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Psychology and counselling

The effect of an educational animation on knowledge of testicular health and fertility of adolescents

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ABSTRACT

STUDY QUESTION: Does the provision of an educational animation, developed with young people, about testicular health and fertility impact the knowledge of these topics among adolescents?

SUMMARY ANSWER: The development and provision of education on testicular health and fertility were welcomed by adolescents and associated with a significant increase in knowledge.

WHAT IS KNOWN ALREADY: Young people may know less than they should about testicular health and male fertility topics. Lack of knowledge can have implications for health including late medical help-seeking for signs and symptoms of scrotal disorders, such as torsion, for which late presentation frequently results in testicular damage.

STUDY DESIGN, SIZE, DURATION: A mixed methods experimental pre- and post-design was used with embedded qualitative data collection. High school students completed a pre-animation questionnaire, watched four animations on testicular health and fertility, and completed a post-animation questionnaire. Data were collected during Personal Social and Health Education lessons across a 2-week period.

PARTICIPANTS/MATERIALS, SETTING, METHODS: Four animations on testicular health and fertility, informed by andrologists, academics, designers, boys, and young men, were developed. Eligible participants were boys and girls in the UK school years 8 and 9 (age 13–14 years). Participants completed a Time 1 (T1) survey (fertility knowledge, demographics) prior to watching the animations and a Time 2 (T2) survey (fertility knowledge, perceptions of the animations) immediately after the animations. Perceptions were rated on 10-point response scales (higher scores better). Participants additionally expressed in their own words positive and negative aspects of the animations. ANOVA was used to examine the effects of the animations using a 2 (time: T1, T2)×2 (gender: male, female) design on topic knowledge, perceived importance, usefulness, and style of the animations according to gender. Regression analysis examined the associations between gender, disability, class year, and knowledge at T2 while controlling for knowledge at T1. Qualitative data on perceptions of the animations were analyzed using inductive thematic analysis.

MAIN RESULTS AND THE ROLE OF CHANCE: Results showed that the animations significantly increased testicular health and fertility-related knowledge from T1 ($\bar{x}$=41.84 ± 24.72) to T2 ($\bar{x}$=79.15, ±15.04). Boys had significantly higher levels of knowledge compared to girls at T1 ($\bar{x}$=44.74, SD = 25.16 versus $\bar{x}$=37.79 ± 23.49, respectively) and T2 ($\bar{x}$=80.07, SD = 15.68 versus $\bar{x}$=77.89 ± 14.30, respectively) but knowledge gain from T1 to T2 was not significantly different according to gender ($P = 0.11$) as shown by non-significant gender×time interaction. There were no significant gender differences in the perceived usefulness and importance of the animations or liking of the style of the animations, with both genders considering the animations as useful, important, and likable. Regression analysis showed only knowledge at T1 to be significantly associated with knowledge at T2. Qualitative data showed three main themes: accessibility of important and useful information; information engagement and help-seeking behaviour; and inclusivity of information.

LIMITATIONS, REASONS FOR CAUTION: This was a pre- and post-study with a sample of young people from a selected educational institution without a control group. Only short-term effects of the animations were recorded.

WIDER IMPLICATIONS OF THE FINDINGS: Adolescents are interested in and learn from the provision of engaging fertility-related information. Boys and men should be considered as being a relevant target population for fertility education, not just girls and women.

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Introduction

Male fertility issues are responsible for ~50% of fertility health problems (Mannucci *et al.*, 2021). There has been a hypothesized decline in sperm quality over the last decade (Levine *et al.*, 2023). This and male fertility issues have, in part, been attributed to modifiable lifestyle factors (Fronczak *et al.*, 2012; Ricci *et al.*, 2017). There has been a reported increase in the prevalence of male infertility (Fainberg and Kashanian, 2019; Okonofua *et al.*, 2022) and poorer sperm quality has been associated with men's overall health, cancer and mortality rates in men (Walsh, 2011; Eisenberg *et al.*, 2014; Hanson *et al.*, 2018). These associations highlight the need to improve the knowledge and awareness of factors that affect testicular health and fertility of boys and men throughout their life course. Knowledge of female fertility (e.g. facts, risks, and myths of fertility) has been shown to be improved through the provision of fertility education (Maeda *et al.*, 2016, 2018; Boivin *et al.*, 2018) as has timely medical help-seeking behaviours (e.g. Maeda *et al.*, 2018).

