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The influence of a porn literacy intervention on explicit and implicit attitudes

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Abstract: Mainstream pornography presumably influences explicit and implicit attitudes. This study presents a media literacy intervention specifically for pornography in form of a short video (3 min.) highlighting that pornography is effortfully constructed. After exposing 80 adults between 18 and 33 (60% female) to mainstream pornography, it was experimentally tested if the porn literacy intervention (compared to a matched control video) decreased perceived porn realism, undesired explicit and implicit attitudes, and whether the influence of the intervention was moderated by sexual experience and prior porn use. The preregistered experiment showed that the porn literacy intervention had no effect on perceived realism of pornography, body dissatisfaction, implicit sexism, or explicit and implicit attitudes toward condom use (all materials, data, and analysis scripts available at https://osf.io/2pk5e/). Explicit sexist attitudes were decreased in individuals with few sex partners and increased in individuals with mean or higher prior porn use. The intervention influenced self-reported sexism but not the presumed mechanism perceived realism (associated with younger age). Across conditions, participants were neither more dissatisfied with their bodies nor more dismissive toward condoms after watching mainstream porn; sexist attitudes were even lower at posttest. The study proves the need for more research clarifying what, how, and when we learn from porn, including more theoretical refinement in media literacy theory with its mechanisms, its application to pornography, and concrete interventions.

Keywords: media literacy, media competence, sexually explicit internet material, pornography, porn studies, Implicit Association Test, attitude change, experiment

Zusammenfassung: Mainstream-Pornografie beeinflusst vermutlich explizite und implizite Einstellungen. Die Studie stellt eine Video-Intervention (3 Minuten) zur Medienkompetenz speziell für Pornografie vor, die verdeutlichen soll, dass Pornografie aufwändig konstruiert ist. Nachdem 80 Erwachsenen zwischen 18 und 33 Jahren (60 % weiblich) Mainstream-Pornografie gezeigt wurde, folgte ein experimenteller Test, ob die Intervention (im Vergleich zu einem abgestimmten Kontrollvideo) den wahrgenommenen Realismus von Pornografie sowie unerwünschte explizite und implizite Einstellungen verringert und, ob der Effekt der Intervention von sexueller Erfahrung und vorherigem Pornografiekonsum moderiert wird. Das präregistrierte Experiment zeigte, dass die Intervention keine Auswirkun-

gen auf den wahrgenommenen Realismus von Pornografie, die Unzufriedenheit mit dem eigenen Körper, impliziten Sexismus oder die expliziten und impliziten Einstellungen zu Kondomen aufweist (alle Materialien, Daten und Analyseskripte sind unter https://osf.io/2pk5e/ verfügbar). Explizite sexistische Einstellungen wurden bei Personen mit wenigen Sexualpartnern verringert und bei Personen mit mittlerem und höherem Pornokonsum erhöht. Die Ergebnisse zeigen Einfluss auf den selbstberichteten Sexismus, nicht aber den als Wirkungsmechanismus angenommenen wahrgenommenen Realismus (dieser hing mit jüngerem Alter zusammen). Teilnehmende waren über beide Versuchsbedingungen hinweg nach dem Konsum von Mainstream-Pornografie weder unzufriedener mit ihrem Körper noch ablehnender gegenüber Kondomen; sexistische Einstellungen waren zur Posttestmessung sogar niedriger. Die Studie zeigt, dass es mehr Forschung dazu braucht, was, wie und wann von Pornos gelernt wird. Außerdem muss die Theorie der Medienkompetenz weiter präzisiert werden wie auch ihre Wirkmechanismen, ihre Anwendung auf Pornografie sowie konkrete Interventionen.

Schlagwörter: Medienkompetenz, Medienerziehung, Pornografie, Pornostudien, Impliziter Assoziationstest, Einstellungsänderung, Experiment

1. Introduction

It would be worrisome if people learned how to drive a car from "The Fast and the Furious". Luckily, action movies are not our only source of information when it comes to driving. We observe others and learn a clear set of rules. For sex, however, there is no formal way of acquiring information. Sex education at school typically problematizes sex, neglects pleasure and desire, and the cultural taboo surrounding sex hinders communication with parents, peers, and older siblings (Goldfarb & Lieberman, 2021). The internet, however, provides anonymity, affordability and accessibility. Thus, young people can easily turn to pornography for information (Albury, 2014; Litsou et al., 2021) and for some, porn may even be a primary source of sex education. The fact that "amateur" and "verified couples" were the top-gaining porn categories, and "amateur" was the search that defined the year 2019 (Pornhub Insights, 2020) shows people's desire for realistic and credible representations.

In 2019, 61% of Pornhub's visitors were between 18 and 34 (Pornhub Insights, 2020). Initial exposure to pornography often happens in early adolescence (Flood, 2007), while the average age for sexual debut is around 17 years (Cavazos-Rehg et al., 2009). Thus, many young people see porn years before making firsthand sexual experiences (Sun et al., 2016). The fact that porn experience often precedes own sexual experiences is alarming because mainstream pornography provides questionable representations of sexuality ripe with sexism and racism (Tsitsika et al., 2009). Those without firsthand sexual experience are especially susceptible to the illusions and undesired effects of pornographic messages (Peter & Valkenburg, 2016).

In other media genres, media literacy interventions can decrease undesired media effects (Jeong et al., 2012). Whereas media literacy has been researched extensively, it lacks evaluations of porn literacy interventions (Albury, 2014; Byron et al., 2021; Testa et al., 2023). The present study tests whether an intervention promoting porn literacy can decrease perceived porn realism and potential undesired effects of pornography.

2. Porn literacy

Porn literacy derives from media literacy, which is an understanding of media production and the resulting gap between media representation and reality (Potter, 2013). While media literacy is an umbrella term for knowledge about media in general, porn literacy denotes knowledge about porn production (Dawson et al., 2019). Porn literacy is the awareness of the goals of sexually explicit media, sensitizes viewers to how bodies, sexual behaviors, and gender roles are represented in pornography and identifies illusions (Albury, 2014). A porn literate consumer is aware that, actors stage pain and pleasure, and movies are heavily edited to construct a flawless final product. However, adults lack media literacy skills, especially concerning online content and concerning hybrid genres that blur the line between reality and fiction (Livingstone et al., 2005; Rasi et al., 2019) as in the case of professional "amateur" porn.

Media literacy interventions can successfully increase knowledge and decrease perceived media realism as well as undesired attitudinal outcomes of different kinds of media (Jeong et al., 2012). Concerning sexuality, media literacy training at school was effective in increasing knowledge about pornography (Aznar-Martínez et al., 2024) and awareness of inaccurate representations of sex (Pinkleton et al., 2012; Pinkleton et al., 2013). Self-perceived porn literacy education at school is associated with lower self-reported objectification of women (Vandenbosch & van Oosten, 2018).

