodological features, emphasising the importance of addressing not only gender beliefs and attitudes but also the socio-moral variables that rationalise sexual harassment (Sánchez-Jiménez et al., 2024). Furthermore, comparing the efficacy of the two experimental conditions provides valuable insight into the potential of VR as an intervention tool, highlighting its benefits over traditional methods in terms of cost-effectiveness and accessibility

for the educational community. This aspect is critical in ethical and responsible research, as it informs the target audience about the expected impact of intervention programmes and the costs associated with them (Guerra et al., 2011).

Finally, the current study has important implications for the development of psychoeducational programmes, indicating that future interventions should be responsive to technological advancements and incorporate innovative elements to enhance their effectiveness. Merely selecting content related to the subject matter is insufficient; the content must be delivered in an engaging manner to capture the attention of adolescent participants. Integrating VR into interventions seems to be one way of generating substantial medium-term changes in victimisation, proactive bystander behaviour, and socio-cognitive attitudes. However, it is important to note that VR is still an emerging technology with significant economic and personnel costs. In this study, the effect sizes found were not significantly different between the two experimental conditions, suggesting that the 2D video programme is a valid resource for the prevention of sexual victimisation among adolescents and certain risk factors. However, if the schools want to use the VR programme, efforts should be made to optimise its implementation. Future research should focus on making it accessible to diverse populations (e.g., educators) in order to enable them to implement the programme autonomously in educational settings. An example of this could be an adapted version of the 360° videos for viewing on mobile devices inserted into more affordable VR headsets for smartphones. This adaptation should be tested in future implementations of the programme.

Conflict of Interest

The authors have no conflicts of interest to declare.

Authors' Contribution

María Luisa Rodríguez-deArriba: conceptualization, data curation, formal analysis, investigation, visualization, writing—original draft, writing—review & editing. **Noelia Muñoz-Fernández:** conceptualization, methodology, validation, investigation, writing—original draft, writing—review & editing. **Estrella Durán-Guerrero:** data curation, investigation, writing—review & editing. **Javier Ortega-Rivera:** investigation, methodology, writing—review & editing. **Juan Ángel Jódar-Marín:** methodology, software, writing—review & editing. **Virginia Sánchez-Jiménez:** conceptualization, funding acquisition, methodology, project administration, resources, supervision, writing—original draft, writing—review & editing.

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Usage of AI

We have not used any AI services to generate or edit any part of the manuscript or data.

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