Despite numerous research efforts to explore and improve male awareness of testicular health and fertility, there are few educational resources and opportunities available for men to learn about testicular self-examination, scrotal signs and symptoms of scrotal disease, and possible causes of infertility (Saab *et al.*, 2018). Research shows that fertility knowledge in the general population is far from optimal but is particularly low among young men and women, and boys and men specifically (Lampic *et al.*, 2006; Bunting *et al.*, 2013; Boivin *et al.*, 2019). For example, previous research demonstrates young men and women are unaware of the biological aspects of achieving pregnancy/fathering a child and overestimate the chances of pregnancy at the time of ovulation (Bunting *et al.*, 2013). Young men and women have also been shown to lack understanding of the steep decline in female fertility after the age of 34 years (Bretherick *et al.*, 2010; Boivin *et al.*, 2019); factors that can negatively impact fertility (Hammarberg *et al.*, 2017; Pedro *et al.*, 2018; Hviid Malling *et al.*, 2022; Larsen *et al.*, 2023). In a systematic review of testicular cancer awareness (Saab *et al.*, 2016), men were found to be unaware of risk factors, signs, and symptoms and few practiced testicular self-examination. However, there are limitations to this evidence base. Past research on reproductive health and fertility knowledge has sampled mostly women. Where there is research on men, results indicate that men may be particularly uninformed (Quach and Librach, 2008; Hammarberg *et al.*, 2017; Pedro *et al.*, 2018; Hviid Malling *et al.*, 2022). Help-seeking behaviour and research suggest that women are indeed more knowledgeable than men about reproductive health and fertility because they tend to be first to consult their health care provider about associated problems (Berg and Wilson, 1991; Bunting *et al.*, 2013; Boivin *et al.*, 2018, 2019).

Poor knowledge of fertility topics may have implications for health by inadvertently exposing individuals to factors that may reduce fertility (e.g. lifestyle factors Bunting *et al.*, 2013; Boivin *et al.*, 2019) and potentially reducing timely help-seeking behaviour in the event of an emergency (e.g. testicular torsion; Saab *et al.*, 2016, 2018). Accessible educational and supportive resources and services could improve disease awareness and reduce the very significant effects of lack of knowledge (e.g. testicular loss; MacDonald *et al.*, 2018; prevalence of testicular disorders and infertility; Ravitsky and Kimmins, 2019). Previous research demonstrates educational interventions designed to improve testicular self-examination and early diagnosis of testicular cancer to be effective in improving testicular self-examination performance 6 months after the intervention (Khani Jeihooni *et al.*, 2021). Subsequently, such research points to the need for educational campaigns aimed to increase fertility knowledge and awareness, particularly for young men, because they may result in an increase in help-seeking behaviour (Ravitsky and Kimmins, 2019). However, a systematic review of men's knowledge, attitudes and behaviours suggests that men may benefit differently from women, from the provision of information and education (Hammarberg *et al.*, 2017). Research highlights the need for educational campaigns and resources targeted at men, to include patient and public involvement, be collaboratively informed and co-produced with stakeholders who have the expertise to address the gaps in knowledge, and be delivered in a way that makes sense to boys and men at different stages in their life course (Berthelsen *et al.*, 2021; Larsen *et al.*, 2023). Developing educational resources in this way would help equip them to act upon information imparted to them and reduce the possibility of negative effects (Larsen *et al.*, 2023).

The aims of the present study were to develop animations with adolescent boys and young men and examine whether the provision of testicular health and fertility education via these animations could increase knowledge in adolescent boys and girls. Boys and girls were asked to complete a short fertility knowledge questionnaire before (T1) and immediately after (T2) watching four animations on testicular health and fertility. It was hypothesized that knowledge scores would significantly increase from time one (T1) to time two (T2), particularly among the young boys.

Materials and methods

Participants

The development of the testicular health and fertility animations was carried out from April 2021 to December 2022. The impact of the animations on testicular health and fertility knowledge was then examined among a group of adolescents from a Welsh secondary school. Eligible participants were all students aged 13–14 years (i.e. in the UK school years 8 and 9). Adolescents in the school year 8 who had not yet turned 13 years of age were not invited to the study owing to the ethical requirements of the

Ethics Committee. The animations were delivered as part of a PSHE lesson, therefore the school did not require informed consent to be obtained from the parents of the children that did participate. The ethics committee at the School of Psychology, Cardiff University provided ethical review and approval for the study (EC.22.04.26.6570GR).