To our knowledge, only one porn literacy intervention has been empirically evaluated (Rothman et al., 2018). A five-session porn literacy curriculum for adolescents of 17 and 18 years covered the issues of sexual risks (sexually transmitted diseases, unwanted pregnancy, coercion) and risks associated with pornography (stigma, compulsive use, the legal situation for minors, non-consensual dissemination). This porn literacy training effectively increased knowledge and decreased perceived realism of pornography: At posttest, participants were able to recognize (in closed-ended questions) true facts and normative attitudes better than at pretest. The curriculum also changed attitudinal outcomes by making participants more negative about violent, sexist, and racist representations.

However, the results of Rothman et al. (2018) only show that participants can reproduce the knowledge and skepticism taught during the course. Whether porn consumers retrieve the acquired porn literacy skills, apply them in the relevant context of pornography exposure, and if porn literacy then decreases undesired attitudinal effects of pornography remains unanswered. Porn literacy knowledge might be reproduced in a school-like environment as in Rothman et al. (2018). Yet, conceptual media literacy knowledge is not always applied in the relevant situation, especially if that context is primarily affect-based (Rozendaal et al., 2011) and if the motivation or need for cognition is low (Xiao et al., 2021). Therefore, we designed an intuitive intervention video conveying the impression that pornography is effortfully constructed. According to media literacy theory (Primack et al., 2006), this awareness decreases a range of undesired outcomes. In line with that, we tested whether the intuitive porn literacy intervention (compared to an active control group) decreases undesired outcomes in an affect-based situation.

3. Perceived porn realism

According to Primack et al. (2006), an understanding of media literacy (e.g., media images filter reality) decreases viewers' susceptibility to media messages and thereby protects viewers against adverse effects of pornography. One of media literacy interventions' most important working mechanisms is perceived realism. McLean et al. (2016b) concluded that out of several media literacy constructs, the concept of perceived realism has the most consistent effects on undesired media outcomes.

Correlational (Li et al., 2023) and longitudinal studies (Peter & Valkenburg, 2010) confirm the importance of perceived realism. In a longitudinal survey of Dutch adolescents, the effect of porn on undesired attitudes was mediated by perceived realism. If porn was not deemed realistic and useful, it did not affect self-reported attitudes about sex (Peter & Valkenburg, 2010). The effect of pornography consumption on condomless sex also depends on perceived realism (Wright et al., 2022). Thus, a porn literacy intervention showing how porn is produced, and images are edited should decrease perceived realism and in turn, decrease adverse attitudinal outcomes associated with pornography. While perceived realism is theorized to be a moderator or mediator, we investigated the main effects of condition on all outcomes independently to keep the design simple.

4. Explicit attitudes

Researchers have found that watching sexual media influences young people's attitudes (Peter & Valkenburg, 2016). Priming effects have been found after only a single exposure to a small prime and researchers have found not only immediate effects on attitudes but also persisting until months later (Carter et al., 2011). While different theories on media effects assume stronger effects after repeated exposure, even short media primes can activate schemas after only a single exposure (e.g., Hald & Malamuth, 2015; Hansen & Krygowski, 1994). The present study focuses on three explicit attitudes that have been associated with watching porn: body dissatisfaction, sexist attitudes, and dismissive attitudes toward condom use.

Mainstream porn typically features a narrow range of bodies, namely muscular men and thin, large-breasted women (Byrd-Bredbenner et al., 2005; Rousseau et al., 2017). Viewers describe (Löfgren-Mårtenson & Månsson, 2010) and quantitative research confirms that exposure to idealized bodies in porn results in constant monitoring and evaluation of one's own body relative to media ideals (Vandenbosch & Eggermont, 2015), which in turn results in body dissatisfaction (Botta, 1999; Peter & Valkenburg, 2014). A review of 21 studies (three of which longitudinal) concluded that, in women and men, watching pornography is associated with body dissatisfaction (Paslakis et al., 2022). Porn consumption is related to body comparisons and self-objectification even over and above demographic covariates and social media use (Maheux et al., 2021). While experiments on effects of porn on body dissatisfaction are lacking, exposure to advertising led to body dissatisfaction one week later – for those with low media literacy skills (McLean et al., 2016a). By decreasing perceived media realism, one could interrupt the comparison with media images (Irving & Berel, 2001).

Sexism has historically been and still is one of the major concerns with mainstream pornography (Dworkin, 1989; Fritz & Paul, 2017). Mainstream porn portrays men as sexually dominant and women as submissive sex objects, who are indiscriminately available for (or actively initiating) the pleasure of men (Kanuga & Rosenfeld, 2004; Klaassen & Peter, 2015) as well as the targets of name-calling, slapping, and spanking (Carrotte et al., 2020; Klaassen & Peter, 2015; Miller & McBain, 2022). Such portrayals in pornography are longitudinally associated with sexist attitudes in both men and women (Allen et al., 1995; Brown & L'Engle, 2009; Peter & Valkenburg, 2007; Peter & Valkenburg, 2016; Rodenhizer & Edwards, 2017). Meta-analyses concluded that the consumption of sexually explicit content can be associated with endorsement of sexist attitudes, particularly objectified views of women (Hald et al., 2010; Mestre-Bach et al., 2024). A single exposure to 25–30 minutes of porn in an experimental context can activate sexist attitudes in women and some men (Hald & Malamuth, 2015; Hald et al., 2013). A porn literacy intervention could be a reminder that how genders are represented in porn is not how they are or should be.

Only 2–3% of heterosexual online pornography includes condom use during penile-vaginal intercourse and only 10% during penile-anal intercourse (Carrotte et al., 2020; Miller & McBain, 2022; Vannier et al., 2014). Therefore, mainstream pornography has been criticized for eroticizing and normalizing unprotected sex with multiple partners. A meta-analysis of 45 studies showed that watching porn featuring condomless sex was related to reporting condomless sex (Tokunaga et al., 2020). Specifically, there is correlational (Harkness et al., 2015; Li et al., 2023), longitudinal (Peter & Valkenburg, 2011), and experimental (Jonas et al., 2014) evidence linking pornography to adults' decreased condom use intentions and behaviors. A video on porn production emphasizes that porn represents an unrealistic fantasy and could thereby decrease negative attitudes toward condoms.

5. Implicit attitudes

If pornography is perceived to be realistic, viewers explicitly use it as a source of sexual information and are prone to adopt promoted attitudes (Peter & Valkenburg, 2010). However, pornography not only influences viewers via explicit learning. Viewers also learn implicitly when they lean back and automatically process entertainment media without cognitive elaboration on the content (Petty & Cacioppo, 1986). Pornography provides the rare occasion to watch other people have sex and observe what they are rewarded and punished for (Sun et al., 2016). This form of implicit observational learning often happens without conscious learning intention or awareness and can only be detected by measuring implicit memory and attitude (Bandura, 2009).

