The effect of an intervention on youth's knowledge and awareness of filter bubbles

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English Summary

Online filter bubbles are the result of the fact that the online news that we dislike or disagree with is filtered out, this can narrow what we know (Fletcher, 2020). In this study, the implications thereof for democracies are discussed, making use of the concept of digital citizenship. The study investigates if an intervention with the goal of increasing youth's knowledge and awareness of online filter bubbles and strategies to influence these filter bubbles was effective. Specific emphasis was placed on how filter bubbles influence news diversity online. The sample consists of second grade students (13-14 years) from a Dutch secondary school. Pre- and post-test questionnaires (*N*=15) measured youth's knowledge, awareness, strategy knowledge and strategy usage related to online filter bubbles. Interviews (*n*=6) were held to get more in-depth insight, especially into the awareness of students of online filter bubbles. The results showed that knowledge of filter bubbles increased (*t*(14) = 1.96, *p* = .070). Students had clear ideas about their own online news consumption and showed high awareness of their own filter bubble and of the pros and cons of filtered news. However, their own internet behaviour as mentioned in the interviews contradicted this awareness. Different explanations for this contradiction, based on other research, are discussed.

　　　Keywords: filter bubbles, news diversity, digital citizenship, awareness, strategies

Nederlandse Samenvatting

Online filterbubbels zijn het gevolg van het feit dat het nieuws dat we niet leuk vinden of waar we het mee oneens zijn, wordt weg gefilterd, wat onze kennis kan beperken (Fletcher, 2020). In deze studie worden de gevolgen daarvan voor democratieën besproken aan de hand van het concept digitaal burgerschap. Deze studie onderzocht de effectiviteit van een interventie die als doel heeft de kennis en het bewustzijn van jongeren over filterbubbels te verhogen, evenals kennis van strategieën om die filterbubbels te beïnvloeden. Er was speciale aandacht voor hoe filterbubbels de diversiteit van online nieuws beïnvloeden. De steekproef bestaat uit tweede klas leerlingen (13-14 jaar) van een Nederlandse middelbare school. Met voor- en nameting vragenlijsten (*N*=15) zijn de kennis en het bewustzijn, evenals de kennis en het gebruik van strategieën ten aanzien van filterbubbels gemeten. Interviews (*n*=6) zijn gehouden om een meer inzicht te krijgen in het bewustzijn van jongeren van filterbubbels. De resultaten laten een toename in kennis van filterbubbels zien (*t*(14) = 1.96, *p* = .070). De jongeren hadden duidelijke ideeën over hun eigen nieuws consumptie en toonden een hoog bewustzijn van zowel hun eigen filterbubbel, als van de voor- en nadelen van gefilterd nieuws. Echter, er was een tegenstelling in hun internetgedrag zoals ze dat besproken in de interviews en hun bewustzijn. Verschillende verklaringen hiervoor, gebaseerd op ander onderzoek, worden besproken.

　　　Kernwoorden: filterbubbels, nieuws diversiteit, digitaal burgerschap, bewustzijn, strategieën

"What I seem to like may not be what I actually want, let alone what I need to know to be an informed member of my community or country." - Pariser, 2011

In the current digitalized society, the internet has been described by several scholars as new online spaces that engage people in civic life (Choi, 2016). This new way of engaging online in civic life calls for a new understanding of citizenship. In general, citizenship is about certain rights and responsibilities people have when they are a member of a (political) community (Mossberger, Tolbert, & McNeal, 2008; Choi, 2016). Digital citizenship can be defined as "the ability to participate in society online" (Mossberger, Tolbert, & McNeal 2008, p.1). *Ethics* and *media and information literacy* are two of the categories that constitute the concept of digital citizenship (Choi, 2016). Digital citizenship as ethics focusses on the internet as online communities and how internet users can live, interact and communicate with each other in appropriate, safe and ethical ways (Choi, 2016). Digital citizenship as media and information literacy concerns "one's abilities to access, use, create, and evaluate information and to communicate with others online" (Choi, 206, p.577). In the online world people can be exposed to a lot of different ideas and people with diverse backgrounds. Specifically, in a democratic community it is important that people are being exposed to diverse ideas (Sunstein, 2002). Therefore, the online world and the ability to participate in that online society, *digital citizenship,* are of importance for democracies.