Materials

Questionnaires (Supplementary Table S1) were completed prior to (T1) and immediately after viewing the animations (T2).

Data collection at T1 only

Data on age (in years), gender (boys, girls, non-binary/third gender, prefer not to say, other), and disability (yes, no, prefer not to say) were collected at T1.

Data collection at T1 and T2

Testicular health and fertility knowledge were measured using 10 items (Supplementary Table S1) that asked questions that corresponded to the information provided by the animations on testicular health and fertility (e.g. *people who have a sexually transmitted infection are likely to have reduced fertility*; *it is normal for one testicle to be slightly bigger than the other*). The response scale was 'true', 'false', or 'do not know'. Answers were scored a point (correct) or zero points (incorrect/do not know) and summed to create a total score (range 0–10).

Data collection at T2 only

Participants were asked to rate how useful and important the animations were for young people in addition to how much they liked the style of the animations on a 10-point Likert scale. Three open text box questions also asked participants to report what they liked the most and the least about the animations, in addition to any other feedback they wanted to provide about the animations.

Testicular health and fertility animations

The four animations on testicular health and fertility were developed to increase awareness for testicular health, and the prevention of male infertility and testicular cancer. The development and content of the animations were informed by a group of andrologists from the Andrology Special Interest Group of the British Fertility Society, psychologists, and a digital creative company. The animations covered the biological purpose of the testicles, the impact of behavioural choices on testicular health and fertility, the importance of regularly checking the testicles, and what to do in the event of a potential problem. The development process involved: discovery of the key messages to include in the animations and the most suitable aesthetic for the final animations; ideation of the over-arching narrative of the final script; and the production of the animations. During the development process, the research group met on several occasions to develop the animation script. Two groups of young boys (aged 13–17 years) and men (aged 18–24 years), from a high school (n = 8) and a youth group (n = 3), respectively, were also consulted during two separate informal focus group discussions held online during July 2022. The focus group discussions were facilitated by one of the researchers (CH) a teacher from the school (GG) and a digital creative company (MH). During the focus group discussion, the boys and young men were asked their perspective on the intended content and the design of the animations. The focus groups occurred prior to the production of the animations and helped inform the final animations, which were produced and designed to be applicable to young boys and young men aged ≤24 years to educate them both in formal education systems and online, for example via social media. The final four animations were entitled: the two essential jobs your testicles do for you; healthy balls healthy body; How can you tell if your testicles are healthy? and the incredibly obvious thing you should do about painful testicles. The animations were designed to be stand alone and short (~1 min long), but they also told a coherent story if they were presented together. In total, the four animations were 6.38 min long and are now available online (https://www.britishfertilitysociety.org.uk/fei/videos/).

Procedure

All students aged 13–14 years from 12 classes in lower secondary school (UK school years 8 and 9) attending their timetabled Personal, Social, Health and Economics (PSHE) lesson on the day the research was scheduled to take place were invited to participate by the three teachers facilitating the lessons (GG, AD, EB). Students participated over the course of a 2-week period during June 2022. Two teachers (i.e. authors AD and GG or EB and GG or AD and EB) were present during each lesson to assist with the completion of the session. On arrival to the PSHE lesson, the teachers informed the students that they would be voluntarily taking part in some research being conducted by researchers at Cardiff University. Those willing to participate were provided with an information and consent form. Once completed, the consent forms were collected in and the T1 questionnaires were distributed. Students were instructed to complete the questionnaires independently. On completion, T1 questionnaires were collected in by the teachers and the students collectively watched the four animations on the big screen at the front of the class. After the animations had finished, the students were instructed to complete the T2 questionnaire. The procedure was the same for each of the 12 classes, with 266 students participating in the research. The researchers (CH or JB) observed and recorded each session online via Microsoft (MS) Teams, software developed in the USA as part of Microsoft 365. Recording each session via Teams ensured procedures were followed and any questions relating to the research could be answered.