Implicit processes guide behavior in situations of high subjectivity and discretion (Hart, 2005; Heilman & Haynes, 2008). Condom use is arguably a context of high subjectivity and discretion. Accordingly, implicit attitudes are more predictive of condom use with casual partners than explicit attitudes (Marsh et al., 2001). Research has demonstrated the relevance of the implicit attitude toward condom use (Czopp et al., 2004; Sakaluk & Gillath, 2016). Two major themes influencing

the attitude toward condom use are pleasure and safety (Khan et al., 2005; Telles Dias et al., 2006). Therefore, we developed two Implicit Association Tests (Greenwald et al., 1998) measuring the strength of implicit associations of condom use with the two relevant dimensions of pleasure and safety. Implicit learning effects have been demonstrated in the case of pornography (Snagowski et al., 2015). However, we lack research demonstrating sexist or condomless representations in mainstream porn inform viewers' implicit sexist attitudes and attitudes toward condom use. An intuitive porn literacy intervention could make porn seem an unreliable source of information and socialization, and thereby decrease sexist attitudes after porn consumption.

6. Moderators of effectiveness

Interventions usually yield the greatest effects in high-risk individuals (Stice & Shaw, 2004), which has been replicated in the case of media literacy interventions (Coughlin & Kalodner, 2006; Primack et al., 2014). Two characteristics that make viewers especially susceptible to pornography's undesired effects are low levels of sexual experience and high amount of porn use. Different theories on media effects (Bandura, 2009; Wright, 2011) agree that media effects depend on real-life experience with the target behavior (sexual experience) and amount of media use (porn use).

Young people use both real-life interactions and media as source of observational learning (Bandura, 2009). However, people with no firsthand sexual experience only have one source of information to turn to. Especially young people with low sexual experience level (and inexperienced peer group) report pornography use as an information source (Brown et al., 2005; Löfgren-Mårtenson & Månsson, 2010; Peter & Valkenburg, 2006). The lack of counterbalancing real-life experiences makes sexually inexperienced individuals especially susceptible to distorted messages of pornography (Hunter et al., 2010).

Another risk factor are high levels of porn use. Sexual media has the strongest influence on those who consume the most (Collins et al., 2004) because repetitive exposure to the same media over time unconsciously results in positive affect, normalization, and reinforced schemas (Zajonc, 2001). Thus, experimental primes have stronger effects (activate acquired schemas more easily) on those with more porn experience. For example, experimental effects of porn exposure on perceived realism are stronger in those consuming more of this pornography type (Miller et al., 2019). Also, experimental effects of porn exposure on condom use are stronger in those who started watching porn at an earlier age (Perry et al., 2019). Since high-risk individuals also profit most from media literacy interventions (Coughlin & Kalodner, 2006; Primack et al., 2014), we expected the intervention to work best in those with low sexual experience and high prior porn use.

7. The present study

Theoretically, media literacy is the knowledge and awareness that (and how) media is constructed. According to media literacy theory (Potter, 2013; Primack et al., 2006), this awareness should shield against undesired media effects. To test this,

we designed a visual pornography literacy intervention in form of a short video that can be processed under low elaboration. The goal of the intervention was to leave the impression that porn is effortfully constructed. For that purpose, the video showed differences between porn representation and reality. For example, it visually showed how bodies can transform through make-up and image editing. The techniques shown may not be used in every porn video, but the intervention video suggests that media images could be edited. The video also included porn performers telling anecdotes about aspects not visible in the final product (precautions and accidents)

The intervention did not address any potential porn effects. In the video, there was no mention of body dissatisfaction as a result of watching porn and no arguments against sexist attitudes or to increase condom use. The intervention merely emphasizes that (and how) pornography is effortfully constructed. As a generic porn literacy intervention, a range of diverse outcomes could be tested. This is unspecific since it tests the prevailing idea that porn literacy may be an unspecific remedy against all kinds of undesired attitudinal outcomes (for criticism see Smith, 2021).

Earlier research demonstrated that short video media literacy interventions were as effective as a combination of video and group discussion (Irving & Berel, 2001). In contrast to interventions intending to change media perception (e.g., Halliwell et al., 2011), the present intervention was delivered *after* pornographic stimuli, when viewers were expected to use porn literacy skills. The reason is a principle from learning psychology, namely *encoding specificity* (Tulving & Thomson, 1973): Retrieval of learned information is most likely in the context in which learning happened. The context consists of external (e.g., environment, media stimuli) and internal (e.g., mood, sexual arousal) cues. Cognitive psychologists have shown that information learned while, for example, intoxicated is best recalled when in the same state (Wang et al., 2023). It follows that one should deliver information in the very (e.g., aroused) state in which that information is expected to be retrieved.

Extending the findings of Rothman et al. (2018) to an aroused context, in which porn literacy is expected to be performed, we arrived at the following hypotheses:

> *H1a: The porn literacy intervention will decrease perceived realism.*
>
> *H2–4a: The porn literacy intervention will decrease undesired explicit attitudes, namely body dissatisfaction (H2a), sexist attitudes (H3a) and negative attitudes toward condom use (H4a).*
>
> *H5–7a: The porn literacy intervention will decrease implicit sexist attitudes (H5a), the implicit negative association of condom use with pleasure (H6a), and will increase the implicit association of condom use with safety (H7a).*

We expected the effect of the intervention to depend on two viewer characteristics:

> *H1–7b: Sexual experience will moderate the effect of the intervention on perceived realism (H1b) as well as on explicit (H2–4b) and implicit outcomes (H5–7b).*

H1–7c: Prior porn use will moderate the effect of the intervention on perceived realism (H1c) as well as on explicit (H2–4c) and implicit attitudes (H5–7c).

8. Method

The hypotheses and methods were preregistered a priori at AsPredicted.com (#23397; https://aspredicted.org/kgm7-mmc6.pdf) and approved by Radboud University's Social Sciences Ethics Committee (ref.no: ECSS-2017-0210-53). We preregistered and collected data from a third moderator, physiological arousal (operationalized via pupil dilation), which is left out here. Eye tracking data is freely available for analysis (https://osf.io/2pk5e/).

8.1 Design

The study used a pretest-posttest randomized controlled trial design with two parallel groups. Participants were randomly allocated to the intervention (porn literacy video, $n = 41$) or active control condition (matched control video, $n = 39$).

8.2 Participants

Participants were recruited via Radboud University's subject pool, flyers (see online appendix), personal approach, and snowball sampling in 2019. The flyer stated that the study was about sexuality, included watching 15 minutes of sexually explicit pornography and that all levels of sexual experience and porn use were recruited.[1] Participation was rewarded with a voucher of €7.50 or one participation point.