There are several risks for democracies, that apply both online and offline, if people lack exposure to diverse ideas. Firstly, people need to hear other ideas than their own to be able to develop themselves fully (Sunstein, 2002). When news websites do not show the same content to every visitor but show each visitor personalized content instead, this is referred to as personalisation of news (Zuiderveen Borgesius et al., 2016). Research into the effect of personalisation on polarisation suggests that if people are not confronted with different ideas, they will eventually develop more extreme ideas (Zuiderveen Borgesius et al., 2016). People who regularly encounter diverse ideas are found to be better at providing reasoning behind their political ideas. Additionally, they are more understanding and tolerant towards ideas of others (Price, Cappella, & Nir, 2002). Secondly, Sunstein (2002) addresses the importance of shared experiences to keep people connected within a diverse democracy. Shared experiences help in times when social problems need to be addressed, they work as a 'social glue' (Sunstein, 2002). When people live in their own bubble, there might be fewer of these shared experiences.

Pariser (2011) adds that a democracy is not only relying on shared experiences: "Democracy requires a reliance on shared facts; instead we're being offered parallel but separate universes." (p.4). These online separate universes are created through the personalisation of content that shapes modern media (Zuiderveen Borgesius et al., 2016). In traditional media, like newspapers and

television, the same content is shown to every consumer. In modern online media, however, content is personalized in two ways: self-selection and pre-selection (Zuiderveen Borgesius et al., 2016). Self-selected personalisation is when people choose themselves to exclusively encounter information that matches with their own believes. In general, people have the tendency to avoid information that challenges their own perspective (Zuiderveen Borgesius et al., 2016). Pariser (2011) stated, as cited at the beginning of this text, that what seems to interest people might not be what they need to be an informed citizen. Pre-selected personalisation is when a platform personalises content without the consent or conscious decision of the user. The concerns that exist about pre-selected personalisation are often discussed with the term 'filter bubble' (Zuiderveen Borgesius et al., 2016).

A filter bubble can be described as "a unique universe of information for each of us […] which fundamentally alters the way we encounter ideas and information" (Pariser, 2011, p.9). Filter bubbles are created through people's use of technology and their specific content preferences. Meanwhile, based on this user behaviour, algorithms behind platforms change what content is shown to the user which can then again influence the content specific user behaviour. So, filter bubbles are constructed interactively between the user's behaviour, the technology of the platforms and the content. Three aspects make media consumption in a filter bubble different from traditional media consumption (Pariser, 2011). Firstly, a filter bubble is individual. Secondly, filter bubbles are invisible; from within a bubble it is almost impossible to see the bias of the bubble. Thirdly, people do not actively and deliberately choose to be in a filter bubble, so they are often unaware of the filter bubble they are in.

The impact of filter bubbles on online news consumption

Filter bubbles are important to address as through influencing people's media consumption, they also influence the ideas and news people are exposed to. Online filter bubbles in the context of news are described as "a situation where news that we dislike or disagree with is automatically filtered out […] this might have the effect of narrowing what we know" (Fletcher, 2020, para 4). An international study found that in most countries for roughly half of the people their main source of news is online, compared to television (Newman, Fletcher, Kalogeropoulos, & Nielsen, 2019). People under the age of 45 are most likely to get their news online. The three main ways people consume news online are through direct consumption via the websites or applications of news providers, through online search engines, or through social media feeds (Newman, Fletcher, Kalogeropoulos, Levy, & Nielsen, 2018). Online news is personalised in different ways and to different extents. For example, when people directly access a source via the news provider, this is a form of self-selected personalisation, as people pick a news provider of their own preference. Using search engines is a combination of pre-selection and self-selection, as people select their search terms themselves, but the search results that are shown are selected by algorithms. Still, using search engines for finding