Data management and analysis

Missing data for testicular health and fertility knowledge items were handled using prorated scores (i.e. computing an average of the available items). Missing data for person characteristics (e.g. gender, age, disability) were not substituted. Descriptive statistics (frequency, percentages) were used for demographic data. ANOVA was used to examine the effects of the animations using a 2 (time: T1, T2) × 2 (gender: male, female) design. Perceptions of the animation were examined in a multivariate ANOVA for three dependent variables (useful, important, like) according to (gender: male, female) design. Regression analysis was used to examine predictors of testicular and fertility knowledge at T2. In this regression, knowledge at T1 was entered on the first step, gender, class year, disability on step 2, and perceptions of the animations (useful, important, like) on step 3. In any analysis with gender, people that did not identify as male, or female were excluded (because of small sample, n = 11). Knowledge gain for this group was examined descriptively. Results are reported for the theoretical distribution (F), mean square error (MSE), significance (p), mean ($\bar{x}$), and (±) SD. Narrative descriptions of reactions to animations (qualitative data) were analyzed using thematic analysis (Clarke and Braun, 2014) with the first step being familiarization with the data. Inductive coding was then used to attach meaningful labels to textual data and generate initial codes. Coding was carried out until no new codes (variation in data) were identified. Codes were

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then grouped into themes. Textual data analysis was presented as a summary accompanied by illustrative verbatim quotations. Within illustrative quotations the use of [...] indicated part of the quotation that was not presented because it was not relevant whereas (text) indicated additional text added for clarity (i.e. readability, comprehensibility). Grammatical errors were corrected and idioms ('like', 'you know', 'kind of') removed. Verbatim quotations were labelled according to participant number (*P*).

Results

Recruitment and participant profile

None of the students attending the PSHE lessons on the day the research was scheduled to take place declined to participate in the research apart from those aged 12 years. In total 266 students participated. Table 1 shows the demographic characteristics of the sample.

Testicular health and fertility knowledge before and after viewing animations

An ANOVA examining the knowledge gain using a 2 (time: T1, T2) × 2 (gender: boys, girls) design showed a main effect of time on knowledge ($F(1, 252) = 658.76$, MSE=534.94, $P \leq 0.001$), and gender ($F(1, 252) = 4.61$, MSE = 279.84, $P = 0.03$) but the two-way interaction (time×gender) was not significant ($F(1, 252) = 2.64$, MSE=267.47, $P = 0.11$). Knowledge scores increased from $\bar{x}$=41.84 ± SD = 24.72 to $\bar{x}$=79.15 ± SD = 15.04. Boys had significantly higher knowledge scores than girls (Mean Diff = 4.56, $P = 0.03$) but the knowledge gain from T1 to T2 was not significantly different between boys (knowledge gain $M = 35.33$) and girls (knowledge gain $\bar{x}$=40.106) (Fig. 1).

Perceptions of the animations

Participants rated the animations in terms of how useful ($\bar{x}$=8.06 ± 1.67) and important ($\bar{x}$=8.84, ±1.47) they were for young people in addition to how much they liked the style of the animations ($\bar{x}$=6.99 ± 2.08) (Fig. 2). There was no significant gender difference in the ratings for usefulness ($F(1, 246)$=0.574, MSE=2.78, $P = 0.45$), importance ($F(1, 464)$=0.74, MSE=2.10, $P = 0.39$), and style ($F(1, 464)$=0.25, MSE = 4.36, $P = 0.62$).

Table 1. Demographic characteristics for the total sample of participating students who watched the animations on testicular health and fertility.

Demographic	Total (N = 266)
Gender	
Boys	147 (55.3)
Girls	107 (40.2)
Non-binary, prefer not to say, other	11 (4.1)
School year	
Year 8	120 (45.1)
Year 9	146 (54.9)
Age[a]	
13 years	142 (53.4)
14 years	84 (31.2)
Disability	
No disability	231 (86.8)
Has disability	15 (5.6)
Prefer not to say	12 (4.5)

Data are presented as n (%). Frequencies and percentages may vary because of missing cases.
[a] 37 students in Year 9 and 4 students in Year 8 did not report their age.

Predictors of knowledge gain

Table 2 shows regression summary statistics predicting testicular and fertility knowledge at T2 while controlling for knowledge at T1. Analysis showed that only knowledge at T1 was significantly associated with knowledge at T2. Summary statistic showed that 16% of variability in T2 was explained by T1 knowledge (step 1), 17.4% by class year disability and gender (step 2), and 18.9% by perceptions of the animations (step 3).

Analysis of cases that did not identify with study categories on gender and disability

Descriptive statistics for individuals who did not identify as boys or girls showed that knowledge scores increased from T1 ($\bar{x}$=46.36, MSE = 7.42) to T2 ($\bar{x}$=80.91, MSE = 3.92) and that the animations were rated as useful ($\bar{x}$=7.91, MSE=0.60), important ($\bar{x}$=9.00, MSE = 0.60) and liked ($\bar{x}$=7.00, MSE=0.65).