The pretest was completed by 215 people, and 81 participants took part in the posttest. Additional pretest data is available online for analysis. After excluding a participant outside the target age group, the final sample consisted of 80 students from 18 to 33 years ($M = 23.41$, $SD = 3.74$). This age range was chosen because most visitors to the biggest Internet pornography site are under 34 (Pornhub Insights, 2020). There were 48 female (60%) and 32 male participants (40%). 60 participants were heterosexual, 11 bisexual and five homosexual.

Sensitivity analysis using G*Power Software 3.1 (Faul et al., 2007) for linear multiple regression with three predictors (condition, sexual experience, and prior porn use) revealed that with 80 participants, we were able to find a medium effect of $f^2 = .10$ (with a power level of 0.80, alpha-level of 0.05, two-tailed testing). However, including individual pretest assessments increases power in RCTs with small samples (Venter et al., 2002).

1 Sampling the entire spectrum of porn use was necessary because (1) we did not know at which levels effects could be expected, (2) because effects may only exist in medium porn users, and (3) because a continuous variable yields more power than comparing only extreme ends (low vs. high porn use). In addition, there is no conventional threshold where to split into high and low use.

8.3 Procedure

Participants did the pretest questionnaire at home, available online at the survey platform Qualtrics. After giving informed consent, participants completed questionnaires on explicit attitudes toward body dissatisfaction, sexism and condom use. Sexism came last, to not prime participants with their own gender before answering body dissatisfaction and condom use attitude. Perceived realism of pornography was not measured at pretest as this could have sensitized participants to the purpose of the study (measuring diverse attitudes with no direct relation to pornography did not carry such risk). At the end of the questionnaire, participants were asked to download Inquisit Web to complete Implicit Association Tests on implicit sexism and implicit attitudes toward condom use. Implicit attitudes were measured after explicit attitudes because the pictures used in the Implicit Association Test for condom use could work similarly to the intervention and decrease male participants' body dissatisfaction.

On completion, participants were automatically guided to Radboud University's online subject pool, to make an appointment for the posttest. To minimize pretest sensitization (i.e., drawing attention to concepts like sexism before watching pornography), participants were asked to make an appointment within a week after pretest. Data was solely linked using an anonymous generated ID (first two digits of birthday and last four digits of mobile phone number); no identifying information was obtained.

In the lab, participants watched 15 minutes of pornography on their own, followed by three minutes of either interventional or control video. Participants needed to view porn before receiving the intervention to increase ecological validity: We wanted participants to be in a similar psychological (e.g., aroused) state as when viewing porn at home since this is when porn literacy should be applied. Delivering an intervention in the very context in which that skill or information is expected to be retrieved increases ease of retrieval and ecological validity. We actively showed pornography so that we could ensure there were no group differences in genre or length.

Subsequently, the dependent measures were assessed. The perceived realism measure was assessed after the other dependent variables to avoid making participants aware of the gap between representation and reality, especially in the control condition. Sexual experience, prior porn use, gender, sexual orientation, and age were assessed later to not prime participants with their own characteristics. The last questionnaire was the manipulation check. For ethical reasons, the control group could choose to also watch the intervention video. The entire experiment took 45 minutes.

8.4 Materials

8.4.1 Porn literacy intervention

After watching porn stimuli (see online appendix https://osf.io/2pk5e/), participants were randomly assigned to either a porn literacy intervention or control condition. For the intervention condition, we designed a short video in line with the media literacy framework by Primack et al. (2006) and a focus group study on what porn

literacy education should entail (Dawson et al., 2019). To be appropriate, an intervention should be short and intuitively understandable (rather than overly informative). To safeguard ecological validity, we created an intuitive and visual intervention and delivered it in an aroused state.

Fitting video material was selected from YouTube by the first author and reviewed by the second author, who is an expert in young people's media use. A professional film editor cut the video. Following the finding that interventions are most effective when delivered by experts (Durantini et al., 2006), the intervention consisted of professional porn performers, producers, and sexologists providing information about porn production. A male porn performer explained that porn is a multi-billion-dollar industry with ad-funded tube sites, most porn is produced by men and for the male gaze and women are the product. Female porn performers differentiated their performance in porn from their private sex lives. Make-up and editing techniques were shown to construct a sexy female and male body. To challenge the view of flawless sex and bodies, three quotes of accidents on the porn set and one of consent negotiations were included. A producer explained why there were no condoms in porn. The intervention video conveys the message that pornography is effortfully constructed without addressing potential effects of pornography (e.g., no mention of [pornography-related] body dissatisfaction).

8.4.2 Matched control video

In the control condition, participants saw a matched control video with the same number of scene changes and equal pace as the intervention video. While other researchers have compared videos featuring porn performers to non-human nature videos (Gleason & Sprankle, 2019; Hald et al., 2013), we created a video featuring humans and selected bodies similar to porn stars, namely rappers Nicki Minaj and Cardi B. The intervention and control video can be found online (https://osf.io/2pk5e/).

8.4.3 Manipulation check

To test if participants perceived the videos to be different according to the manipulation (porn literacy), we asked all participants to rate the video they had seen (intervention or control) at the very end of the study. Since there are no items for porn literacy, we formulated three items based on media literacy theory (Primack et al., 2006): The introduction read: "You have seen one video that was not sexually explicit. What was it about? (Note that this question is not about your opinion on porn but about the message of the video)". Participants rated three items (Cronbach's alpha = .70) on a 4-point scale: "The video emphasized that porn videos filter reality," "The video emphasized that porn videos omit (leave out) information" and "Overall, the video promoted critical thinking about pornography." Participants considered the intervention video (M = 2.57, SD = 0.72) to promote porn literacy more strongly than the control video (M = 1.96, SD = 0.88), $t(78)$= -3.42, p = .001. Thus, the two videos differed according to the manipulation.

8.5 Measures

8.5.1 Dependent variables

Perceived realism was measured by the Perceived Social Realism Scale (Peter & Valkenburg, 2010), consisting of four realism and three utility items: Seven items, such as "Sex on the Internet is realistic" and "By watching sex on the internet you can learn things you wouldn't learn otherwise." were rated on a 4-point Likert-scale from 1 = *fully disagree* to 5 = *fully agree* (M = 1.86, SD = 0.54). Cronbach's alpha was .75.

Body dissatisfaction was assessed through the non-verbal contour drawing rating scale (Thompson & Gray, 1995). Female participants rated female figures, indicating their actual and ideal body figure, male participants rated male bodies. Participants' actual body figure (M = 5.31, SD = 1.63) was bigger than their ideal body figure (M = 4.56, SD = 1.37). The difference between actual and ideal body figure was calculated and labeled dissatisfaction. Body dissatisfaction at pretest (M = 0.75, SD = 1.17) did not differ from posttest (M = 0.68, SD = 1.14, $t(79) = 1$, p = .320).