news was found to give people a more balanced news diet than direct access (Fletcher & Nielsen, 2018b). On social media, people select themselves which people or pages they follow, but the algorithm of the platform pre-selects which posts are shown to the user. People often do not go to social media explicitly for news. However, they are more often incidentally exposed to news on their feeds on these platforms (Fletcher & Nielsen, 2018a). This effect is stronger for younger people, assumingly because youth typically consume less news so the effect of this incidental exposure on social media is bigger for them (Fletcher & Nielsen, 2018a). People who use social media were also found to use more news sources, more diverse sources and to be exposed to more opposing views than people who directly access news providers (Fletcher, 2020). As mentioned earlier, being exposed to diverse ideas is crucial for people living in democratic societies. However, more diverse news and media can also consist of more partisan and polarising content (Fletcher, 2020). News consumption through social media networks and search engines was indeed found to have an increasing effect on ideological distance between people (Flaxman et al., 2016). So, although news consumption through social media is exposing people to more diverse sources, news on social media can also have a negative effect on the ideological distance between people in society.

To conclude, in a democracy people need to be exposed to diverse ideas. Through pre-selected personalisation in online media, filter bubbles are created that can lead to a lack of diversity of ideas and news that people are exposed to. Within their filter bubble people are, often unconsciously exposed to news that is close to their own standpoint. Mainly young people get their news through social media, which means that they are primarily exposed to personalized news within their filter bubble. As nowadays civic life is for a big part happening online, youth should be made aware of their online filter bubbles and how these can affect the diversity of news they are exposed to.

Current study

The current study focusses on a project where a game was developed to make youth more aware of their online filter bubbles. This project is an initiative of the project UNION (union.sites.uu.nl) and supported by the Utrecht University research theme 'Dynamics of Youth' (www.uu.nl/en/research/dynamics-of-youth), as part of the interdisciplinary research hub of 'Change your perspective!'. This research hub focusses on the problem of students living in increasingly separated world whilst not being aware of the different perspectives of others (Utrecht University, n.d.). The project was executed by order of UNION, the department of Information Science of Utrecht University and digital citizenship project Mira Media (www.miramedia.nl). A group of computing science students from Utrecht University worked on the development of this game.

The first goal of this game was to make students aware of their own online filter bubble and of the bubbles from others around them. The second goal was to teach students about strategies to

influence their filter bubbles. Over the course of five months, the computing science student team developed a first prototype of the game. As the actual application to play the game was still being developed, several elements designed for the application were used to create an online intervention specifically for this study.

This study focusses on youth's knowledge on and awareness of online their filter bubbles, and knowledge and usage of strategies to influence their filter bubbles. A specific focus is put on how filter bubbles relate to the diversity of news that youth see online. In this study, a filter bubble is defined as the result of the individual online information selection that is constructed in the interaction between technology, user behaviour and content. The following research questions will be used:

1. What is the effect of the intervention on youth's knowledge and awareness of filter bubbles?
    a. What is the effect of the intervention on youth's knowledge and awareness of how filter bubbles influence the diversity of news they see online?
2. What is the effect of the intervention on youth's knowledge and usage of strategies to influence their filter bubble?
    a. What is the effect of the intervention on youth's knowledge on and usage of strategies to influence the diversity of news they see online?

Method

Type of research

The current study is part of a design-based research project. Design-based research is defined as "a series of approaches, with the intent of producing new theories, artefacts, and practices that account for and potentially impact learning and teaching in naturalistic settings." (Barab & Squire, 2004, p.2). It is a way of doing research in which the role of the complex social context is taking into consideration, which makes that the results have more potential to influence educational practices (Barab & Squire, 2004). Design-based research focusses on testing a particular design of a product or practice, whilst also contributing to further establishing the theoretical knowledge of the field (Barab & Squire, 2004). The design tested in this project is the filter bubble application. This specific study focussed on the intervention lesson derived from the content created for the application.