Narrative descriptions of reactions to animations

Thematic analysis revealed seven primary codes for what the participants liked the most about the animations, five codes for what participants liked the least and one code for other feedback. The codes were grouped to into three themes: accessibility of important and useful information; engagement with information and help-seeking behaviour; and inclusivity of information.

Accessibility of important and useful information

Participants found the animations to be useful and interesting, containing important information to aid their understanding of testicular health and infertility. This information was reported to be presented in a way that was appealing and accessible to them, in addition to addressing a sensitive topic well.

> *'The animations are very useful and give lots of information about this important topic. They give facts that many people won't know.'* P156, Female.
> *'I liked the fact that I could understand what he was talking about instead of loads of complex words.'* P107, Male.
> *'I liked how the animation was laid out and I think it was less embarrassing for people.'* P348, Female.
> *'It had a lot of information and was very useful. The video also showed me things I've never seen before'* P182, Male.

Conversely, some participants reported that the animations were too short, included scientific language that was difficult to understand, and overall presented the information at a pace that was too fast to easily digest.

> *'It was quite fast and could be a bit longer.'* P146, Male.
> *'There were some words I didn't understand.'* P41, Female.
> *'I didn't like the fact that they were very scientific words which is hard to remember for our age group.'* P163, Male.
> *'There was too much on the screen at some points' P6, Female.*

Information engagement and help-seeking behaviour

Participants reported that they liked the way the animations raised awareness of testicular health and infertility and contained helpful advice and tips to reduce the possibility of experiencing potential problems in the future. Participants also reported that they liked the way the animations contained information and advice about how to identify what is and is not normal and what to do if an abnormality was identified. On the other hand, a few participants reported that they did not like being exposed to information about testicular cancer and found them a bit scientific and repetitive.

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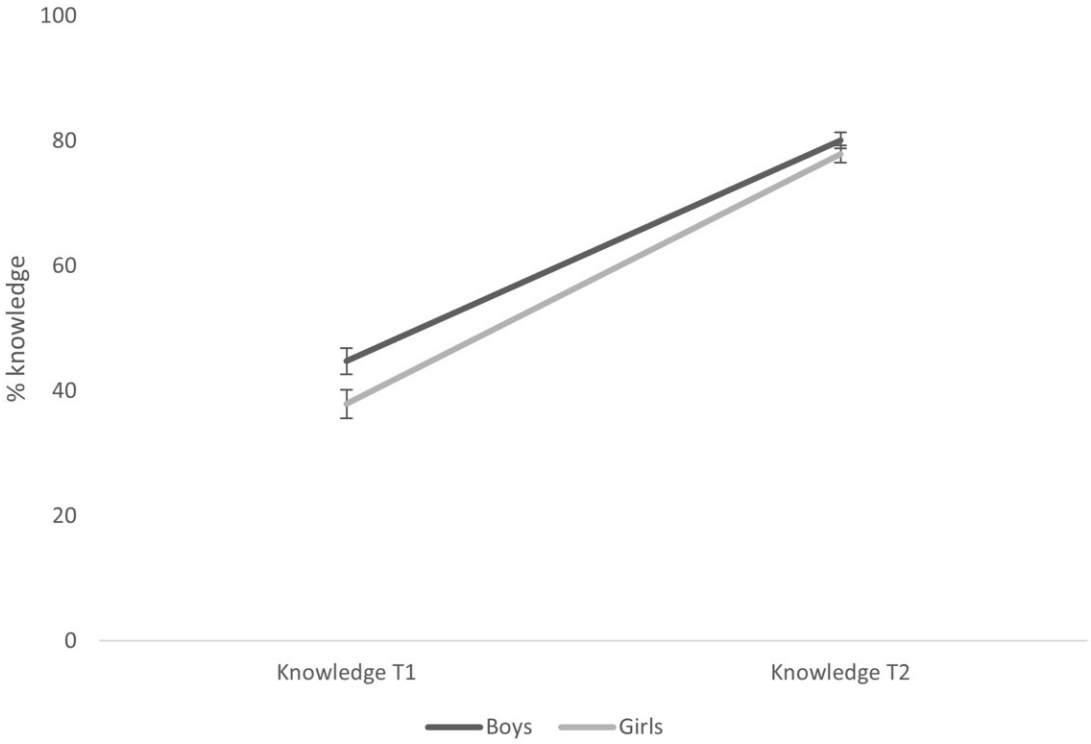

Figure 1. Testicular health and fertility knowledge score (0–100% correct) for the 266 participating students, according to gender, prior to and after provision of the animations. T1, prior to watching animations; T2, after watching the animations.

