Serious game pilot
Trialling a serious game as an approach to making children safer online

Ofcom Behavioural Insight Hub

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1. Ofcom foreword

Ofcom foreword

Ofcom has a statutory duty to promote and research media literacy, including in relation to material available on the internet. Our approach to media literacy is multi-dimensional and considers a range of aspects, including how the design of services can impact on users' ability to participate fully and safely online. A key way we seek to fulfil this duty is through our *Making Sense of Media* programme, which aims to help improve the online skills, knowledge and understanding of children and adults in the UK. Ofcom was also given powers in autumn 2020 to regulate UK-established video-sharing platforms (VSPs). In December 2020, the Government confirmed its intention to nominate Ofcom as the regulator for online safety in the UK, under the Online Safety Bill, which is currently in Parliament.

As referenced in our Roadmap to Online Safety Regulation, this report is one in a series of research studies into online safety that will inform our preparations for implementing the new online safety laws. As part of these preparations, we are building a comprehensive evidence base, bringing together internal and external data, collected using different methods, from a variety of different sources.

In this context, this programme of research further develops our understanding of online harms and how we can help to promote a safer user experience. The findings should not be considered a reflection of any policy position that Ofcom may adopt when we take up our role as the online safety regulator.

2. Executive summary

Serious Game for Online Safety: Background and context

- While the internet offers many benefits to children, there are also risks. **Over eight in ten UK children who have been bullied experienced bullying online**, through sites like social media, or via devices.[1]

- Online platforms provide information and tools to help users stay safe online. However, there are concerns children aren't aware of and / or don't engage with these. **Four in ten 13-17's are unaware of the safety measures in place on video-sharing platforms**.[2]

- There is some evidence to suggest that serious games (*games that do not have entertainment, enjoyment, or fun as their primary purpose*[4]) such as the Bad News Game, can help to engage people with content designed to improve their safety online[5]. However, overall, there is **limited empirical evidence supporting the efficacy of serious games and their impact on behaviour**.[6]

Elements of social media etiquette

🔒	Private vs. public profiles	Understanding the impact of different privacy settings
ℹ️	Personal information (a & b*)	Understanding the consequences of posting personal information online
👣	Digital footprint	Understanding that content posted leaves a digital footprint, even if deleted
👥?	Asking for permission	Knowing to always ask permission before sharing photos of other people or adding others to group chats
☹️	Negative comments	Understanding why it's best not to respond to negative comments online

Ofcom's serious game landing page

- **Ofcom's Behavioural Insight Hub designed a simple serious game and conducted a pilot randomised controlled trial (RCT) among children** to test the impact on knowledge, understanding, and online behaviour, compared to the control (reading text guidance).

- Our game was designed to educate about **social media etiquette -** the 'social code' of appropriate behaviour on social media.

- Although our game was relatively simple, we incorporated gamification techniques to engage users. We made the game **interactive** to create an experience that is active and involves an element of challenge; and we also included an element of **personalisation** (the choice of one of three avatars) to give players a sense of control.

- You can play our serious game via https://populuslive.online-host.solutions/ASP/P019714Cog2/login.asp?u3=Game (Please note: no data will be collected from players).

[1] Ofcom, March 2022, Children and parent's: media use and attitudes report 2022
[2] Ofcom, October 2020, Safety measures on video sharing platforms
[3] Ofcom, October/ November 2021, Online Experiences Tracker
[4] Michael, D., & Chen, S. (2006). *Serious games: Games that educate, train and inform*. Boston, Mass: Thomson Course Technology.
[5] Roozenbeek, J., & van der Linden, S. (2019). Fake news game confers psychological resistance against online misinformation. *Palgrave Commun* 5(65). https://doi.org/10.1057/s41599-019-0279-9
[6] Hainey, T., Connolly, T. M., Boyle, E. A., Wilson, A., & Razak, A. (2016). A systematic literature review of games-based learning empirical evidence in primary education. *Computers & Education*, *102*, 202–223. https://doi.org/10.1016/j.compedu.2016.09.001
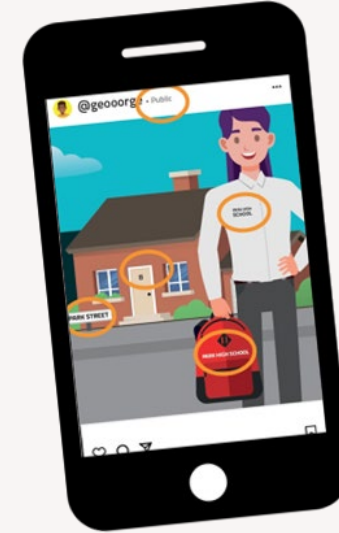
Findings from the pilot

We found that:

- **Both the serious game and reading the control of text guidance improved levels of knowledge and understanding** of social media etiquette. The control guidance was short and simple, with clear headings; the simplicity of this guidance may have facilitated increased knowledge and understanding.

- However, **the serious game improved levels of knowledge and understanding more** than the control guidance and indicative findings suggest that **the serious game was more effective at encouraging positive social media etiquette behaviours** (such as reviewing privacy settings) in the two weeks following the pilot.

A screenshot from a task in the serious game, where respondents had to click on elements of the picture that revealed personal information

A screenshot from the serious game, showing an avatar posting an image of their school (and someone swearing at a teacher!) on social media

We also conducted qualitative research which revealed that:

- **Interactive and personally relevant elements of the game were remembered best**. For example, where participants were asked to click on a picture to answer a question, or where participants were shown information that related to their lived experience, such as posting an image of a school on social media.

- **Visually stimulating elements were also better recalled**. For example, teachings delivered visually provided context and added entertainment value.

Implications and next steps

- These findings reveal that simply getting online safety information in front of children – in any format - builds knowledge. However, **gamifying information leads to increased knowledge acquisition** and **could lead to a greater positive influence on behaviour.**

- Overall, this pilot suggest that **serious games could be a promising online safety measure**. Serious games are better than text at improving knowledge, positively influencing behaviour and are more engaging.

- This was a small-scale pilot, and we are keen to build on this work to further strengthen the evidence base for serious games in online safety. For example, we would like to explore:

  - The efficacy of serious games on **different topics** and with **different demographics**

  - The **longitudinal impact** of serious games

  - The effects of **different game features** (e.g. interactivity and multimodality)

  - How to distribute serious games to **engage users** to initiate playing

- We hope this research stimulates further debate and research on this issue. We would welcome the opportunity to explore the scope for conducting trials in collaboration with industry stakeholders. If you want to get in touch, please email behaviouralinsightshub@ofcom.org.uk.

