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The Effectiveness of a Psycho-educational App to Reduce Sexist Attitudes in Adolescents[☆]


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ABSTRACT

The present study evaluates the effectiveness of an intervention using a mobile app game aimed at reducing sexism in adolescents. A quasiexperimental pretest–posttest study is executed with intervention and control groups. The participants are 369 secondary school students from the province of Valencia, of whom 196 are assigned to intervention and 173 to control group. Hostile and benevolent sexism are assessed at both points in time using theory of ambivalent sexism. The two hours' intervention involved explaining the game's dynamic, implementation and use. The results of applying the programme are evaluated of the two dimensions of sexism in two time periods. Intervention with the app brought about a significant change, reducing sexism in adolescents by between six and 12%. The study highlights the usefulness to make use of information and communications technology (ICT) as a tool for combating sexism and co-educating in equality using gaming strategies to develop non-sexist prosocial competencies.

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Eficacia de una app psicoeducativa para reducir el sexismo en adolescentes

RESUMEN

El presente estudio evalúa la eficacia de una intervención consistente en el uso de una aplicación móvil en formato juego dirigida a reducir el sexismo en adolescentes. Se lleva a cabo un estudio cuasiexperimental pretest–posttest con grupos de intervención y de control. Participan 369 estudiantes de Educación Secundaria Obligatoria de entre 12 y 17 años de la provincia de Valencia, de los cuales 196 se asignan a la condición de intervención con la aplicación y 173 al grupo control. Se evalúa sexismo hostil y benévolo a partir de la teoría del sexismo ambivalente en ambos momentos temporales. La intervención presencial, de dos h de duración, consiste en explicar la dinámica e implementación del juego que después han de practicar. Los resultados de aplicación del programa se evalúan sobre las dos dimensiones de sexismo. La intervención con la aplicación muestra un cambio significativo reduciendo entre un seis y un 12% el sexismo en adolescentes. Este estudio destaca la utilidad de integrar las TIC como herramientas para la prevención y coeducación en igualdad desde el ámbito educativo, a partir de estrategias lúdicas que permitan el desarrollo de competencias prosociales no sexistas.

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Palabras clave:

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Introduction

Adolescence is seen as a transitional stage on the way to adulthood characterized by considerable biological and psychosocial changes. It is also an evolutionary period during which affective attractions begin to surface. Many adolescents find themselves in a couple relationship for the first time, and this could either form the basis for positive practice if it is prosocial (Arenas, 2013) or determine a socialization of risk if it brings out attitudes of control or sexist behaviours (Moyano, Expósito, & Trujillo, 2013; Rodríguez-Castro & Alonso-Ruido, 2017; Rubio, 2009). Various studies warn

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of the danger posed to the adolescent's proper emotional and psychological development by false beliefs (De Villiers & De Villiers, 2012) and the fact that these experiences proliferate during the first stages of socialization (Chiung-Tao, Yu-Lung, & Gao, 2012; Cowie, 2013), since in some cases they leave latent traces during adolescence (Glowacz & Courtain, 2017; Malonda, 2014) and even in adulthood (Karakurt & Silver, 2013; O'Keefe & Triester, 1998; Wincentak, Conolly, & Card, 2016).

Numerous scientific papers have identified sexism as a serious risk factor leading to gender-based violence (Arnosó, Ibabe, Amoso, & Elorriaga, 2017; Giordano, Soto, Longmore, & Manning, 2010) because it maintains inequality between the sexes (Montañés, Megías, De Lemus, & Moya, 2015) and justifies love based on the domination, control (Merás, 2013) and submission of women (Ruiz, 2016). It is defined as a multidimensional construct that involves not only sexist beliefs but attitudes too, including "hostile sexism, socially accepted everyday sexism, cognitive biases against women and tolerant attitudes towards violence against women" (Arnosó et al., 2017, p. 10). Accepting these beliefs involves attitudes connected to biological sex (Rottenbacher, 2010; Ubillos-Landa, Goiburu-Moreno, Puente-Martínez, Pizarro-Ruiz, & Echeburúa, 2017). Glick and Fiske (1996) add a more hidden benevolent dimension to the much more obvious hostile aspect of sexism. Together these form ambivalent sexism, with two clearly distinguishable but very closely linked structures. *Hostile sexism* is an attitude of prejudice and discrimination based on the supposed inferiority of women as a group and involves beliefs associated with aggressive possession, sexual violence (Russell & Trigg, 2004), psychological humiliation (Khan, Berger, Wells, & Cleland, 2012) and financial control (Shorey, Cornelli, & Bell, 2008), whereas *benevolent sexism* involves a whole series of stereotyped beliefs and attitudes towards women, that are misperceived as being kindly and characterized by conveying a positive affective tone and taking on the appearance of prosocial behaviours.