Explicit sexist attitudes were measured through the revised Attitudes Toward Dating and Relationship Measure by Ward (2002). The two relevant subscales contain statements about women as sex objects (eight items, e.g., "Women should be more concerned about their appearance than men.") and statements about men as sex-driven creatures (seven items, e.g., "Men are always ready and willing for sex; they think about it all the time.") rated on a 6-point scale from 1 = *strongly disagree* to 6 = *strongly agree*. Internal consistency was excellent (Cronbach's -alphapre = 0.86; Cronbach's alpha(posttest) = 0.89); hence, we combined both subscales to measure sexist attitudes. At pretest, sexist attitudes were higher (M = 2.68, SD = 0.82) than at posttest (M = 2.58, SD = 0.90, $t(79) = 2.27$, p = .026).

Explicit attitude toward condom use was assessed in a questionnaire based on the Bipolar Attitudes toward Consistent Condom Use Scale (Sakaluk & Gillath, 2016). Participants were asked to indicate on a 7-point semantic differential, how they would feel about if they (their partner) used a condom *every time* they had penile-vaginal intercourse in the next three months. We used ten adjective pairs of the dimension pleasure (e.g., pleasurable/painful, comfortable/uncomfortable, calming/distracting, erotic/dull, delicious/nasty, easy/awkward) and ten of the dimension safety (responsible/reckless, protected/unprotected, safe/dangerous, healthy/unhealthy). After combining the pleasure and safety subscales, internal consistency was excellent (Cronbach's alpha(pretest) = .83; Cronbach's alpha(posttest) = .88).

Higher scores indicated a more dismissive attitude. A low score (M = 2.81, SD = 0.89) indicated consistent use was evaluated as pleasurable and safe. Following, participants rated the same adjectives again, answering how they would feel if they (their partner) *never* used a condom for penile-vaginal intercourse in the next three months. A relatively high score (M = 4.52, SD = 1.20) indicated that consistent non-use was rated as unpleasurable and dangerous. From the attitude toward consistent non-use, we subtracted the attitude toward consistent use. Higher scores indicated a dismissive attitude toward condoms. At pretest, participants evaluated condoms similarly (M = 1.64, SD = 1.70) than at posttest (M = 1.78, SD = 1.97, $t(79) = -1.25$, p = .216).

Implicit attitudes were assessed using three self-generated Implicit Association Tests (Greenwald et al., 1998). That is, we created an IAT for implicit sexist attitudes, for implicit condom pleasure attitude, and implicit condom safety attitude. More information can be found online, and the IATs are freely available for reuse (https://osf.io/2pk5e/).

8.5.2 Moderator variables

Sexual experience was operationalized by one item, the number of lifetime sex partners, from the Youth Risk Behavior Survey (Kann et al., 2018). Initially, we had planned to form an index out of three items, but internal consistency was unacceptable (Cronbach's alpha = .44).[2] We selected the number of lifetime sex partners as a variety of partners allows one to encounter a diverse range of bodies and sexual behaviors. For analysis, absolute numbers were transformed into 15 ordinal groups (for explanations, see appendix https://osf.io/2pk5e/). Up to ten lifetime sex partners, original numbers were used, and from ten upward, absolute numbers were summarized into five groups (10–15/16–25/26–50/51–100/>100). The variable was then centered and scaled.

Prior porn use was measured using four self-report items developed by Kraus and Rosenberg (2016). We used items investigating (1) the age at which participants first saw pornography, (2) the age at which they first masturbated to porn, (3) how often they had masturbated to porn in their life, and (4) how often in a typical week. The two age items were open-ended questions, answers to these two items were subtracted from participants' current age to calculate years of viewing and masturbating to porn. The two frequency items were rated on a 5-point scale (never/1–2/3–5/6–10/11+ times). Items about addiction or getting help were excluded as this study did not take a pathologizing stance. Internal consistency was good (Cronbach's alpha = .71). To account for different units, the index was standardized.

8.6 Data analysis

Seven separate hierarchical linear multiple regressions were carried out to test the hypotheses, one for each dependent variable. Regression analyses were conducted using the lm function from the package stats (R Core Team, 2018). Outliers at ± 2.5 *SD* from the mean were winsorized using the Winsorize-function from the package DescTools (Signorell, 2016). We initially had preregistered that we would delete all outliers but later found this unnecessarily strict. More information, as well as the data and analysis script for the self-report measures can be found online (https://osf.io/2pk5e/).

2 The unused items were the questions (1) at what age have participants had sex for the first time and (2) how many sex partners they have had in the past three months.

9. Results[3]

9.1 Perceived porn realism

Table 1 (Appendix) displays the results of the intervention effect and moderators on perceived realism. There was no significant difference between the porn literacy intervention condition and the control condition, b = -.01, se = .05, p = .817, indicating that the intervention did not decrease perceived realism of pornography. Therefore, H1a was not supported. In the second step, neither the interaction between the intervention and sexual experience, b = .00, se = .06, p = .933, nor between the intervention and prior porn use was significant, b = -.03, se = .06, p = .611, so H1b and H1c were not supported. The covariate age was negatively related to perceived realism, b = -.04, se = .02, p = .048, indicating that older participants perceived pornography to be less realistic than younger participants.

9.2 Explicit attitudes

The results of the intervention and moderators on body dissatisfaction can be found in Table 1 (Appendix). The intervention did not influence body dissatisfaction, b = -.03, se = .06, p = .643, so H2a was not supported. In the second step, neither the interaction between the intervention and sexual experience, b = -.05, se = .07, p = .507, nor between the intervention and prior porn use was significant, b = .05, se = .07, p = .497, so there was no support for H2b and H2c.