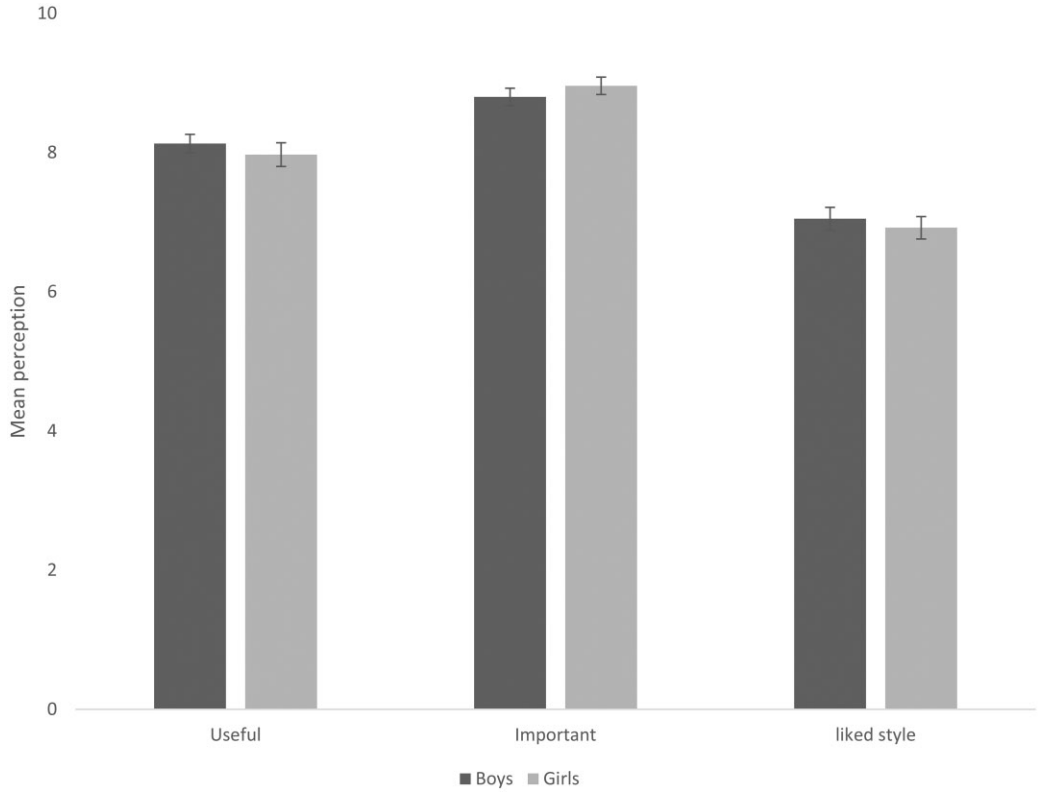

Figure 2. Mean perceptions of how useful, important, and liked the animations were, as rated by the 266 participating students, according to gender (SE ±2). Perceptions were rated on a 0–10 Likert scale. There was no significant gender difference in the ratings for usefulness, importance, and style of the animations.

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Table 2. Regression analysis for the association between the correlates of knowledge at T2, controlling for knowledge at T1.

	B	SE	Beta	Sig
Knowledge at T1	0.25	0.04	0.40	<0.001
Class year (Year 9)	3.05	1.81	0.02	0.10
Disability (no disability)	0.09	0.35	0.02	0.81
Gender (girls)	−0.45	1.82	−0.01	0.81
Useful	1.00	0.73	0.11	0.17
Important	0.36	0.77	0.03	0.64
Liked style	−0.08	0.52	−0.01	0.88

T1, before watching the animations on testicular health and fertility; T2, after watching the animations.

> '*The info about your body tells you how to keep your testicles healthy, tells you what doesn't help.*' P169, Male.
>
> '*What I liked most about the animation was that they told you what to look out for and how to treat it if something is wrong and they put a lot of important information as well.*' P130, Female.
>
> '*The animations were helpful and told me what to look out for*'. P77, Male.
>
> '*The videos were very repetitive and said the same things over and over again*'. P83, Female.

Inclusivity of information

Some girls reported that they would have liked the animations to include information about female fertility, and that in their current format they were not very relevant to women.

> '*Make it talk about women/girls too.*' P122, Female.
>
> '*That it's just aimed towards the boys.*' P140, Female.