It was recently reported (Macroencuesta Mujeres, 2015) that sexist attitudes related to violence and control against young women aged 16–19 had risen by 25% and that 12.5% of young women aged 16 had suffered sexual or physical violence in their relationship with their partner. According to Viejo, Monks, Sánchez, and Ortega-Ruiz (2016, p. 1453), this violence "affects the quality of the relationship". Ellsberg et al. (2015) point out that sexist attitudes routinely manifest themselves as possessiveness when using social networks (WhatsApp, Facebook, etc.) and in depersonalization in the mistaken belief that protection is synonymous with ownership (Logan-Greene, Nurius, & Thompson, 2012). These are paternalistic attitudes that Howard and Wang (2005) believe can be seen as predictors of toxic relationships soured by the appearance of gender-based domination and power imbalances.

Meanwhile Venegas (2015) explains that "segregation-based arrangements have a direct impact on the education system and ultimately on society by reinforcing sexism and inequality, for example, and thus the various ways in which gender-based violence manifests itself" (p. 49). But what are the implications of sexism in school? In an educational setting, sexist behaviours are associated with expressions of violence (Bennett, Guran, Ramos, & Margolin, 2011; Vázquez & Castro, 2008). Research carried out by these authors explores the issue of student victimization through the use of ICT, focusing on four main aspects: hostility, humiliation, exclusion and intrusion. Male students talk more about victimization and female students about constant repetition and anxiety. In an attempt to reduce these objectionable behaviours, Vázquez and Castro (2008) point out that sexism can be overcome through the use of coeducational practices designed to educate girls and boys by taking diversity, respect, peaceful coexistence and gender equality into account in the learning process. Thus a school education with a balance between biological sex and cultural questions

about gender has more tools available to deal with the risks of adolescence. Incorporating a health perspective, Kaukinen (2014) identifies correlations between low-performing adolescents with health problems and involvement in violent episodes at school, whether gender-based or generic. This connection is associated with the fact that students with chronic illnesses find it more difficult to become integrated and therefore feel less attachment to educational contexts. The study points out that these differences in levels of commitment affect their sense of loyalty to the school community. Sexism in schools has been an object of analysis for over a decade and is seen as something that should be stamped out, since it is not helpful in any way in an equality-based education. Escámez and García (2005) note the importance of adapting textbooks and making women more visible in areas involving science, engineering, etc. López-Navajas (2014) suggests transforming iconographies on the basis of visual representations that swap classic gender roles, while Heller (2004) recommends that colours such as blue and pink should be dropped from advertising campaigns that have an effect on uniforms and school items like pencil cases, satchels, etc. From another perspective, the models depicted of women and men are so different that, according to Olid (2008), textbooks revolve around an image of feminine seductiveness, which is a breeding ground that subliminally (Racionero, 2008) leaves an imprint on the students' consciousness and perception. A study by Ballber (2012) reported that 78.7% of primary and secondary schools do not use non-sexist coeducational practices in their education planning. A notable characteristic in this regard is the underuse of inclusive language in the materials prepared by teachers and in their everyday communications. According to Mariscal and Gallego (2013), students imitate the forms and uses of language they observe in teachers, educators and parents. Inclusive language is therefore crucial in everyday interactions, since it is picked up without effort and incorporated naturally.