3. Pilot set-up: objectives, research design and ethical and legal considerations

Pilot objectives

The overall objective of the pilot was to **explore the effectiveness of a serious game as a tool to educate children about social media etiquette**.

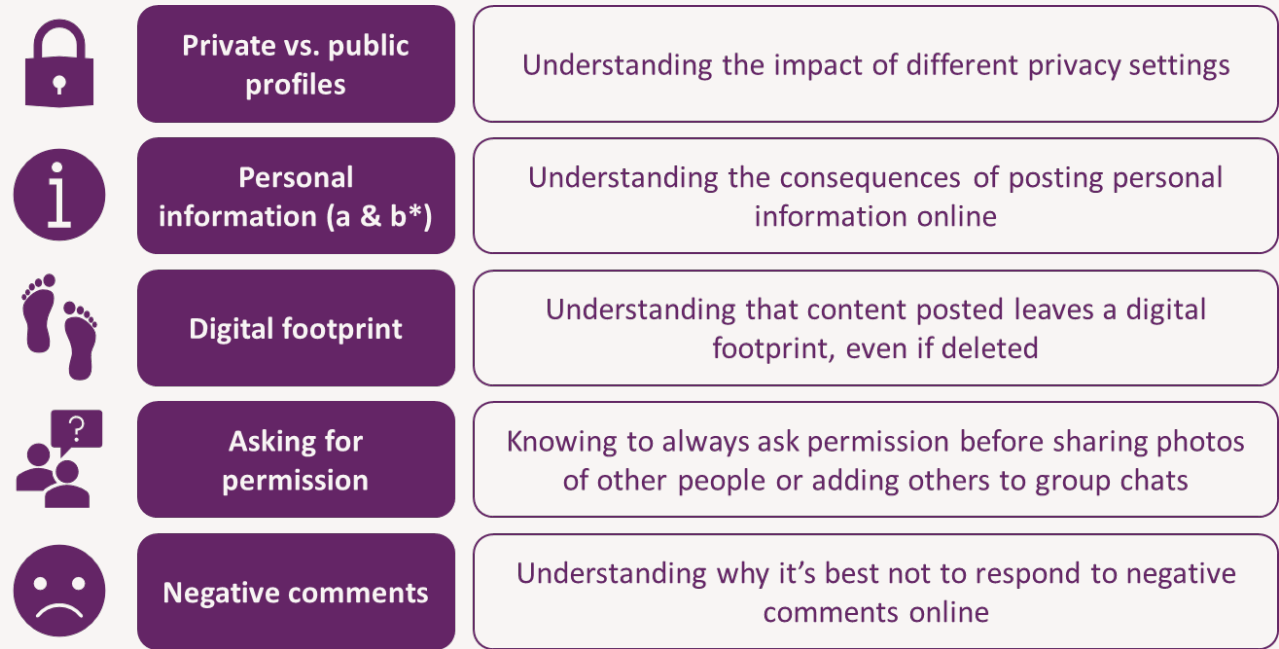However, broader objectives to conducting this pilot which were to:

- assess the **feasibility of trialling on a larger scale** in the future;

- contribute to the **evidence base around the effectiveness of serious games** by sharing our learnings;

- build our internal **capability around approaches to evaluation**; and

- build our **understanding of 'what works'** in relation to online safety features and tools.

The topic: Social media etiquette

- We chose **social media etiquette** as the topic to use in the game.[1] Social media etiquette is the 'social code' of appropriate behaviour on social media.

- **Over eight in ten UK children** who have been bullied **experienced bullying online**, through sites like social media, or via devices.[2] And the effects of online bullying can be harmful. Therefore, an understanding of **social media etiquette** is important to prevent avoidable harms.

- The overarching theme of social media etiquette is '**think before you share**'. For example, think about the consequences of sharing, including how others might react and feel, before you post. For the purpose of developing the game, we identified five sub-topics that comprise this theme (see Figure 1).

Figure 1: Social media etiquette sub-topics

Private vs. public profiles	Understanding the impact of different privacy settings
Personal information (a & b*)	Understanding the consequences of posting personal information online
Digital footprint	Understanding that content posted leaves a digital footprint, even if deleted
Asking for permission	Knowing to always ask permission before sharing photos of other people or adding others to group chats
Negative comments	Understanding why it's best not to respond to negative comments online

* There were two elements to the sub-topic on personal information. One about attitudes towards sharing posts containing personal information, this was labelled personal information (a). The other was about knowledge of reasons for not sharing posts containing personal information and was labelled personal information (b). For the purposes of analysis, these elements have been split out. For more information on the pre- and post-test questions relating to personal information, please see Section 5 in the Serious game pilot: Trial protocol document.

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[1] For more information on why we selected this topic, please see Section 3 in the Serious game pilot: Trial protocol document
[2] Ofcom, March 2022, Children and parent's: media use and attitudes report 2022

The serious game

Participants in the **serious game** group played Ofcom's **'interactive quiz-style'** serious game.

Behavioural design considerations

- **Personalisation:** Research has consistently shown that personalisation attracts attention and leads to positive outcomes.[1] For example, using personalised emails, rather than generic messages, significantly increased charitable giving.[2] To personalise our experience, participants could select from one of three **avatars** whose day they followed (see Figure 2).

- **Interactivity:** Gamification increases people's engagement and motivation, and/or improves learning on a topic.[3] Gamification changes the way respondents interact with a topic, by creating an experience that is adventurous, challenging and includes the chance of 'winning'. By creating a game in which participants followed the day of an avatar and answered challenging questions, we changed the way they interacted with the topic (compared to the control guidance).

- **Short and simple:** A key lesson from behavioural literature, is that if you want people to do something; make it easy.[4] In our serious game, we used simple language, provided answer codes for respondents to select from, presented the key message clearly in bold text and included specific and concrete recommended actions. We also kept the length of the game to no more than five minutes.

Serious game

Figure 2: Ofcom's serious same landing page

You can play our serious game via https://populuslive.online-host.solutions/ASP/P019714Cog2/login.asp?u3=Game

Please note: no data will be collected from players

[1] - Behavioural Insights Team (2011): "Applying Behavioural Insights to Fraud, Error and Debt" Cabinet Office http://38r8om2xjhhl25mw24492dir.wpengine.netdna-cdn.com/wp-content/uploads/2015/07/BIT_FraudErrorDebt_accessible.pdf
[2] - Behavioural Insights Team (2013). "Applying Behavioural Insights to Charitable Giving" Cabinet Office. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/203286/BIT_Charitable_Giving_Paper.pdf
[3] - Henderson, E. (2020, December 22). *A Behavioral Engagement Path: Combining Nudge and Gamification*. BVA Nudge Unit. https://bvanudgeunit.com/a-behavioral-engagement-path-combining-nudge-and-gamification/
[4] - Behavioural Insights Team (2014), EAST: Four simple ways to apply behavioural insights

The control guidance

Participants in the control group read control guidance (see Figure 3) similar to that found in social media platform's community guidelines.