Discussion

Findings showed the brief educational animations on testicular health and fertility had meaning and significantly improved the testicular health and fertility knowledge of adolescent boys and girls. The results highlight the importance of producing inclusive educational resources to help improve reproductive health and fertility that are targeted at boys and men, as well as girls and women. This is particularly important given the hypothesized decline in semen quality and subsequent rise in male factor infertility (Levine *et al.*, 2023), and the research that shows gaps in men's reproductive health and fertility knowledge (Pedro *et al.*, 2018). Improving male reproductive health and fertility knowledge could potentially lead to increased help-seeking behaviour and improved male fertility, both of which are important when it comes to individual and couple level reproductive decision making, behaviour, and outcomes (Maeda *et al.*, 2018). More research is, however, needed to understand the influence of the animations on the testicular health and fertility knowledge of people from other age groups and demographics.

Fertility knowledge at T1 was modest, with an average score of 41.84%. At T2, knowledge scores were on an average 79.15% showing a 100% increase in testicular health and fertility knowledge as a result of watching the animations. However, boys were not found to benefit more than girls. The significant increase in knowledge from T1 to T2 for all adolescents suggests the animations were an effective method of providing young individuals with fertility-related education. Although the increase in knowledge was measured immediately after the provision of the animations, this result reinforces findings from previous research that consistently shows knowledge to improve immediately after the provision of information (e.g. Daniluk and Koert, 2015; García *et al.*, 2016; Conceição *et al.*, 2017; Boivin *et al.*, 2018). Previous research is equivocal about the longer term retention of fertility education. Some research has shown knowledge to be retained for at least 2 years and acted upon (e.g. Maeda *et al.*, 2018), whereas other research has shown knowledge is not retained longer than 6 months (Daniluk and Koert, 2015). Consequently, it is not known whether the improvement in knowledge demonstrated by the current research would be retained for a significant period of time. As previous research suggests, longitudinal assessment and follow up is an important area for future research (Daniluk and Koert, 2015).

Lower levels of testicular health and fertility knowledge at T1 may have been because the adolescents in the current study were young and likely to have been at different stages of puberty and may not readily identify with sex, sexuality, reproductive health, and fertility. For example, higher levels of knowledge may have been found for older age groups (e.g. >15 years of age). Notwithstanding this, low levels of fertility knowledge have the potential to jeopardise testicular health and fertility (Stevenson *et al.*, 2021). The fertility knowledge questions included in the current study referred to content that was in the animations, content that could ultimately help boys, men, and individuals assigned male at birth safeguard their testicular health and fertility (e.g. what to do in the event of a potential problem). Therefore, improving knowledge levels from an early age through provision of such information could offer a successful approach to safeguarding testicular health and future fertility. Future research should examine testicular health and fertility knowledge, pre- and post-animations among older groups of individuals at different life stages. Moreover, further research is needed to examine whether knowledge gain is retained for a substantial period after the provision of the animations (e.g. 1–3 months) by including a time 3 (T3) assessment point. Including a T3 would help to assess the longer-term impact of the animations. Ideally, future research should evaluate the impact of the animations through the implementation in a randomized controlled trial.

Both boys and girls had positive perceptions of the animations, reporting that they liked the style of the animations and regarded them to be important and useful for young people. With current relationship and sex education in schools remaining primarily female orientated (Maslowski *et al.*, 2022), these findings suggest educational resources containing fertility-related information directed at boys and girls could offer an effective innovative approach to delivering fertility-related education to in schools in the UK. Our results also suggest that individuals who did not identify as male or female liked the animations and found them useful and important. However, because of the small sample size, future research would need to explore the acceptability of the animations among this group of individuals further. Future research should also examine the feasibility of implementing the animations in different settings, for example as part of Relationship and Sex Education in schools in the UK, via social media and via websites.

In line with previous research, our quantitative and qualitative findings suggest the need to ensure the provision of gender inclusive educational resources (Maslowski *et al.*, 2022; Mertes *et al.*, 2023). Although the animations were developed with and primarily for boys and young men, our results demonstrate that girls and individuals who identified as non-binary or other, also benefited from the animations and found them meaningful. These results point to the possibility of working with boys, girls, men, women, and LGBTQIA+ individuals to develop future gender inclusive and accessible educational resources.