Today's digital era, also known as the risk society (Beck, 2002), places in situations of vulnerability those adolescents who a priori have no risk profile (Paul, 2015) precisely because conflict transcends physical parameters and penetrates into abstract settings (Navarro & Pastor, 2018). Risk is not confined – as it was decades ago – to particular suburbs or neighbourhoods and slum areas, but spreads across territories that have no geographical boundaries, such as virtual networks. Adolescents of both sexes, seduced by the immediacy, attach more importance than ever to cyberculture, online entertainment and social networks (Feixa, 2011). Young people interact from an abstract position more readily than previous generations, a factor that enables them to exchange experiences and reflections in virtual environments (Livingstone, 2009; Robson, 2016). Socializing via ICT allows them to be constantly connected to the rest of the world both in real time and virtually and facilitates the exchange of information, omnipresence in different spaces, visibility, etc. Networks like Twitter, Facebook, WhatsApp and Instagram collaborate in this immediacy, which is built up as a main attribute. Hence the importance of providing prosocial strategies adapted to the 4.0 systems on which students socialize, supplying tools for information searches and extending the P2P networks used to socialize during leisure time, look for relationships, plan activities, self-promote on social media, keep in touch with people in real time, etc. (Bringué & Sábada, 2010; García-Aretio, Ruiz-Corbella, & Domínguez, 2007). According to Segovia, Mérida, Olivares, and González (2016), ICTs motivate adolescents to take an active part and encourage the educational community to mobilize. Charsky (2010) notes that the incorporation of new technological tools into formal education makes it possible for students to acquire knowledge across a wider timescale, since face-to-face learning situations are bolstered by other psychoeducational options.

Table 1
Sociodemographic characteristics of the control and intervention groups

	Control (n = 173)	Intervention (n = 196)	Difference between groups
Average age \pm SD	13.89 \pm 1.24	13.76 \pm 1.19	$t(365) = .988$; $p = .324$
Women, n (%)	95 (55.9)	104 (53.1)	$\chi^2(1) = .292$; $p = .589$
Middle socioeconomic level, n (%)	130 (75.6)	148 (75.9)	$\chi^2(4) = 2.03$; $p = .730$
Parents married, n (%)	130 (76)	147 (74.6)	$\chi^2(6) = 3.13$; $p = .793$
Siblings, n (%)	105 (63.3)	124 (65.3)	$\chi^2(7) = 8.54$; $p = .288$
Lives with both parents, n (%)	126 (72.8)	133 (67.5)	$\chi^2(9) = 8.15$; $p = .519$
Father in work, n (%)	148 (87.1)	176 (90.7)	$\chi^2(5) = 3.70$; $p = .593$
Mother in work, n (%)	132 (76.7)	147 (77.8)	$\chi^2(4) = 1.05$; $p = .902$
Uses social networks to socialize, n (%)	153 (88.4)	173 (87.8)	$\chi^2(1) = .034$; $p = .854$
Uses social networks every day, n (%)	115 (68)	133 (68.9)	$\chi^2(4) = 2.04$; $p = .728$

Along similar lines, education aimed at preventing sexist beliefs and attitudes in adolescents in conjunction with good teaching practices in this area (Valdés-Cuervo, Martínez-Ferrer, & Carlos-Martínez, 2018) could use these new formats and languages of psychoeducational intervention to their advantage. It is possible to educate about sexism (Venegas, 2015) and also to make predictions on the basis of cultural patterns (Maltby, Hall, Anderson, & Edwards, 2009) in the same way that secondary school can be used as a resource to deal with these contents more easily (Jackson, 2002). ICT games (apps, videogames, virtual social networking sites, etc.) enable adolescents to participate autonomously, becoming fixtures in their everyday socializing environments and leisure spaces and supplying motivation for learning and reflection (Levis, 2004). Carrasco, Alarcón, and Trianes (2015) stress the need to encourage an active, participative and cooperative methodology as a tool for learning, and to show scientifically the effectiveness of psychoeducational interventions as applied to all adolescents.

The main objective of the present paper is to test the effectiveness of the Liad@s app (Navarro, Oliver, Morillo, & Carbonell, 2018) in reducing sexist beliefs and attitudes in adolescents. A secondary objective is to provide useful information for the educational community regarding the differences in effectiveness according to the variables of sex, age, household composition and urban or metropolitan as opposed to rural location.