Design considerations

- **Platform neutral:** we developed a platform neutral guide to remove any bias that might result from the guide resembling that of a particular platform.

- **Consistency with the game:** the control guidance document covered the same topics as the game and in a similar order, used consistent language to convey key learnings, and did not contain any more or less detail on key learnings than covered in the game.

- **Short and simple:** the control guidance was a single page of A4, with clear headings.

Control guidance

Figure 3: Control guidance

Guidance for staying safe on social media

Access to personal information

You are in control of the information you share on social media. Posts that contain personal or identifiable information about you or the people you post about could lead to strangers being able to identify and find you or these people in real life.

Examples of personal information include (but are not limited to): street names, house numbers, school name and logo on uniforms or bags.

Private or public posts

If your social media accounts are public this can increase the number of people that view your posts. Public posts can be viewed by anyone with internet access, even if they don't use the social media site.

Once something has been posted online you no longer have control over it, you don't know who might see it, particularly if you have posted it publicly.

Deleting posts

Deleting a post will remove it from your account and may reduce the number of people who see it, but it may not be completely removed from the internet.

Anyone can take a screenshot or screen recording of your posts. They can be shared and copied onto other social media sites like Snap, Insta or Facebook, sent by email or even shown on a smartphone screen. You can only remove the copy that you posted.

Asking for permission

You should always have the permission of the person/people included in your posts before sharing. There are many reasons why people may not want a photo or video of themselves posted online including (but not limited to) the post containing personal or identifiable information about them.

If a friend or connection has posted something about you that you would like to be kept private, contact them and ask to remove the post.

Negative comments

If you respond to a negative comment online, it is likely that you will increase the number of people who see the original negative comment. You can unfollow or block communication from an account if you receive negative comments from them.

If you see posts that are potentially harmful you can report these to the social media site and should speak to an adult that you trust.

You can read our control guidance at Annex 3 in the Serious game pilot: Trial protocol document
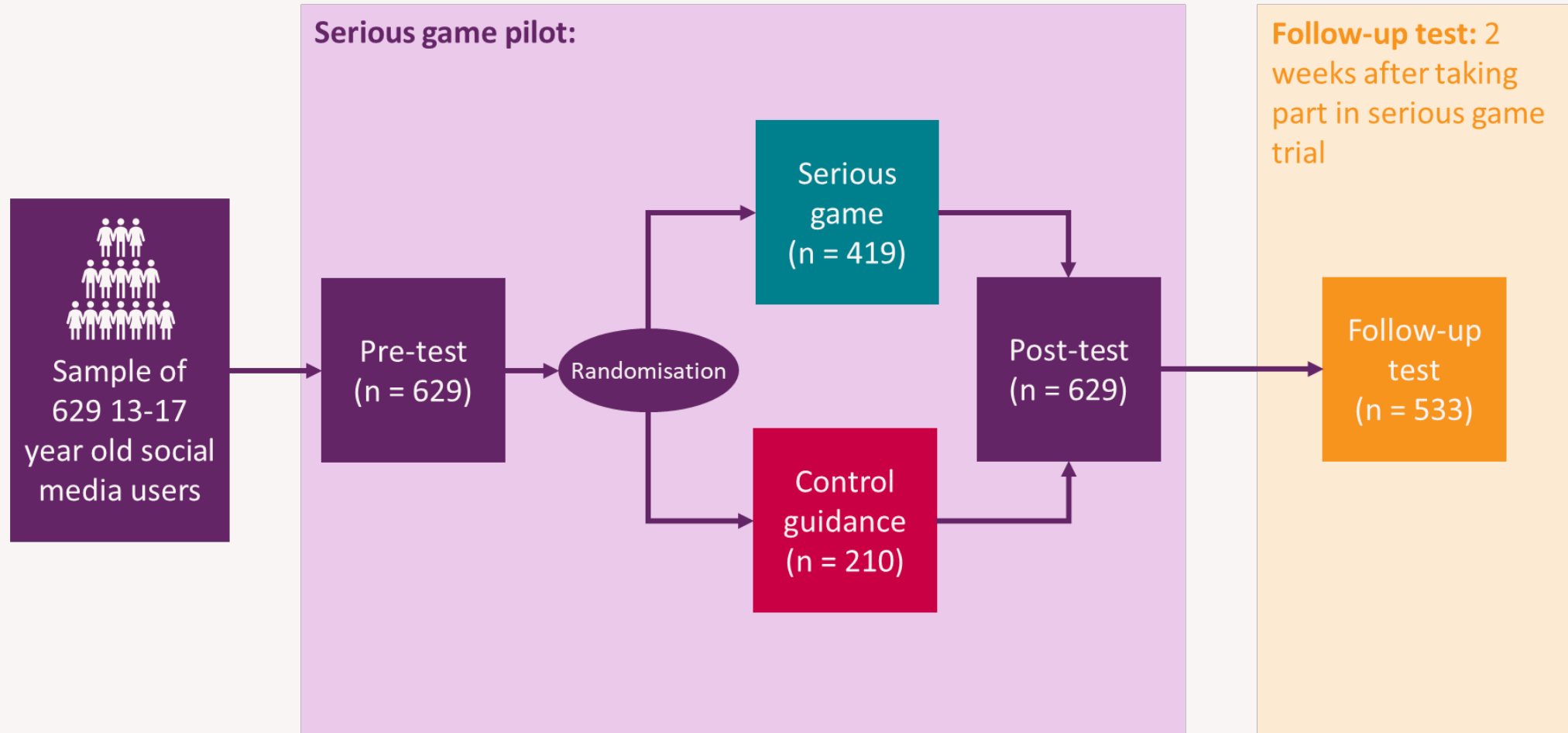
Overview of our approach

We conducted a **randomised control trial** ('RCT') **pilot** to explore the effectiveness of a serious game as a tool to educate children about social media etiquette.

- **Trial design:** we chose a **pre-test / post-test control-group design** to test the effectiveness of the serious game. In our trial all participants were assessed at the beginning of the study (pre-test). They were then randomised between two intervention groups; either the serious game group or the control guidance group. The serious game group played the game (our interactive quiz) and the control group read a page of platform neutral community guidelines. Immediately following the intervention, all participants were assessed again (post-test). We wanted to look at immediate effects of the game and assess its impact two weeks later, so we conducted a follow-up-test two weeks after the trial (see slide 15).