Procedure

Due to the COVID-19 outbreak and the closing of all the secondary schools, this study had to be done digitally. An online lesson was offered to the school. The data collection was part of this lesson. The entire session including the data collection and intervention lesson lasted for 90 minutes and was taught through Microsoft teams. The mentor of the class was present during the lesson. The

lesson was taught by the author and a fellow researcher, both researching this project but with their own focus. The data collection was a combined effort as well, so the instruments were designed to be collecting data for both studies. There were three instruments for this data collection: a pre-test and post-test questionnaire and individual follow-up interviews. A small pilot was done for all instruments, with participants contacted through the network of the researchers, to test the fit with the target group.

At the beginning of the lesson, the students got an explanation of the study and they received a link to give online consent. Parental consent was arranged through email and an online form prior to the lesson. After giving consent, the participants received a link to complete the pre-test questionnaire. The intervention lesson was taught by the author and the fellow researcher. A day after the lesson, under the supervision of the mentor, all participants filled in the post-test questionnaire. Six days after the lesson, the school opened again. This created the opportunity to conduct follow-up interviews whilst the students were in school.

Participants

The population of this study is youth in the ages of 13 and 14, students in the second grade of secondary school. The sample has been taken from a school in the city of Utrecht, the Netherlands. This school was contacted, through partnering organization Mira Media, to participate in this study as they previously expressed their enthusiasm about the current project. The participating class, selected by the contact person at the school, had 23 students of which the majority was on MAVO level (pre-vocational) and 7 students on HAVO level (senior general). Although ethnicity was not registered in this study, the mentor of the class mentioned that there were many different cultural backgrounds in the class, and several students had parents who were not fluent in the Dutch language. This is representative for the population as 52% of the VMBO-students in the city of Utrecht has a migration background (CBS, 2020). The sample is less representative for the province of Utrecht or the whole of the Netherlands, where only around 25% of the VMBO students have a migration background (CBS, 2020). There were slightly more boys than girls in this class. Of the 23 students in the class, 17 were present in the lesson, of which 15 gave consent and completed both questionnaires. All participants were approached and encouraged (by the researchers and the mentor) to take part in the interviews, however they were not obliged. Six students agreed to take part in the individual follow-up interviews.

Intervention lesson

During the development process of the application, five classroom activities were designed. For the intervention lesson, three activities were selected around which the lesson was constructed. Since the application was still in development, the assignments were executed in alternative ways, but closely related to the original idea. The goal of the lesson and focus in these assignments was on

increasing students' knowledge on and awareness of filter bubbles, specifically in the context of online news. Furthermore, students were taught some strategies to influence their filter bubbles.

The first assignment was focussed on creating an artificial individual bubble. Through answering quiz questions about their media preferences, students were assigned an artificial media 'bubble' for the lesson. For this assignment there were three types of bubbles, all referring to different purposes for using online media: social contact, seeking information or entertainment. An example of a quiz question was 'Which do you prefer to read?', where students could choose between a picture of a social media post or a news article, both on the same topic. After this assignment, it was explained to the students how the things they like and follow online, so their online behaviour, influences what else they get to see online.

The focus of the second assignment was on increasing students' knowledge on and awareness of filter bubbles, specifically in the context of online news. Per topic, students got an information source that was selected for them. The type of bubble that was assigned to a student in the first exercise, decided which source they got. This source was either a news article, a social media post or a discussion forum post, all with a different perspective on the topic. Students were asked to vote for or against a statement, based on the source they got. Students entered their vote via their mobile phones, and the voting results were shared with the class. It was discussed with the students how they all consulted an information source but still ended up different answers. This was linked to how filter bubbles can lead to a selection in the information we see and that it is important to realize that what you see might not be all the information there is.

The third assignment focussed more on explaining a technical aspect of online filter bubbles. This assignment gave students more insight in how algorithms behind platforms work. For this assignment, one of the researchers shared her screen whilst pretending to be a viewer, watching videos on YouTube. The class was 'the algorithm' and had to decide which video should be selected and played next. The goal was to keep the viewer interested in the videos for 2 minutes. At the end of the exercise the researcher showed her home page on YouTube to show how much more that was personalized after those few videos. It was discussed how what you see online can be personalised due to algorithms and cookies. The lesson ended with discussing settings that students can use to make their internet less personalised, such as deleting browser history and not accepting cookies.