Method

This investigation forms part of a much wider diagnostic exploration and uses proportional stratified sampling (maximum error rate $\pm 3\%$ with a 95% confidence interval) broken down by school status (state, state-assisted or public school) and location (urban, metropolitan or rural) in line with Halfacree's (1993) demographic criteria. Rural is defined as a residential area with insufficient communication or more than 30 km from a population centre of over 25,000 inhabitants.

Participants

This is a quasi-experimental study with randomization of groups and measurements taken before and after implementation of the Liad@s app (Navarro et al., 2018). The participants were 369 students in compulsory secondary education. The approximate size of the intervention and control groups was estimated a priori with G-Power, taking into account the information on effect size obtained in approximate studies, with effect sizes between low and medium according to eta-squared, assuming a type I error of .05, power .8, in a mixed ANOVA and MANOVA analysis framework. The control group comprised 173 participants from four schools (one urban, one metropolitan, two rural), while the intervention group comprised 196 participants from five schools (two urban, one metropolitan, two rural). Of the control group, 117 adolescents (67.6%) lived in an urban or metropolitan setting and

56 (32.4%) in a rural environment. Of the intervention group, 111 lived in an urban or metropolitan setting (56.6%) and 85 in a rural environment (43.4%). The participants were evenly distributed as regards school status in both the control group (two state and two state-assisted or public) and the intervention group (three state and two state-assisted or public).

No significant differences were detected between the control group and the intervention group in any of the variables considered ($p > .05$), which is evidence of equivalence between groups (see Table 1). As regards age, which was the only quantitative variable considered, the t -test showed no significant differences between the two groups. The same result was obtained in all the chi-square tests carried out, as can be seen from the p -values in the last column. The table shows the percentages for the most frequent categories in each variable for both the control and the intervention group. Thus, for example, we see that the distribution by sex is very similar in the two groups, with women being in the majority in both cases (55.9% in the control group and 53.1% in the intervention group).

Instruments

ASI-Adolescents. Ambivalent Sexism Inventory for Adolescents (Lemus, Castillo, Moya, Padilla, & Ryan, 2008), an adaptation of Glick and Fiske's (1996) Ambivalent Sexism Inventory (ASI), validated in Spain for an adolescent population. Its authors report a confidence interval of .81 for *ambivalent sexism*, .84 for *hostile sexism* and .77 for *benevolent sexism*. The instrument comprises 20 items distributed into two dimensions: *hostile sexism* (HS) with items such as "Boys should have control over whom their girlfriends mix with" and *benevolent sexism* (BS) with statements like "Boys should look after girls". The response to each item is polytomic with 6 options, where 0 = Strongly disagree, 1 = Moderately disagree, 2 = Slightly disagree, 3 = Slightly agree, 4 = Moderately agree and 5 = Strongly agree. The internal consistency values for alpha and omega (Composite Reliability Index) in this investigation are .88 and .93 respectively for the overall scale, .84 and .89 for the *hostile sexism* dimension, and .82 and .86 for *benevolent sexism*.

Liad@s – University of Valencia (Navarro et al., 2018) is a smartphone app available for both iOS and Android. Developed in game format with characteristics of a preventive, socializing, psychoeducational nature, this instrument is designed to reduce sexist behaviours and increase awareness of gender-based violence in adolescents. The challenges and tests of the app aim to encourage critical, reflexive thinking by boosting the development of prosocial competences and attitudes, questioning socially accepted beliefs and identifying negative messages. The intervention is carried out based on the use and implementation of this app.

The game consists of a roulette wheel with compartments of different colours that each feature a different type of test or message, plus a monitor that determines the cell on which the player will land (see Table 2 and Figure 1). Unlike other purely informative apps and awareness workshops, this app includes gamification

Table 2
Liad@s app tests

Test/colour	Name	Aim
Red	Question-answer	To put the player in a situation with three response options from which they have to select the right one.
Green	Ecological love	To recycle positive messages and discard negative ones.
Brown	Sort it out	To identify key content with the letters of each word jumbled up.
Yellow	Balloons	To burst the balloons containing harmful words.
Blue	True or false	To say whether a sentence is true or false.
Purple	Under the magnifying glass	To judge a simulated WhatsApp conversation.
Orange	Songs with a message	To identify implicit messages in songs.
Pink	Detectodrome	To detect key concepts from both healthy and harmful couple' relationships using word search puzzles.
Black	Lose points	Decreases the points accumulated in the game by 20%.
White	Double points	Doubles the points accumulated in the game.
Grey	Save points	Consolidates points and positions player in the scores ranking.
Multicolour	Random test	Randomly redirects the player to another test.