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Moreover, previous research highlights the importance of making fertility resources suitable for distribution online as men prefer to receive fertility information online (Daniluk and Koert, 2015). Notwithstanding this, previous research also highlights the importance boys and young men place on receiving fertility education in schools (Berthelsen *et al.*, 2021). Our results suggest that these animations could offer an effective option of providing information that is easily understood (i.e. accessible) and applicable to different demographics, online, and in educational settings. Qualitative data also suggest that the inclusivity of educational resources could be related to content engagement and help-seeking behaviour in the event of a potential problem. The few negative comments that were received as feedback from the boys and girls reinforce this further because they highlight the need to ensure the content of educational resources is applicable to the target audience (girls as well as boys and vis-à-vis), at different life stages (e.g. age) and situations (e.g. educational level). This, as highlighted by previous research, is an important consideration when designing educational resources aimed at improving knowledge (Larsen *et al.*, 2023). Perceptions of whether the animations and the newly acquired knowledge would encourage individuals to be more inclined to seek health care (i.e. help-seeking behaviour) in addition to the perceived acceptability and feasibility of accessing the animations online, and in educational settings, are important areas of exploration for future research.

The positive perceptions and 100% increase in knowledge suggest that working collaboratively with boys and men could have contributed positively to the success of the animations as an educational resource. This supports previous research that finds tailoring information to be applicable to particular groups (e.g. gender) or knowledge levels to be more successful than untailored information (e.g. Hammarberg *et al.*, 2017). It also supports previous research that emphasizes the importance of engaging the target population prior to and during the development of fertility-related educational interventions to increase the acceptability of the information at different life stages and situations (e.g. Larsen *et al.*, 2023). The positive perceptions of the animations and the increase in knowledge overall highlights the importance of providing fertility-related information to boys and young men as well as girls and women. The current research shows that boys are interested in, and engage with, fertility information when it is made available to them. The results therefore point to the need to involve boys and men equally to women in the development and dissemination of fertility educational resources.

Strengths and limitations

We recognize several limitations to the current study. This was a pre- and post-study with a sample of young boys and girls from only 2-year groups in a selected Welsh educational institution. The lack of control group is problematic, but in the brief period of time between assessments, it is unlikely that other factors could account for knowledge gain. The research and results need to be replicated among young people from other schools and educational settings, across geographical regions in the UK and worldwide, with boys, girls, men, women and LGBTQIA+, and among older individuals (e.g. ≥15 years) in the age range for whom the animations were developed (i.e. 13–24 years) with broader socioeconomic backgrounds. Without this research, success of the application of the animations to other groups is unknown. We also did not assess longer term knowledge gain and retention over the long term. This was primarily due to school access restrictions that prevented the researchers from attending the school in person to carry out the research and thus lack of teacher capacity to deliver the research again at another time. The inclusion of the T3 measure should be a goal of future research because the knowledge gain illustrated by the current study was recorded immediately after the animations and therefore may be the result of memory recall rather than retention. Although there is a need for replication, the gain in knowledge from T1 to T2 is in line with previous research (e.g. Daniluk and Koert, 2015; Maeda *et al.*, 2016; Boivin *et al.*, 2019), suggesting that the results are likely to be valid beyond the specific group of boys and girls sampled in the current study.

Conclusion

The study demonstrated the benefits of providing boys and girls with accessible educational resources that address male-related fertility issues. Positive ratings of the animations suggest that information on testicular health and fertility is welcomed by young people and could become integrated in the wider sexual and reproductive health curriculum alongside the primarily female-orientated information provided.

Supplementary data

Supplementary data are available at *Human Reproduction* online.

Data availability

The data underlying this article will be shared on reasonable request to the corresponding author.

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Authors' roles

C.H. and J.B. designed the study. C.H., J.B., K.M., U.M., M.L., B.W., A.L., A.P., and M.H. informed the content and design of the animations. C.H., J.B., G.G., and M.H. informed the PPI work with young men. G.G., A.D., and E.M. contributed to the acquisition of data. C.H. and J.B. contributed to the analysis and interpretation of the data. C.H. and J.B. drafted all versions of the article, and all authors approved the final version for publication.

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Conflict of interest

J.B. reports a grant from Merck Serono Ltd outside the submitted work. C.H., G.G., A.D., E.B., U.G., M.L, B.W., and M.H. declare no conflict of interest. K.M. reports honoraria from Bayer and Merck.

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A.P. reports paid consultancy for Cryos International, Cytoswim Ltd, Exceed Health, and Merck Serono in the last 2 years, but all monies have been paid to the University of Sheffield.

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