Instruments

Pre-test. The pre-test questionnaire consisted mainly of multiple-choice questions. A few open questions at the end of each topic gave students the opportunity to elaborate on their multiple-choice answer if they wanted. To answer the first research question, students' current knowledge on and awareness of filter bubbles were investigated, as well as on how filter bubbles influence the diversity of news online. An example of a knowledge question on filter bubbles: 'Do you

think you have influence on which news you see on news websites or apps, like the NOS app? (no – a bit – yes)'. All these knowledge questions were followed by a question to indicate participants' awareness: 'Do you notice this yourself? (never – sometimes – often – always)'.

To answer the second research question, knowledge and usage of strategies to influence their filter bubbles were investigated. Strategies were asked with two types of questions about familiarity with a strategy and their actual use of the strategy: 'Do you know how to delete your cookies in your browser? (no – yes)' followed by, 'Do you delete your cookies in your browser? (never – sometimes – often – always)'. The questionnaire also contained questions about students' attitudes towards filter bubbles (on social media), these questions were not included in the current study. The pre-test was executed with the use of Qualtrics software (Qualtrics, 2020).

Post-test. The post-test questionnaire was used to examine the effect of the intervention, by comparing the answer of the pre- and post-test. The post-test was very similar to the pre-test, with a few adaptations in the phrasing of questions. Instead of asking about current use of strategies, students were asked about their planned use of those strategies: 'Are you planning on deleting cookies in your browser? (never – sometimes – often – always)'. Due to the change in phrasing, not all questions have a classical pre-post-test design. This will be taken in consideration in the discussing of the results. At the end of the pre-test students were asked to describe filter bubbles in their own words.

Follow-up interviews. The follow-up interviews were held to get more in-depth insights into their ideas and reasonings concerning filter bubbles. The interviews were used to get more data for all research questions, but with a specific focus on question 1a, focussing on youth's awareness of how filter bubbles influence the news seen online. During the interviews, students were asked to reflect on what they learned from the intervention, to share if and how they experience their filter bubbles and discuss their online (news consuming) behaviour and preferences.

The author and the fellow researcher conducted interviews at the same time. The interviews they conducted where the same for the most part. With all students, knowledge ('How would you describe a filter bubble in your own words?') and awareness about filter bubbles was discussed ('Do you notice yourself that you are in a filter bubble?'). Students were also asked what their most used application was and were observed whilst using their phone to show a strategy that was discussed in the lesson (f.e. deleting search history in an application). Both researchers had a few topic specific questions focussed on their own study. So, the questions about students' online news preferences were only answered by half of the interviewees. News questions focused on their online news consumption, news diversity and their preferences and ideas about the personalisation of news. For example, students were asked whether they see a lot of news with opinions similar or different to

their own, and what they think of that. The interviews lasted 10-20 minutes and were recorded with a mobile phone.

Data analysis

Quantitative data. The data of the pre-test and the post-test were compared to look for effects of the intervention on students' knowledge and awareness of filter bubbles and their strategies to influence their bubble and the diversity of the news they see online. The data of the pre-test and post-test were processed with the use of the programme *Statistical Package for the Social Sciences* (SPSS) version 25 (IBM Corp., 2017). In SPSS a paired sample t-test was done to compare the overall score on the pre-test and the post-test. To get a more in-depth analysis of the total test-score, questions were also clustered based on the different aspects they adressed. These clusters separated questions into whether they concern knowledge, awareness, or usage. They were further divided into whether they were about filter bubbles in general, filter bubbles in relation to news diversity or about strategies to influence filter bubbles. In total, this led to seven clusters of questions that were analysed with separate paired sample t-tests.

The McNemar Test of Change was used to assess changes in the pre- and post-test for three questions with binary data. Questions with more than two nominal answer categories, were analysed by comparing the frequencies of answers in the pre- and post-test.