- **Target population and sample size:** A total of 629 UK social media users aged 13 to 17 were recruited for the trial. We chose this age group as they are high users of social media, with many platforms requiring a minimum age of 13. Therefore, the learnings in the game (covering the topic of social media etiquette) were relevant to this age group. The trial required all participants to be social media users.

- **Fieldwork:** Fieldwork took place in January and February 2022 using Ofcom's online research panel, hosted by Yonder.

- **Follow-up qualitative research:** This was conducted with 20 UK social media users aged 13 to 17, to gain an in-depth understanding of what they knew about and their attitudes towards social media etiquette, and their overall experience completing the serious game.

Trial design

Figure 4: Ofcom's serious game pilot design

Serious game pilot:

Sample of 629 13-17 year old social media users

Pre-test (n = 629)

Randomisation

Serious game (n = 419)

Control guidance (n = 210)

Post-test (n = 629)

Follow-up test: 2 weeks after taking part in serious game trial

Follow-up test (n = 533)

Note: The sample size in the serious game group (n = 419) was larger than the control group (n = 210) to allow for analysis of the effect of the game by age groups and gender.
Note: The sample size in the follow-up test is smaller than the overall sample due to drop-out; not all respondents who participated in the trial agreed to take part in the follow-up test. Of the 533 participants who took part in the follow-up test, 352 had played the serious game and 181 had read the control guidance.

Primary, secondary and exploratory outcome measures (1/2)

Below we set out the primary, secondary and exploratory outcome measures[1,2] in this trial.

Primary outcome measure: level of knowledge and understanding of social media etiquette	Measured the impact of the serious game and control guidance on level of knowledge and understanding of social media etiquette (using the pre- and post-tests). This was then compared between the serious game and control guidance groups.
Secondary outcome measure 1 (S1): Change in knowledge and understanding of social media etiquette from pre- to post-test*	Measured the amount of change in knowledge and understanding as a direct result of playing the serious game and reading the control guidance. The amount of change was then compared between the serious game and control guidance groups. This outcome measure was limited to two sub-topics[3]: private vs. public profiles and personal information a & b.

*This outcome measure is different to the primary outcome measure in that it measures the amount of change in knowledge using only those questions asked in both the pre-test and the post-test. In contrast, the primary outcome measure uses questions asked in both the pre-test and the post test, and questions asked only in the post-test, to compare any improvement in the level of knowledge and understanding between trial arms. We couldn't include certain questions in the pre-test as doing so would have given participants the knowledge and understanding the serious game/ control guidance was designed to impart – see slide 28 and 30 for more discussion on this).

[1] An outcome measure is a measure which is used to assess the effect (positive, negative or no effect) of an intervention. Primary outcome measures are the outcome measure(s) of greatest importance and correspond to the primary objective of the research. Secondary outcome measures are the outcome measures of lesser importance than the primary outcome measure but still part of the analysis for evaluating the effects of the intervention. Exploratory outcome measures are more speculative outcome measures, which may not have a high likelihood of showing differences between trial groups.

[2] For more information on the scores for each outcome measure see slide 35 and for detail on the questions used and scoring regime, please see Section 5 in the Serious game pilot: Trial protocol document.

[3] See slide 11 for detail on the sub-topics.

Primary, secondary and exploratory outcome measures (2/2)

Secondary outcome measure 2 (S2): Levels of knowledge and understanding by sub level media etiquette topics	Measured the impact of the serious game and control guidance on level of knowledge and understanding for each of the sub-topics individually (see slide 11 for detail on the sub-topics). Results from each sub-topic were then compared between the serious game and control guidance groups.
Secondary outcome measure 3 (S3): Enactment of social media etiquette behaviour	Measured the impact of the serious game and control guidance on social media etiquette behaviours[1] in the two weeks following the trial. This was then compared between the serious game and control guidance groups.
Exploratory outcome measure: Retention of knowledge and understanding	Measured the impact of the serious game and control guidance on longer-term knowledge and understanding (two weeks after the trial) and compare this between the serious game and control guidance groups.

[1] Social media etiquette behaviours included were: reviewing and/ or changing privacy settings on social media, checking for personal or identifiable information in social media posts and actions taken if personal info identified, asking for permission before sharing pictures/ videos of others on social media and action taken/ would take if seen a negative or nasty post on social media.

Ethical and legal considerations

As part of our research design, we carefully considered the ethical and legal considerations relating to:

- **Selecting the topic for the serious game:** we selected social media etiquette as the topic for the game because the ethical concerns associated with this topic are lower than other types of online safety topics, such as online grooming.

- **Age of participants:** we aligned our target demographic (13 -17 year olds) with the minimum age requirement for using social media (13 for most social media sites) so we weren't teaching children about a service they weren't allowed to use.

- **Conducting research with children:** we followed Yonder's safeguarding and ethics process, which includes obtaining parental consent (see Annex 2 in the Serious game pilot: Trial protocol document). We conducted cognitive testing to make sure the language used in all materials was clear and understandable for 13- to 17-year-olds.

- **Data protection:** we conducted a Data Protection Impact Assessment (DPIA) to protect the children involved in the research from financial, reputational and other harm. At the start of the research, participants were informed what the research was about and were notified of Yonder's Privacy Policy which set out why Yonder collected data, how it was used and how long it was kept for.

4. Pilot results, insights, methodological lessons learned and areas for future research

Results at a glance

Both the serious game and the control guidance **improved levels of knowledge and understanding** of social media etiquette

The **serious game improved levels of knowledge and understanding more** than the control guidance

When taking into account pre-existing knowledge, the **serious game directly increased knowledge and understanding more** than the control guidance

When looking at the sub-topics, level of knowledge and understanding of **reasons for not sharing personal information online was higher among the serious game group** than the control guidance group

Indicative findings suggest that **the serious game was more effective at encouraging positive social media etiquette behaviours** in the two weeks following the trial

The serious game improved levels of knowledge and understanding more than the control guidance

Figure 5: Total scores

- To understand level of knowledge and understanding of social media etiquette, a **'total score'** [1] was calculated for each respondent. This was calculated by subtracting respondent's pre-test scores from their post-test scores. The total score was made up of questions about the sub-topics: private vs. public profiles, personal information (a & b), digital footprint and asking for permission.[2] These scores were then compared between the serious game and control guidance groups.

- The total score for both the serious game and control guidance groups were positive, which shows that **both the serious game and control guidance improved levels of knowledge and understanding**. The control guidelines were short and simple, with clear headings. The simplicity of these guidelines may have facilitated increased knowledge and understanding.