Figure 1. Images of the Liad@s app being played, showing various tests.

aspects to encourage the game dynamic (double, lose, save points), strengthening the player's connection with the intervention and ensuring consistent use of the game.

Sociodemographic variables: data are gathered for the variables age, sex, family unit, family socioeconomic level, parents' marital status, number of siblings, parents' employment status and use of social networks.

Procedure

First of all the school management teams were contacted by phone and then sent a follow-up email containing information about the investigation. The study had to be given the green light by the school board in each school. Dates were then arranged for the three stages of the investigation: pretest, intervention, posttest. The schools in the control group had the intervention after the posttest.

As regards the intervention group, two female researchers provided details about gender-based violence to contextualize the interest in using the app. They also explained how to install it, how each test worked, how the scoring system worked, the aims of the game and the four-week time period the participants would have in which to play it. Demonstrations of how to play were given as part of the same two-hour workshop. The time periods for the control and intervention groups were arranged to be simultaneous in order to allow for any possible outside sources of influence such as news items on the subject, anxiety about forthcoming academic assessments, etc. Participants used their mobile phones to take part in the intervention using the app. Extra tablets and smartphones were available for those who did not have a device, thereby guaranteeing that all students could familiarize themselves with the app during the session.

Further information on the acceptability and playability of Liad@s (Navarro et al., 2018) was collected from the intervention group, and two screening questions were asked as inclusion criteria to make sure that a minimum number of games would actually be played and that the mechanics of the game were understood. All the participants passed this screening. Once the intervention was over, the questionnaires were again administered to the experimental group to check its effectiveness. In the control group, measurements were taken at two points in time and the intervention with the app was carried out at the end of the investigation in accordance with ethics committee protocol.

The instruments were administered to the students in their usual classrooms during a normal class period with the course teacher-tutor always present. The students' parents and/or legal guardians were asked for their consent and it was made clear at all times that participation in the investigation was voluntary and anonymous. The investigation had the necessary authorization from the local education authority (Generalitat Valenciana) allowing access to the schools in accordance with the ethics committees of the participating institutions and in line with current regulations (informed consent and right to information, personal data protection and guarantees of privacy, non-discrimination, no cost, and the right to leave the study at any point).

Data analysis

The reliability of the ASI-Adolescents was obtained via internal consistency using Cronbach's alpha coefficient and the Composite Reliability Index or CRI (Raykov, 1997) on the WLSMV estimate for the confirmatory analyses of the *hostile* and *benevolent sexism* subscales, carried out by the Mplus 7 programme. Both coefficients

Table 3
Descriptive statistics for the *ambivalent sexism* dimensions by group

	Control				Intervention			
	M	SD	Min.	Max.	M	SD	Min.	Max.
Hostile sexism pre-intervention	1.41	.84	.00	3.80	1.41	.93	.00	4.10
Benevolent sexism pre-intervention	1.96	.95	.00	4.60	2.09	1.04	.00	4.80
Hostile sexism post-intervention	1.50	.88	.00	4.60	.90	.76	.00	3.70
Benevolent sexism post-intervention	1.95	1.02	.00	4.90	1.07	.87	.00	3.67

were interpreted analogously, indicating their proximity to 1, i.e. excellent reliability. Descriptive statistics of these two dimensions of sexism were calculated for each point in time (mean, standard deviation, minimum and maximum scores). *T*-tests were then carried out to compare the means in independent groups in order to verify equivalence in the sexism measurements for both groups at the start. Afterwards, multivariate analyses of variance (MANOVA) were carried out on the differences before and after the intervention with Liad@s (Navarro et al., 2018), according to whether the participant belonged to the intervention or the control group. The MANOVA assesses the differences in the means of the dependent variables for the various categories of independent variables. The most robust Pillai criterion (Tabachnick & Fidell, 2007) was used to analyze the effectiveness of the treatment, which is shown by a significant effect in the group variable.