Qualitative data. The interviews were transcribed verbatim with the use of Transcribe software (Wreally Studios, 2020). NVivo software was used to code the transcripts (QSR International Pty Ltd., 2015). Coding was done according to Grounded theory, the coding process started with open coding to break down and categorize the data (Boeije, 2010). Thematic analysis was used to examine the data for common themes and patterns in order to answer the research questions. Codes were created whilst studying the data, no codes were made beforehand. After a first round of coding, there were 151 open codes created. Examples of open codes: *cookies-knowledge, cookies-not accepting, filtered=useful, filtered=easy.* In the second coding phase some codes were rephrased to more general codes that fitted with more fragments. For example, the last two codes in the open code examples were combined into: *opinion filter bubbles – pleasant.* In this second phase there were also axial codes created to sort open codes into overarching categories. This led to 90 open codes and 16 axial codes. Some examples of the axial codes: *Opinion filter bubbles, definition filter bubble, preferences online news, aware of own settings.*

Results

Assumptions and reliability

The assumption of normality was confirmed for the students' total pre-test scores by the Shapiro- Wilk statistics (W(15)= .976 p= .930), as well as the Skewness and Kurtosis statistics (Z_s =

0.15, Z_k = -0.35, both < ±1.96) and a visual inspection of the histogram. The histogram of students' post-test scores did not show a very clear normal distribution. Deleting the one slight outlier did not show clear improvement, so the outlier was kept in the dataset. However, the Shapiro-Wilk statistic (W(15)= .902 p= .101), as well as the Skewness and Kurtosis statistics (Z_s = 1.36, Z_k = 0.15, both < ±1.96) confirmed that the students' post-test scores were normally distributed.

The normality of the difference of the total test-score was confirmed to be normally distributed by the Shapiro- Wilk statistics (W(15)= .906 p= .117), as well as the Skewness and Kurtosis statistics (Z_s = 1.66, Z_k = 1.67, both < ±1.96) and a visual inspection of the histogram.

The reliability of the seven clusters of questions was tested with Cronbach's alpha for both the pre-test and post-test. Only three out of fourteen clusters were found to have a Cronbach's alpha of >.7. An explanation for this is that the questionnaire was developed by the researcher and not used before this study. Although the clusters were not found to analyse the same construct, it was still decided to analyse the means of the clusters as they do group the questions into similar themes. In combination with the unreliability, that made that analysis was also done at item level to get more insight in the different elements addressed in a cluster.

Knowledge of filter bubbles

This cluster is made up of questions about the extent to which students think they and/or the algorithm of social media applications and search engines influence the content that is shown. For this cluster of questions on knowledge of filter bubbles, on average students scored higher on the pre-test than the post-test (M_{dif} = - .6). A paired sample t-test with an α of .05 was used to compare the mean scores on knowledge on filter bubbles on the pre-test (M = 9.47, SD = 1.25) and post-test (M = 8.87, SD = 1.13), this difference was not significant, t(14) = 1.96, p = .070. The students might have already been more familiar with the topic than expected, which could explain why no statistical difference was found here. Out of six interviewees, two expressed that they liked the lesson but did not learn anything new, two others said that they learned some new things (how to delete cookies (L5), or search history in apps (L1)) and that other parts were useful repetition. When looking at separate items it was found that their perception of their own influence on the content they see online decreased, whilst their perception of the influence of algorithms increased.

Seven students answered in the pre- and post-test that they think they see different search results on Google than others. A McNemar test indicated that the change three students made from 'the same' to 'different' was not statistically significant, p= .625. Ten students answered in the pre- and post-test that they think that what their friends search for and click on at Google does not influence their own search results. Four students changed their opinion, three of them went from 'influence' to 'no influence', which was not statistically significant, p= .625.