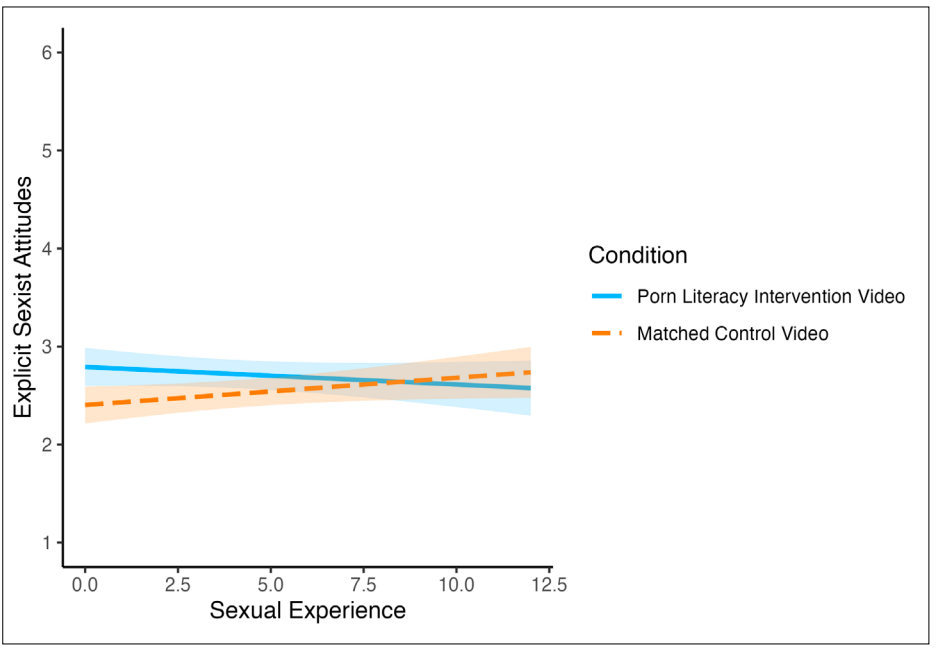
Table 2 (Appendix) displays the results of the intervention effect and moderators on explicit sexist attitudes. While in the first step, the effect of the intervention on explicit sexist attitudes was non-significant (or marginally significant), b = .06, se = .04, p = .092, the main effect of the intervention became significant in the second step, b = .09, se = .04, p = .025, supporting H3a. Controlling for sexist attitudes at pretest, self-reported sexist attitudes were lower in the intervention group than in the control group. This effect was qualified by a moderation: In support of H3b, the interaction between the intervention and sexual experience was significant, b = -.09, se = .04, p = .034. The intervention effectively decreased sexist attitudes among participants with relatively low sexual experience (see Figure 1). Furthermore, the interaction between the intervention and prior porn use was significant, b = .10, se = .04, p = .016 (Hypothesis 3c). Contrary to expectations, however, the intervention was more effective in decreasing sexist attitudes among participants with relatively low levels of experience with pornography (see Figure 2). No variance inflation factors were higher than 1.5, so none exceeded the critical threshold of 2.5, 5 or 10 (O'Brien, 2007), indicating that predictors contributed uniquely and coefficients were not inflated due to multicollinearity.

Specifying the interaction, the unstandardized simple slope for individuals with low levels of sexual experience was .17 (se = .06, p = .003). The unstandardized simple slope for moderate sexual experience was smaller, but significant (b = .08, se = .04, p = .026). This indicates that the intervention significantly decreased ex-

3 All results can be found in the online appendix: https://osf.io/2pk5e/.

plicit sexist attitudes in individuals with low and moderate levels of sexual experience. The slope for individuals with high sexual experience was non-significant (b = -0.10, se = .06, p = .868). Johnson-Neyman regions of significance specified a lower bound of 4.4, which means that the intervention was effective in individuals with up to four sex partners. This supported the hypothesis that the porn literacy intervention decreases explicit sexist attitudes in people with no or low levels of sexual experience (H3b).

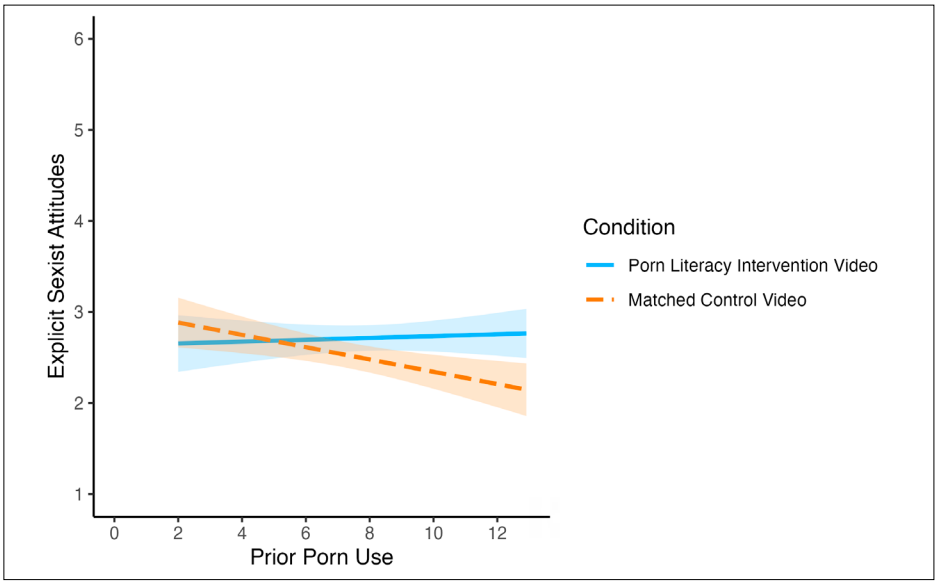
Figure 1. Explicit sexist attitudes predicted by sexual experience



Note. Fitted regression lines represent the two conditions (porn literacy intervention and control).

To specify the interaction of the porn literacy intervention and prior porn use, simple slopes were calculated at low, mean and high levels of prior porn use. Simple slopes for low levels of prior porn use were not significant (b = -0.09, se = .06, p = .156). The unstandardized simple slope for mean (b = 0.19, se = .06, p = .003) and high (b = 0.30, se = .09, p = .001) prior porn use was significant, indicating that the intervention increased explicit sexist attitudes in individuals with mean and high prior porn use. The intervention had this adverse effect in individuals with little more than mean prior porn use.

Figure 2. Explicit sexist attitudes predicted by prior porn use



Note. Fitted regression lines represent the two conditions (porn literacy intervention and control).

Table 2 (Appendix) displays the results of the intervention and moderators on explicit attitude toward condom use. There was no significant effect of the porn literacy intervention on explicit condom use attitude (b = -.04, se = .10, p = .662) and, therefore no support for H4a. In the second step, there was no interaction of the intervention with sexual experience, b = .16, se = .12, p = .192, or prior porn use, b = -.12, se = .12, p = .343. Therefore, H4b and H4c were not supported.

9.3 Implicit attitudes

The results of the intervention and moderators on body dissatisfaction can be found in Table 3 (Appendix). There was no significant effect of the porn literacy intervention on implicit sexist attitudes, b = .00, se = .04, p = .965 and H5a was not supported. The control variable gender was significant, b = .12, se = .04, p = .003, in the way that men, on average, displayed more implicit sexism than women. In step two, there was neither an interaction effect of the intervention together with sexual experience, b = 0.00, se = .01, p = .784, nor together with prior porn use, b = -.02, se = .05, p = .715, on implicit sexist attitudes. Hence, H5b and H5c were not supported.