Once the effectiveness of the intervention was verified, in order to find out possible profiles or differences in the way the app works, follow-up MANOVAs and ANOVAs were carried out on the change scores for the intervention's target variables, the quantitative sociodemographic variables, and variables such as sex, environment and household composition. Each MANOVA analyses the two dimensions of sexism, *benevolent* and *hostile*, as dependent variables. When examining the means after the intervention, a reduction is expected to be seen in all of the variables considered. If any are significant, follow-up ANOVAs are carried out to study in which particular variables the statistically significant differences appear. The effect size is estimated using partial eta-squared (η^2) which, depending on how close it is to .01, .06 or .14, is interpreted as small, medium or large respectively. When assessing the effectiveness of the intervention, a corresponding confidence interval of 90% is included as recommended in the literature (Lakens, 2013). The data analysis is carried out using SPSS 24.

Results

Equivalence between groups for *hostile sexism* was first verified. The Levene test allows equal variances to be assumed ($p = .185$) and the consequent comparison of means was not significant: $t(367) = -.102, p = .919$. Similarly, assuming equal variances for *benevolent sexism* ($p = .118$), the comparison of means did not throw up any significant differences: $t(367) = -1.247, p = .213$. The means for each condition can be seen in Table 3. The descriptive results for sexism showed higher scores in the *benevolent sexism* dimension. After the intervention, scores for *benevolent* and *hostile sexism* decreased in the experimental group, while means for the control group remained similar.

A MANOVA carried out on the change scores (pretest minus posttest) for the *hostile sexism* and *benevolent sexism* variables supplied the following results: a Pillai trace of .118 associated with $F(2, 367) = 24.634, p < .001, \eta^2 = .118$. Once joint significance was confirmed using MANOVA in accordance with the analysis protocol, follow-up ANOVAs were carried out for each of the two variables. The results in both cases indicated statistical significance. With *hostile sexism* $F(1, 368) = 23.843, p < .001, \eta^2 = .061$, IC 90% over η^2 of .014 to .212 a medium effect size was obtained, while with *benevolent sexism* the effect size was medium-large $F(1, 368) = 48.498,$

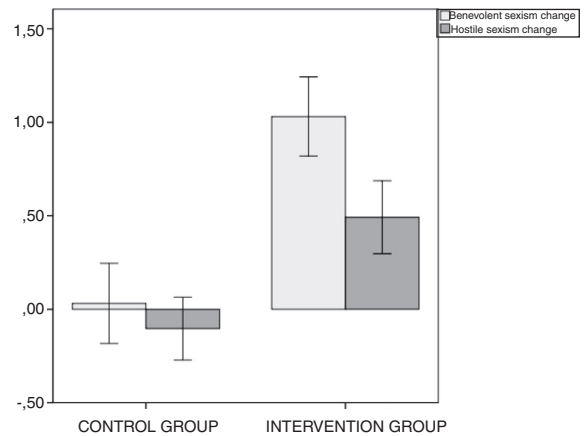


Figure 2. Magnitude of change in pretest–posttest measurements for the control and intervention groups for both dimensions of the Ambivalent Sexism Inventory.

$p < .001, \eta^2 = .116$ with IC 90% over η^2 of .015 to .367. As the graph in Figure 2 shows, the control group had similar scores in both the pretest and posttest stages, whereas in the experimental group the intervention with the Liad@s app (Navarro et al., 2018) brought about the desired change in the two sexism factors in our study. According to the effect size measurements mentioned above, the perceptions of *hostile sexism* decreased by 6% and for *benevolent sexism* by almost 12%.

As regards the sub-objectives that seek to discover in which profiles or situations the effectiveness of the intervention was greater, we can consult the results of the correlations between the quantitative variables that express the magnitude of the change in *hostile* and *benevolent sexism* and age, school year and game score. The correlations with age for *hostile sexism* ($r = -.045, p = .528$) and *benevolent sexism* ($r = -.027, p = .718$) reveal that the changes brought about by the intervention are not associated with age but are independent. However, a greater use of the app measured in terms of game scores does correlate significantly and positively with the desired changes in the two facets of sexism, *hostile* ($r = .180, p = .012$) and *benevolent* ($r = .232, p = .001$).