- The total score of those in the serious game group was 9, versus the control group total score of 8. Total scores in the serious game group were statistically significantly higher than those in the control group. This shows that **the serious game improved levels of knowledge and understanding more than the control group**. However, the difference is small (knowledge of social media etiquette of participants who played the serious game group was 4% higher than those who read the control guidance[3]).

[1] Median total scores are shown in the chart. To calculate the total score, respondent's pre-existing levels of knowledge and understanding of social media etiquette (measured by the pre-test) was deducted from their level of knowledge and understanding after completing the trial (measured by the post-test). The total score ranged from a maximum of 16 to a minimum of -8. Negative scores were possible because of subtracting pre-test scores from post-test scores. See Section 5 in the Serious game pilot: Trial protocol document for more detail.
[2] Negative comments sub-topic were not included as this question on this sub-topic was behavioural (rather than knowledge and understanding) and therefore excluded from this analysis as not related to the outcome measure.
[3] Percentage calculated using difference between serious game and control guidance total scores (9-8 = 1), as a proportion of the total range of scores (+16 to -8 = 24). 1 expressed as a percentage of 24 = 4.25%.

The serious game was no more or less effective by gender or age

- We also tested whether there was a difference by gender and age[1] in the serious game group[2] for our primary outcome measure.

- We found no difference in total scores between males and females, or between 13- to 15-year-olds and 16- to 17-year-olds who played the serious game. This shows that **the serious game was no more or less effective by gender or age**.

- However, the qualitative research found that the learnings from the game were less likely to 'stick' and impact behaviours for older participants. For the younger participants, the information was newer (due to them being more recently educated on social media safety) and therefore they had more scope to acquire knowledge and understanding. Older participants already knew much of the information and had less scope to acquire knowledge and understanding. With a larger sample size, we may have observed such differences by age in the trial.

[1] The sample size in the serious game group (n = 419) was larger than the control group (n = 210) to allow for analysis of the effect of the game by age groups and gender.
[2] We did not conduct any analysis by age and gender for secondary outcome measures to reduce the impact of multiple comparisons. Multiple comparisons lead to a much higher risk of type I error, which occurs when we incorrectly reject the null hypothesis. For example, we find a significant effect when there are none present.

PILOT RESULTS

Secondary outcome measure 1 (S1): Change in knowledge and understanding of social media etiquette from pre to post test

The serious game directly increased levels of knowledge and understanding more than the control guidance

Figure 6: Pre- and post-test change scores

↑ Denotes significant difference between groups
⇧ Denotes significant difference within groups
Note: Scores on this slide and other slides are not comparable as different questions were used to calculate the scores.

- To understand the change in level of knowledge and understanding between the pre- and post-tests[1], each respondent was assigned a score[2] based on their responses to knowledge and understanding questions in the pre-test (pre-test change score) and a separate score based on their responses to the same questions in the post-test (post-test change score). Scores were made up of questions on the sub-topics: private vs. public profiles and personal information a & b (due to limitations around what could be included at the pre-test stage).[3]

- The pre-test change scores for the serious game and control group were both 3 and not found to be statistically significantly different from each other. This shows that **pre-existing levels of knowledge and understanding were consistent across trial arms.**

- In both the serious game and control groups, the post-test change scores (7 and 6 respectively) were statistically significantly higher than the pre-test change scores. This shows that **playing the serious game and reading the control guidance positively changed (increased) levels of knowledge and understanding of three areas of social media etiquette** (private vs. public profiles and both elements of personal information).

- The post-test change scores for the serious game group (7) were statistically significantly higher than the post-test changes scores of the control guidance group (6). As the pre-test change scores were not statistically significantly different, this means **the serious game positively changed (increased) knowledge and understanding, more than the control guidance.**

[1] This outcome measure is different to the primary outcome measure, in that this analysis measures the amount of change in knowledge and understanding as a direct result of the intervention, using only those questions asked in both the pre-test and post-test. By contrast the primary outcome measure compares any improvement in the level of knowledge and understanding between trial arms.

[2] Median pre- and post-test change scores are shown in the chart. Scores were calculated using responses to questions asked in both the pre- and post-test and scores ranged from a maximum of 8, to a minimum of 0. See Section 5 in the Serious game pilot: Trial protocol document for more detail.

[3] Only two (private vs. public profiles and personal information) of the five sub-topics were asked about in both the pre- and post-test. This was because of limitations on what we could include at the pre-test stage without giving participants the knowledge and understanding that the serious game and control guidance were designed to impart. Therefore, the extent to which we can imply any change in knowledge and understanding is limited to these two sub-topics. See Section 5 in the Serious game pilot: Trial protocol document for more detail.

PILOT RESULTS

Secondary outcome measure 1 (S1): Change in knowledge and understanding of social media etiquette from pre to post test
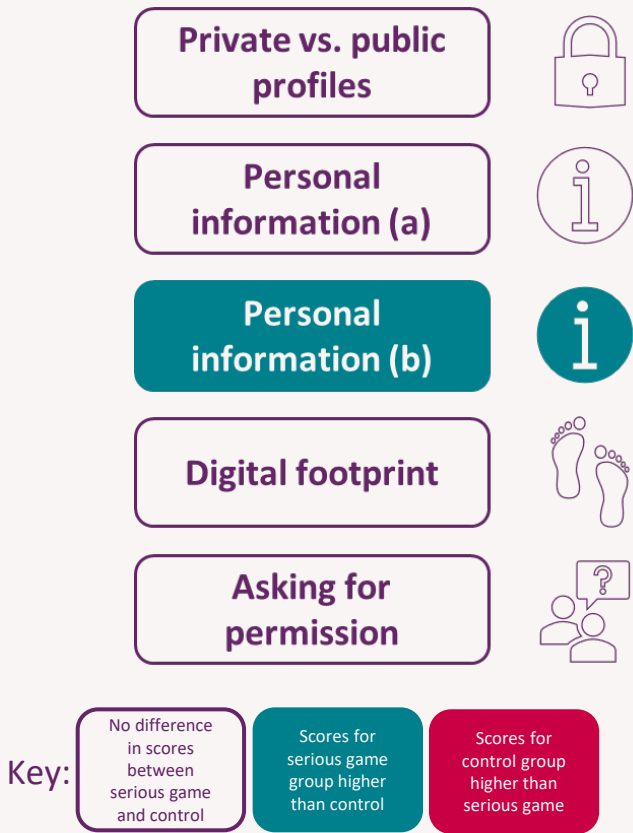
Despite limited scope to acquire knowledge, the game still improved knowledge more than the control guidance

- The qualitative research revealed that most participants felt they already knew most of the information that was provided in the game through lessons at school, family and peers (but they saw the game as a useful reminder). This suggests that there was little scope for improvement in knowledge and understanding, given the high levels of pre-existing knowledge.