Table 4 (Appendix) displays the results of the intervention and moderators on implicit association of condom use with pleasure. There was no significant effect of the intervention on the implicit association of condom use with pleasure, b = .05, se = .04, p = .192. Participants in the porn literacy intervention condition associated condom use as much with pleasure (or discomfort) as participants in

the control condition; thus, there was no support for H6a. In the second step, there was no interaction of the intervention with sexual experience, b = -.04, se = .04, p = .321, nor with prior porn use, b = -.01, se = .07, p = .877, so H6b and H6c were not supported.

The results of the intervention and moderators on the implicit association of condom use with safety can be found in Table 4 (Appendix). The intervention had no significant effect on the implicit association of condom use with safety, b = .03, se = .05, p = .517, so H7a was not supported. In the second step, there was no significant interaction effect of the intervention with sexual experience, b = .00, se = .01, p = .786, or with prior porn use, b = .00, se = .07, p = .168, thus, H7b and H7c were not supported. Exploratively, we found that prior porn use had a marginally significant positive main effect on the implicit association of condom use with safety, b = .13, se = .07, p = .055. So, those who reported more pornography use displayed stronger implicit association of condom use with safety.

10. Discussion

The present study aimed to test if a porn literacy intervention could decrease perceived porn realism as well as undesired explicit and implicit attitudes, as proposed by media literacy theory (Primack et al., 2006). We designed a porn literacy intervention in form of a short video, delivered it after exposure to pornography, and measured explicit and implicit attitudinal outcomes. We expected the intervention to be most effective in decreasing perceived porn realism and undesired attitudinal outcomes in viewers with low levels of firsthand sexual experience and with heavy prior porn use.

10.1 Perceived porn realism

The porn literacy intervention did not decrease perceived porn realism: Participants receiving the intervention rated pornography as equally realistic and useful as the control group. This was in contrast to previous findings: A porn literacy intervention by Rothman et al. (2018) effectively decreased participants perceived realism. Several explanations are possible. We delivered our intervention immediately after exposure to pornography as this is the relevant context viewers are expected to perform porn literacy skills. We designed the intervention to be processed in a context of high arousal and low elaboration. One reason why the intervention did not decrease perceived realism of pornography might be the affect-based state, in which viewers are unlikely to apply media literacy skills and activate critical defense mechanisms (Rozendaal et al., 2011).

In addition, the form of the porn literacy intervention delivered in this study differed substantially from the successful porn literacy training by Rothman and colleagues (e.g., duration: three minutes versus five two hours sessions). The video format was chosen based on research demonstrating short video interventions decrease perceived realism of advertising as effectively as a combination of video and discussion sessions (Irving & Berel, 2001). The non-significant results of this study imply that this may not be not true for porn literacy: It may take more time

to decrease perceived realism of pornography, and video interventions may not be effective. For general media literacy, longer interventions with multiple sessions are usually more effective (Bergsma & Carney, 2008; Jeong et al., 2012). Future comparative research for porn literacy must determine the most appropriate length and form of intervention as well as the most effective moment and state of delivery. These would be experiments contrasting different interventions with each other and different levels of participant arousal. Apart from an immediate assessment of outcomes, future experiments should include delayed follow-up measures to investigate when literacy effects happen and how long they last. However, before testing all questions surrounding the effect of literacy interventions, researchers should first test those questions for the effects of porn itself.

This study not replicating the effect of porn literacy training on perceived porn realism by Rothman et al. (2018) might also be due to other differences between the studies. Methodologically, our study used an experimental design with two groups, while Rothman and colleagues had no control group and compared pre-intervention to post-intervention answers in a group of 24 students. Furthermore, we used a video, while Rothman et al. (2018) used teacher-led discussion sessions prone to demand characteristics, that is, participants sensing the intervention goal and answering accordingly. Future experimental research must clarify if the effect of porn literacy training on perceived realism can be replicated when participants are unaware of the intervention goal. Lastly, older participants within our age range (18–33 years) found pornography a less realistic depiction of sex than younger participants.

10.2 Explicit attitudes

We further investigated if the intervention decreased undesired attitudinal outcomes of pornography. The intervention did not decrease participants' body dissatisfaction (H2a) or their negative explicit attitude toward condom use (H4a). The aforementioned reasons, length, and video form of the intervention could explain why this porn literacy intervention did not decrease body dissatisfaction, while other media literacy interventions did (Xie et al., 2019). It could be that media literacy does not affect attitudes toward one's body or condom use; that is, explicitly knowing that porn is effortfully created does not lessen explicit learning from porn.

Concerning explicit sexist attitudes, we found interesting effects: Across conditions, sexist attitudes were higher at pretest (M = 2.68, SD = 0.82) than at posttest after exposure to porn stimuli and intervention or control video (M = 2.58, SD = 0.90). This stands in contrast to prior experiments finding increased sexist attitudes after exposure to 25–30 minutes of porn (Hald & Malamuth, 2015; Hald et al., 2013). An explanation for our sample of 60% women could be that sexist content has been shown to decrease women's gender stereotypes by inducing an increased accuracy orientation (Ramos et al., 2016). As this effect was not hypothesized, future research should focus on the effect of porn on sexist attitudes.

When testing the hypothesized effect of the condition, we found that watching the intervention video decreased explicit sexist attitudes compared to the matched control video after watching pornography. However, this effect was qualified by

an interaction between intervention and sexual experience: As expected, the effect of the intervention on explicit sexist attitudes was significant in those with few sex partners but did not decrease sexism in those with moderate or high numbers of sex partners. This indicates that porn literacy is effective in those with little firsthand sexual experience to counterbalance the images provided by pornography (H3b). This is in line with findings from Coughlin and Kalodner (2006) and Primack et al. (2014) and the notion that interventions work best in high-risk individuals, namely, individuals with low levels of firsthand sexual experience.

However, contrary to expectations, we found that in individuals with mean or high levels of prior pornography use, the intervention *increased* explicit sexism. An explanation for a porn literacy intervention increasing sexist attitudes in certain people may be found in studies on smoking media literacy. Comparable to the promotion of smoking in mainstream movies and advertising, pornography eroticizes sexist gender roles. Studies on smoking media literacy have established that, apart from increasing knowledge and awareness, media literacy interventions can also increase desirability and positive affect toward a portrayed smoking message (Austin et al., 2007). Likewise, the present intervention could have increased desirability of sexist gender roles, especially in individuals consuming sexist pornography. Regular porn consumers may have perceived the intervention as patronizing and therefore responded with reactance. We conclude that the porn literacy intervention decreased explicit sexist attitudes in individuals with low levels of sexual experience and increased explicit sexist attitudes in individuals with mean or high levels of prior pornography use. The mechanisms should be clarified by future studies.