The MANOVA provides clear results as to whether the decrease in sexism is greater among boys or girls, whether it decreases at different rates in urban, metropolitan or rural settings, and whether there is any interaction between these variables. The Pillai trace of .021 associated with $F(2, 361) = 3.848, p = .022, \eta^2 = .021$ indicated significance in the joint analysis for the setting variable (urban as opposed to rural), which needed to be developed with follow-up ANOVAs. These were significant for setting for *hostile sexism* ($p = .045$ and $\eta^2 = .011$) and *benevolent sexism* ($p = .006$ and $\eta^2 = .020$), in both cases with a small effect size and indicating greater change in the direction expected in schools located in rural rather than urban or metropolitan settings. In the case of sex a similar pattern of significant differences is seen, with a Pillai trace of .074 associated with $F(2, 361) = 14.322, p < .001, \eta^2 = .074$. The follow-up ANOVAs for the sex variable are significant for *hostile sexism* ($p < .001$ and $\eta^2 = .074$) and *benevolent sexism* ($p = .001$ and $\eta^2 = .029$), in both cases indicating greater change in boys than girls,

with a medium effect size in the case of *hostile sexism* and a small effect size in the case of *benevolent sexism*. However, the interaction does not show differences according to combinations of sex by school location *Pillai trace* of .001 associated with $F(2, 361) = .091$, $p = .913$, $\eta^2 = .001$ through the comparison statistics or the effect size associated with the MANOVA. In other words, no combination of sex by school location shows the app functioning in a different way.

Finally, another MANOVA showed that no differences in the intervention's effectiveness *Pillai trace* of .008 associated with $F(4, 720) = .751$, $p = .558$, $\eta^2 = .004$ were introduced by household composition (parents living together, parents separated or divorced, single-parent families).

Discussion

The main objective of the present paper was to test the effectiveness of the Liad@s app (Navarro et al., 2018) in reducing sexist beliefs and attitudes in adolescents. A secondary objective was to provide useful information for the educational community as regards the app's effectiveness broken down by the variables of sex, age, household composition and urban or metropolitan as opposed to rural setting.

As regards the main objective, in agreement with Ruiz's (2016) results we find the presence of sexist stereotypes in secondary school students, with higher levels of benevolent than hostile attitudes, manifesting themselves in a more subtle and emotional way and helping to perpetuate gender stereotypes. The findings of the present study are in line with the introduction of preventive psychoeducational programmes combined with ICT (Kallio, Mayra, & Kaipainen, 2010; Young, 2007). From coeducational positions, these make it possible to intervene in behaviours such as sexist beliefs and attitudes that in the medium or long term may spread to other areas of the adolescent's development in school socialization and even have an effect in adulthood (Piquero, Farrington, Welsh, Tremblay, & Jennings, 2009; Sydow, Retzlaff, Beher, Haun, & Schweitzer, 2013).

Sexist patterns are reduced as a priority in the intervention with Liad@s (Navarro et al., 2018). Following the experiences of Díaz-Aguado (2006), cooperative relationships are established along with the construction of a curriculum of non-violence given shape through non-sexist coeducational practices. The app at the centre of this paper incorporates a dual role for the adolescent, in which they are simultaneously both player and spectator, and this enables them to observe and reflect on violence and sexism while acquiring competences. Collaterally and in line with the proposals made by Venegas (2015), the effects of an equality-based education for students through interaction with ICT-based games facilitate learning and, according to the results of this study, sexism does indeed decrease due to the intervention.

The results indicate that the Liad@s app, developed and validated by Navarro et al. (2018), the co-authors of this paper, is a useful tool in educational settings. The experience shows that it can be used not only in recreational settings (personal, family and group leisure spaces) but also in formal education settings (during teaching hours) and for out-of-school activities. Authors such as Greenberg and Harris (2012) report that the acquisition of socio-emotional skills at an early age helps people to cope with stress throughout the life cycle and promotes resilience and psychological wellbeing. These points to the advisability of using preventive intervention programmes to promote socioemotional and cognitive development in adolescents. Schools are universal spaces and the ideal medium in which to apply these programmes at a point that is especially important for the adolescents' personal development (Hale, Fitzgerald-Yau, & Viner, 2014).