- The potential to acquire knowledge and understanding for this outcome measure was further limited by the inclusion of only two social media etiquette sub-topics (private vs. public profiles and personal information a & b).

- Despite this, the serious game still improved knowledge and understanding more than the control guidance. This could be driven by the inclusion of sub-topic personal information (b) in this measure; the serious game improved knowledge and understanding of this sub-topic more than the control guidance (see slide 25 and 26 for more detail on this).

- If the sub-topics included in this outcome measure were less familiar and the scope to increase knowledge and understanding greater, we may have seen a larger difference in the impact of the serious game vs. control guidance.

Level of knowledge and understanding of reasons for not sharing personal information online was higher among the serious game group

Figure 7: Results from significance testing of sub-topic scores

Private vs. public profiles

Personal information (a)

Personal information (b)

Digital footprint

Asking for permission

Key:
- No difference in scores between serious game and control
- Scores for serious game group higher than control
- Scores for control group higher than serious game

- To understand level of knowledge and understanding by sub-topic, each respondent was assigned a score either by subtracting their pre-test scores from their post-test scores or based on post-test scores only (for sub-topics where there was no pre-test question).

- The sub-topics that we could generate scores were: private vs. public profiles; personal information a) & b) (a) attitudes towards sharing posts containing personal information and b) reasons for not sharing personal information)*;* digital footprint; and asking for permission.[1] These scores were then compared between the serious game and control guidance groups.

- Scores for the sub-topic personal information (b)[2] were statistically significantly higher in the serious game group than in the control guidance group. This means that **the game was more effective at improving levels of knowledge and understanding around reasons for not sharing personal information online,** than the control guidance.

- **For the other sub-topics** (private vs. public profiles, personal information (a), digital footprint and asking for permission), **scores in the serious game and control guidance groups were not statistically significantly different.** However, while scores for the **four sub-topics** were not statistically significantly different, **they were all slightly higher in the serious game group**, which cumulatively increased the efficacy of the serious game compared to the control.

[1] Negative comments sub-topic not included as this question on this sub-topic was behavioural (rather than knowledge and understanding) and therefore excluded from this analysis as they don't relate to the outcome measure. See Section 5 in the Serious game pilot: Trial protocol document for more detail on the scoring approach for this outcome measure.
[2] There were two questions in the pre- and post-test about personal information. One asked about attitudes towards sharing posts containing personal information and was labelled personal information (a). The other asked about knowledge of reasons for not sharing posts containing personal information and was labelled personal information (b). For the purpose of analysis, these questions have been split out. See Section 5 in the Serious game pilot: Trial protocol document for more detail.

There was greater potential to acquire knowledge and an interactive element used to educate about reasons for not sharing personal information online

**Figure 8: Interactive element of the serious game**
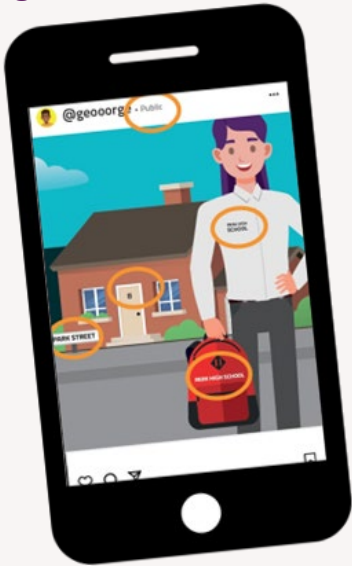
- One explanation for why sub-topic personal information (b) is significantly higher in the serious game group is because the range of scores available for this question were greater than for the other sub-topics.[1] Therefore, there was **greater potential to acquire knowledge and understanding in relation to this sub-topic**.

- Another explanation from the qualitative research was that **interactive elements of the game better engrained information in participants' minds.** The personal information (b) sub-topic was covered by an interactive element of the game in which participants clicked on elements of the picture that revealed personal information (see Figure 8). Furthermore, the qualitative research highlighted high pre-existing levels of knowledge and understanding around public vs. private profiles and asking for permission, so there was less scope to acquire knowledge and understanding of these sub-topics.

[1] The range of scores for personal information (b) was maximum score 4, minimum -4. The range of scores for private vs. public profiles and personal information (a) was maximum score 2, minimum score -2; for digital footprint was maximum score 3, minimum score 0; and asking for permission was maximum score 5, minimum score 0. For more information on the scoring regimes, see Section 5 in the Serious game pilot: Trial protocol document.

Indicative findings suggest the serious game was more effective at encouraging positive social media etiquette behaviors

Figure 9: Behaviour scores

Behaviour score

3 (Serious game)
2 (Control guidance)

■ Serious game   ■ Control guidance
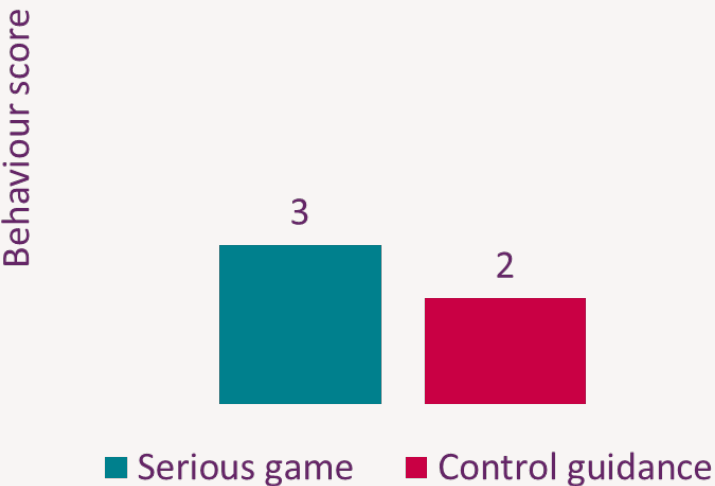
↑ Denotes significant difference between groups
Note: Scores on this slide and other slides are not comparable as different questions were used to calculate the scores.

- To understand whether there is a difference in the enactment of positive and / or negative social media etiquette behaviours in the two weeks after the intervention, each respondent was assigned a '**behaviour score**'[1].

- The behaviour score for both the serious game and control guidance groups were positive, showing that **both the serious game and control guidance encouraged enactment of positive social media etiquette behaviours**.

- The behaviour score for the serious game group was 3, which is not statistically significantly different to the behaviour score of 2 in the control guidance group (at the 95% confidence level). However, it is indicatively higher (at the 90% confidence level) which suggests that **if we had a greater sample size, we may have found that those in the serious game group, claimed to have enacted more positive social media behaviors in the two weeks following the trial** than those in the the control guidance group.