Regarding explicit attitude toward condom use, we found no differences between experimental and control group: The intervention did not influence how participants evaluated condoms, this might be due to the idea that porn is effortfully constructed being too abstract and unspecific to influence specific attitudes like the attitude toward condoms. Media literacy may not be an unspecific remedy against all attitudinal outcomes (for criticism see Smith, 2021). Interestingly, however, descriptive results showed that exposure to 15 minutes of pornography (and intervention or control video) also had not influenced how participants evaluate condoms. So, descriptive results did not show any assumed porn effects regarding body dissatisfaction, sexist attitudes, and attitude toward condom use. In the present study, we only tested the intervention. Yet, future research should scrutinize commonly assumed effects of pornography and test an interaction of porn stimuli with an intervention (or control).

10.3 Implicit attitudes

Concerning implicit attitudes, we expected the porn literacy intervention to decrease implicit sexist attitudes and negative implicit attitudes toward condom use, its pleasure and safety, respectively. Although the porn literacy intervention effectively decreased explicit sexist attitudes, implicit sexist attitudes were not influenced by the intervention. Although the intervention was intended to be processed in an affect-based context of low elaboration, it could not influence implicit sexist atti-

tudes. Only the control variable gender predicted implicit sexist attitudes in the way that men displayed stronger gender-stereotypical associations than women.

There was no evidence for an effect of the intervention on the implicit association of condom use with safety (H7a). Rather high scores on both pretest and posttest suggest a ceiling effect. People probably agree on the safety of condoms, but the reason they have unprotected sex with multiple partners is because of factors like pleasure (Oncale & King, 2001). When trying to capture the attitude toward condom use, it is useful to distinguish between the affective dimension of pleasure and the rational dimension of safety. This distinction could have implications for promoting condom use. Rather than advertising with rational, utilitarian arguments, it may be effective to eroticize condoms. Hedonic and sensory appeals have been effective in promoting healthy foods (Samson & Buijzen, 2019). Future interventions could promote condoms using hedonic and sensory appeals.

10.4 Limitations and suggestions for future research

Theoretically, media literacy theory broadly claims literacy training decreases the effects of media on a range of outcomes (i.e., cognitions, attitudes, behaviors). For the present experiment, we chose porn realism and attitudinal outcomes most associated with pornography, but future research could test any other cognitive, attitudinal, or behavioral outcome. Furthermore, with our experimental design, we could test causal effects (and moderators). Yet, potential working mechanisms behind media literacy training should be clarified by experiments manipulating mediators (e.g., cognitive defense mechanisms) or (longitudinal) surveys. Conceptually, we must keep in mind that how realistic pornography is as compared to reality is not only a result of media literacy skills but also depends on individual realities. Media is not just an (in)accurate representation of reality, it also shapes people's realities. Therefore, future research should account for individual realities (statistically accounting for individual differences or qualitative approach) and clearly distinguish between message accuracy, plausibility, desirability and social utility.

Four methodological limitations of the present study should be noted. First, porn literacy skills before and after the intervention were not compared. Before the intervention, we chose not to measure literacy skills or perceived porn realism to avoid sensitizing participants to the purpose of the study. After the intervention, we measured perceived realism, only one construct of media literacy, which was at medium levels in both conditions (scores around two on four-point scale). Future research should account for porn literacy at baseline. Not accounting for baseline sample characteristics disputes the generalizability of results as, in studies on taboo subjects like sexuality, self-selected samples could differ from the general population. Future studies should measure baseline porn literacy skills or use samples with low levels of media literacy to begin with. General media literacy might moderate effects of the intervention on attitudes; that is, short interventions could have stronger effects (or only be effective) in individuals who perceive porn to be very realistic.

Second, for ethical reasons, we allowed participants to skip the question on the number of sex partners in their lifetime. When it turned out we had to rely solely

on this item to measure sexual experience, this decreased construct validity and sample size. The analysis excluded participants with any missing data so that, eventually, the significant interaction effect of the intervention and sexual experience on explicit sexism was based on only 67 degrees of freedom. Therefore, this effect should be replicated.

Third, the instrument to measure prior porn use had two shortcomings. One item assessed the number of times people had watched pornography in their lives, with the highest possible option being "more than 11 times", which did not have much variance. The distribution was heavily skewed as many people chose the highest possible option. This instrument could not distinguish between people watching porn once a week and three times a day. Moreover, the instrument (Kraus & Rosenberg, 2016) did not capture differences in pornographic content. It is crucial to know what pornography *genre* people typically watch and if it contains relevant (e.g., sexist) messages. Although scholars recently focused on porn featuring specific sexual activities (Busby et al., 2020), we still lack a validated measure capturing diverse intensities and genres (Paslakis et al., 2022). With a diverse pornographic landscape, research on pornography needs to become more specific as well. Due to this specification, the field might loosen its heavy focus on undesired effects and start including desired effects (e.g., sexual exploration). Future research might examine how porn literacy not only mitigates undesired effects, but also what it does to desired outcomes of pornography. However, to the best of our knowledge, this is first time a media literacy intervention was tested in a randomized controlled trial design, the gold standard for testing interventions in medicine and social sciences (Meldrum, 2000).

If learning from pornographic messages is deemed problematic, it may not suffice to teach young people that (and why) pornography is not a useful source of sex education. After the porn literacy intervention by Rothman et al. (2018), which was deemed successful, participants still ranked pornography number one in their sources of sex education. Instead of mitigating undesired effects of pornographic messages, future research could examine how to support desired sources of sex education.

11. Conclusion

We experimentally tested a porn literacy intervention after showing mainstream pornography (in a context of arousal). However, after watching mainstream porn, none of the presumed porn effects showed: Participants were neither more dissatisfied with their bodies nor more dismissive toward condoms than before; sexist attitudes were even lower at posttest. Hence, researchers should further study what, how, and under which circumstances we learn from sexually explicit media.

Regarding porn literacy, we found that the intervention video (versus the matched control video) did not decrease perceived porn realism and most tested attitudinal outcomes remained unaffected. The intervention video successfully decreased explicit sexist attitudes in individuals with low levels of sexual experience. On the one hand, this attitudinal change lends support to media literacy theory (Potter, 2013; Primack et al., 2006). On the other hand, effects were small and perceived

realism, the presumed mechanism behind decreasing attitudinal outcomes, remained unaffected. The intervention did not trigger cognitive differentiation between media and reality, suggesting that there may be other mechanisms at work. Mechanisms other than cognitive may be worth studying, especially when thinking of implicit effects. Apart from the working mechanisms, media literacy theory should be further concretized and theoretically refined in terms of specific outcomes (e.g., implicit attitudes), its application to pornography, and its application in an arousing, affect-based state.

Declaration of conflicting interests

The authors declare that they have no known competing financial interests or personal relationships that could influence the work reported in this paper.

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