In connection with this intervention, Levis (2004) states that the use of pedagogical videogames provides additional motivation for students. It is from this position that Liad@s (Navarro et al., 2018) was devised as a stimulus for learning and reflection, given the variety of tests involving sexism and the dilemmas of romantic love around which the game revolves. The design and diffusion of didactic tools in version 4.0 (audiovisual materials, phone apps, WhatsApp groups, Facebook, etc.) focusing on dialogical reflection, tasks undertaken for MOOCs in e-learning, etc. enables members of the educational community (teachers, students, parents, etc.) to make use of these tools – which have been proved to be effective – in order to work towards positive coexistence and the reduction of the sexist beliefs and attitudes that have a negative effect on the school climate.

Our secondary objective was to provide useful information for the educational community as regards differences in effectiveness by sociodemographic variable (sex, age, household composition and urban or metropolitan as opposed to rural setting). Effectiveness is achieved in the various scenarios considered, but the magnitude of the change in all players is not the same because higher or lower scores are obtained depending on the characteristics of each participant. Taking the sex variable as an example, in line with previous evidence (Maltby et al., 2009; Moyano et al., 2013) differences in both *hostile* and *benevolent sexism* are found after use of the app, with the maximum change being found among boys for *benevolent sexism*. The results indicate that the game is more effective when there is a higher level of sexism, since the more it is played, the more these attitudes and beliefs decrease. Students in schools located in rural settings benefit more than those in urban areas. This is due to the fact that the original level of sexism is greater in rural settings, and therefore the game's relative effectiveness is too. The results of the present study match those of a recent analysis carried out by Rodríguez-Castro and Alonso-Ruido (2017) on adolescents in rural Galicia, according to which they are more sexist than those living in cities. The interpretation of these results is also supported by international research, which associates *hostile sexism* with the patriarchal structure of rural societies (Khan, 2017) and attributes it to the geographical isolation of rural areas being in analogy to gender imbalances (Wendt, 2009). As regards age and household composition, in both cases the intervention shows no significant results. Just over half the sample (53%) live with both parents, 77% of whom are married, but there are no data on the quality of family relations at home. Equality-based coexistence between parents and children results in non-sexist dynamics (Marks, Bun, & McHale, 2009) and recent studies reveal that a system of shared responsibilities leads to low levels of sexism in family relations (Gere & Helwig; 2012; Ogletree, 2014).

As far as age is concerned, perhaps due to the narrow range, no differences in the effectiveness of the intervention were found. However, it is important to mention that with the average age of participants being 14, as in this investigation, it is best to carry out interventions as described in the literature (Augimeri, Farrington, Koegl, & Day, 2007; Garaigordobil & Aliri, 2012).

Complementing the aims of this intervention, the results – backed up by positive feedback from the participants – show that technology provides the opportunity to acquire competences in equality and non-discrimination, which are essential for reducing sexist and violent attitudes and beliefs (Levis, 2004; Valdés-Cuervo et al., 2018). Analysis sharing with Segovia et al. (2016), the acquisition of non-sexist competences using ICT – in this case the Liad@s app (Navarro et al., 2018) – is especially suitable for adolescents socialized in 4.0.

A limitation of this study is that schools need to have ICTs and that these are freely accessible to students (Wi-Fi). Another limitation is the use of self-reporting, which is more sensitive to social desirability. Investigating in educational settings in a real context

has greater ecological validity, but it also has its drawbacks. Lastly, it would be interesting to find out how sustainable these effects are by carrying out a longitudinal follow-up with measurements taken later in time. This line of research would be of great interest in similar future investigations.

Finally, the data obtained in this investigation contribute to the literature by supplying a study of an app that reduces sexism among participating adolescents using a non-sexist re-education programme with technological support to implement coeducational strategies.

Conflict of interest

The authors declare that there are no conflicts of interest regarding the publication of this article.

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