- These behaviours were: reviewing and / or changing privacy settings on social media; checking for personal or identifiable information in social media posts and actions taken if personal information was identified; asking for permission before sharing pictures / videos of others on social media; and action taken / would act if saw a negative or nasty post on social media.

- Participants in the qualitative research mentioned that the game elicited some action in checking previous posts and generating pause for thought in future posts. However, they also felt that social pressures limit their behaviours around asking for permission. For example, most said the game had little impact in their confidence to request disliked content relating to themselves to be removed, if not from a close friendship group.

[1] Median behaviour scores shown in the chart. To calculate the Behaviour score, we used responses to the behavioural questions in the follow-up test. Positive social media etiquette behaviours were assigned a positive score, negative behaviours a negative score and neutral behaviours / can't remember / no relevant behaviour enacted assigned a score of zero. The Behaviour score ranges from maximum 16, to minimum -16. Please note the following limitation to the analysis of this outcome measure: only four (of the five) sub-topics were included in the behaviour score (private vs. public profiles, personal information, asking for permission and negative comments). Digital footprint not included as the question related to knowledge and understanding, not behaviour. Therefore, the extent to which we can imply any impact on behaviour, is limited to these four sub-topics (NB – the sub-topic personal information is not split into a & b for this measure as the behavioural questions asked in the follow-up test did not split out the sub-topic in this way). Furthermore, we cannot control for the experiences that occur between trial and follow-up test, which may affect their responses to the follow-up test. However, randomisation mitigates this as there is no reason for the experiences that occur between trial and follow up test to be different by trial arm. See Section 5 in the Serious game pilot: Trial protocol document for more detail.

It was not possible to report on retention of knowledge and understanding

- To understand the extent to which respondents had retained (or lost) their knowledge and understanding of social media etiquette, we calculated a '**retention score**'[1] for each respondent. However, the limitations associated with this score resulted in being unable to report on this outcome measure.

- The limitations associated with the calculation of this score were:
  1. The retention score was calculated based on questions relating to two (of the five) sub-topics (private vs. public profiles and digital footprint). We chose to focus questions in the follow-up test on behaviour (rather than knowledge and understanding) to gain more insight into the impact of the serious game on behaviour. Therefore, the extent to which we can demonstrate any retention of knowledge and understanding would be limited to these two sub-topics.
  2. There were methodological limitations around what we could include at the pre-test stage without giving participants the knowledge and understanding that the serious game and control guidance were designed to impart. As such, for one of the sub-topics (digital footprint) used to calculate the retention score, the questions on this topic were only asked in the post- and follow-up tests (not asked in the pre-test). This means we are unable to ascertain whether the knowledge and understanding of this sub-topic existed prior to the intervention, and therefore the retention score may reflect retention of pre-existing knowledge and understanding.

[1] To calculate the Retention score, respondents were assigned a positive score if they gained knowledge and understanding as a result of the intervention and retained it at the follow-up test (two weeks later). Respondents were assigned a negative score if they gained knowledge and understanding following the intervention, but had lost that knowledge and understanding by the follow-up test. See Section 5 in the Serious game pilot: Trial protocol document for more detail.

Lessons learned from our pilot methodology (1/2)

This pilot was conducted to assess the feasibility of conducting a larger trial and to build our understanding of the approach to evaluation. Below we discuss the implications of lessons we learned on the methodology of the pilot.

- **Sample size:** The sample size (629) was sufficiently large to detect differences between the serious game and control group. However, it was insufficient to provide the statistical power to conduct more granular analysis of the data, for example by sub-topic. With a larger sample size we might detect more significant differences, such as the small differences noted between the serious game and control guidance at sub-topic level, and conduct more analysis within age or other demographic.

- **Age range:** The age range of participants (13-17) was wider than we would have liked. However, we were limited by the sample available on our online panel (hosted by Yonder). As such, it was necessary to increase the age range, to recruit sufficient sample. With a narrower age range, the game could have been more targeted to the developmental stages of the participants.

- **Game design:** The game design was 'quiz style', in which participants tested what they know by answering questions with correct answers revealed on the following page, with limited design and functionality (graphics and text only; no videos or sound). This could have limited the overall impact of the game. More sophisticated serious game designs include **inoculation style** which draws on an inoculation metaphor, where pre-emptively exposing, warning, and familiarising people with a scenario helps confer cognitive immunity when exposed to a similar scenario in real life; and **'create your own story'** whereby the level of interactivity is increased such that users influence the course of events in the game. However, despite our relatively simple game design, the pilot detected positive significant differences between the serious game and the control guidance with regards knowledge and understanding and stated enactment of behaviour.

Lessons learned from our pilot methodology (2/2)

- **Claimed behaviour:** To understand whether the game had an impact on behaviour, we used a follow-up test which asked respondents to self-report on their enactment of social media etiquette behaviours. This reliance on claimed behaviour has limitations around accurate recall (as human memory is unreliable) and social desirability bias (respondents might have wanted to give answers that they thought were the socially acceptable or 'right'). That said, we used the same approach to compare across groups so we are confident that any differences in claimed enactment of behaviours, are true differences.

- **Longitudinal evaluation:** To minimise rate of respondent drop-out at the follow-up survey stage, we ran the follow-up survey two weeks after the trial. Therefore the impact of the game on longer-term (longer than two weeks) knowledge and understanding and behaviour is unknown. This is important because the game aims to prepare the user to respond to online scenarios before they encounter them in real life. So, accurate evaluation relies on them being able to recall the information and enact appropriate behaviours in the long term. There are other challenges associated with longitudinal evaluation, such as not being able to control for the experiences participants incur between the trial and any follow-up test (see slide 28 for the limitations associated with measuring retention of knowledge and understanding in this trial).

- **Obtaining measures of pre-existing knowledge and understanding:** As noted on slide 28, there were limitations around what we could include at the pre-test stage without giving participants the knowledge and understanding the serious game and control guidance were designed to impart. This meant there was an absence of three of the five sub-topics (digital footprint, asking for permission and negative comments) at the pre-test stage and this impacted any analysis that involved the pre-test score.

Potential areas for further research on serious games

Our pilot suggests that serious games have potential to be a promising online safety tool. These suggestions for potential areas of future research are relevant to both Ofcom and industry stakeholders.

- **Longitudinal evaluation of serious games:** As noted on slide 30, we were limited in the extent to which we could evaluate the long term impact of serious games and future trials should seek to explore.

- **Efficacy of different features of serious games:** As noted on slide 29, our game was limited to a 'quiz-style' design. Further research to understand which game features (such as interactivity or multimodality) are most effective for facilitating learning and influencing behaviour would be of benefit given the lack of evidence on this.

- **Different target demographics:** We trialled our game among teenagers, and existing research on serious games has trialled their efficacy among young adults[1]. It would be interesting and worthwhile to trial serious games on different demographics (for example, older or vulnerable adults) and on narrower age ranges of children, to account for developmental stages.

- **Engagement with serious games:** Our trial suggests that engagement with social media etiquette information through a serious game improves knowledge and understanding. However, a question that remains unanswered is how to get people to engage with the game in the first place. Options to address this could include trialling approaches (such as pop ups) to engage people with serious games via online platforms.

- **Obtaining evidence of 'real life' behaviour change:** As noted on the slide 30, our findings around behaviour were limited to self-reported behaviour. A consideration for future research is around how we measure the impact of serious games (or other online safety measures) on actual behaviour change.

- **Collaborating with an online platform:** Trialling a serious game hosted by an online platform would help to address several of the lessons from this pilot. This approach could provide data on users' behaviour (for example change in privacy settings pre- and post-trial), removing the recall / self-report limitations evident in our pilot and provide some insight into users' knowledge and understanding. Access to a larger population to sample would enable greater confidence in results, and would allow for a longer period and / or multi-stage tracking of retention of knowledge and understanding and / or behaviour change. An online platform could provide implicit data on users' knowledge and understanding, for example, through their behaviour/ privacy settings, and might help to address challenges around obtaining pre-existing levels of knowledge and understanding.

We hope that this research prompts further debate and research on this issue and we welcome the opportunity to explore the scope for conducting trials in collaboration with industry stakeholders. If you want to get in touch, please email behaviouralinsightshub@ofcom.org.uk.

[1] Roozenbeek, J., van der Linden, S. Fake news game confers psychological resistance against online misinformation. *Palgrave Commun* 5, 65 (2019). https://doi.org/10.1057/s41599-019-0279-9

5. Annex

Approach to statistical analysis

- Unless otherwise stated, by convention our test for statistical significance is at the 5% level (i.e., $p < 0.05$)[1].

- The numerical scores are based on a scoring regime we devised to reflect participants performance in the pre-, post-, and follow-up tests. However, what is important is whether scores are different in the serious game group compared to the control, for example the relative rather than absolute scores.

- The statistical analysis is robust even when there are uneven sample sizes in the trial arms.

For full details of our approach to statistical analysis in the pilot and scoring regimes, please see the Serious game pilot: Trial protocol document.

[1] To minimise the risk of a type 1 error, we separated the different analyses conducted on our results into 'families', based on the aims of the analyses and the data used, and then applied Bonferroni correction to each family. For more information, please see Section 6 and Annex 9 in the Serious game pilot: Trial protocol document.

Preliminary analysis

To ensure that the randomisation had not resulted in any skew between trial arm, we conducted preliminary analysis to check whether there were any statistically significant differences in the split of demographic variables (gender and age), online behaviour (existing privacy settings) and importantly prior knowledge of social media etiquette (measured by the pre-test) across trial arms.

Preliminary analysis showed that:

- The proportion of respondents in each gender category (male and female) was consistent across trial arms.

- The proportion of respondents in each age group (13, 14, 15, 16 and 17) was consistent across trial arms.

- Overall, privacy settings[1] of respondents were consistent across trial arms.[2]

- Pre-existing levels of knowledge and understanding of social media etiquette[3] were consistent across trial arms.

[1] Based on answers to pre-test Q2. See Annex 1 in the Serious game pilot: Trial protocol document for more detail.

[2] This analysis was conducted on the answer codes to Q2. in the pre-test collectively using a chi squared test (which looks at distribution over all the answer codes at once). We also conducted analysis on the answer codes individually (using a z proportion test) and this analysis found that those in the serious game group were significantly more likely to say all their accounts were public (6%) than those in the control group (2%). This potentially gives more room for behaviour change (from public to private profiles) for those in the serious game group. (Answer codes: All of my social media accounts are private; Some of my social media accounts are private, and some are public; All of my social media accounts are public and; I don't know).

[3] Based on answers to Pre-test Q5, Q6a and Q6b. See Annex 1 in the Serious game pilot: Trial protocol document.

Explanation of the scores for each outcome measure

In this deck, we present different scores for each outcome measure. The table below provides an explanation of each score.

Outcome measure	Score(s)	Approach to calculating score(s)	Sub-topics included in the score
Primary outcome measure: Level of knowledge and understanding of social media etiquette	Total score	Total score = post-test score – pre-test score • Pre-test score = score for all knowledge and understanding questions in the pre-test • Post-test score = score for all knowledge and understanding questions in the post-test	Private vs. public profiles Personal information a & b Digital footprint Asking for permission
Secondary outcome measure 1 (S1): Change in knowledge and understanding of social media etiquette from pre to post test	Pre-test change score and post-test change score	• Pre-test change score = score for all knowledge and understanding questions in the pre-test (this is the same as the pre-test score used to calculate the Total score) • Post-test change score = score for knowledge and understanding in the post-test that were also asked in the pre-test (this is different to the post-test score in that it includes fewer questions i.e. only those also asked in the pre-test)	Private vs. public profiles Personal information a & b
Secondary outcome measure 2 (S2): Levels of knowledge and understanding by sub level media etiquette topics	Sub-topic scores	• Private vs. public profile score = pre-test score for private vs. public profile question – post-test score for same question • Personal information (a) score = pre-test score for personal information (a) question – post-test score for same question • Personal information (b) score = pre-test score for personal information (b) question – post-test score for • Digital footprint* = post-test score for digital footprint question • Asking for permission* = post-test score for asking for permission question	Private vs. public profiles Personal information a & b Digital footprint Asking for permission
Secondary outcome measure 3 (S3): Enactment of social media etiquette behaviour	Behaviour score	Behaviour score = scores to behavioural questions in the follow-up test	Private vs. public profiles Personal information Asking for permission Negative comments
Exploratory outcome measure: Retention of knowledge and understanding	Retention score	Retention score = scores to knowledge and understanding questions asked in the pre-test, post-test and follow-up test	Private vs. public profiles Digital footprint

*No pre-test question available for these sub-topics due to methodological limitations around what we could include at the pre-test stage without giving participants the knowledge and understanding the serious game and guidance was designed to impart.

Trial protocol document

The Serious game pilot trial protocol document can be found:

https://www.ofcom.org.uk/__data/assets/pdf_file/0017/245024/serious-game-pilot-trial-protocol.pdf