Students were asked to define a filter bubble in their own words on both tests. One student already had a quite complete definition beforehand. Before the lesson six students answered not much more than 'a filter', five students mentioned one aspect like advertisement, social media, personalised searches or information collection, and three students said to have 'no idea'. After the lesson three students still said to have 'no idea', and four answered 'a filter'. The definitions of four students got more elaborate discussing the personalisation of internet, f.e. "Your internet that is based on your internet behaviour". In the interviews almost all students showed a better understanding than they showed on the questionnaires. One student that plainly answered 'something that is completely your thing' on the questionnaire, was able to give the following explanation during the interview: "Yes, that is a sort of… for example that the app or so, that Safari for example decides which information you get to see" (L1). To conclude, based on the questionnaires no overall improvement of knowledge of filter bubbles was found. However, students' perception of the influence of algorithms increased and students that did not have a lot of prior knowledge defined filter bubbles more elaborate afterwards.

Awareness of filter bubbles

The cluster of awareness consisted of follow up questions of the questions of the first cluster, asking students per aspect: "Do you notice this yourself?". In this cluster of questions on awareness of filter bubbles, on average students scored higher on the pre-test than the post-test (M_{dif} = - .6). A paired sample t-test with an α of .05 was used to compare the mean scores on awareness of filter bubbles on the pre-test (M = 9.87, SD = 1.92) and post-test (M = 9.23, SD = 2.79). The mean score on the pre-test was slightly higher than on the post-test, but this difference was not statistically significant, $t(14)$ = 0.99, p = .34. When analysed at item level it was found that their awareness of their own perceived influence on social media content increased slightly. Awareness of their own as well as the algorithm's influence on their search results decreased.

After explaining what a filter bubble is, all six interviewees were asked whether they noticed that they are in a filter bubble. All expressed that they did notice this, most of them easily being able to give an example, "Yes I do notice that, I have that sometimes with- when I look up something on internet and then go to YouTube and then under the bar I see all kinds of things there that I've looked up earlier." (L4). When the students were asked about their opinion about filter bubbles, the majority commented to like filter bubbles arguing that the selection of information and content that interests them is useful. However, two students added some concerns as they found it "a bit strange that people can actually just watch a long with what you're doing" (L4) and "you don't know where the information goes" (L5).

The maximum score possible for this cluster of questions was 16, quite a bit higher than the achieved mean scores for both tests. This seems to suggest that students are not very aware of filter

bubbles. Four out of five students who gave an example of filtering talked about YouTube. This might prove this point further, as YouTube was the only media platform explicitly discussed in the lesson as part of the third assignment. The lack of examples of other platforms may indicate a limited awareness of the impact of filter bubbles on their social media.

Knowledge of filter bubbles in relation to news diversity

Students were asked to which extent they think that they or the algorithm of a (news) platform influences the news they see online or on social media. For this cluster of questions, on average students scored higher on the post-test than the pre-test (M_{dif} = .4). A paired sample t-test with an α of .05 was used to compare the mean scores of the cluster on knowledge on filter bubbles and the influence on the diversity of news on the pre-test (M = 7.60, SD = 1.45) and post-test (M = 8.00, SD = 1.85). The mean score on the post-test was slightly higher than on the pre-test. This difference was not statistically significant, $t(14)$ = -0.634, p = .54. When looking at item level it became clear that their knowledge did increase on how they and the algorithm both influence the news they see online. This was only true for news on news websites or applications, not for news on social media.

In the interviews, students showed clear understanding of their online news consumption. Three students were explicitly asked about news, and one mentioned it by himself, all had a clear answer about what news they see and why they like it that way. L4 mentioned football results being the only news he reads online. Whilst L3 explained his choice to accept cookies on news websites: "So, I can already see what I like, what I find interesting. Then I don't have to look further into it. And if I want it differently, I can just look it up." L5 also said she mainly sees news messages with similar opinions, which she likes as it is based on what she looked at previously. L6 actually said he sees a lot of different opinions when he reads news online, which he experiences as pleasant. When asked about it, he (L6) also expressed that the lesson did not change his mind about the news he sees online. The clear answers and reasons the interviewees gave for their online news consumption, might indicate that more of the students already had clear ideas about their online news consumption beforehand, as a result of which the lesson might not have much impact on this particular aspect.

Awareness of filter bubbles in relation to news diversity

For this cluster of questions, awareness was again measured following up on the previous questions about knowledge by asking: "Do you notice this yourself?". In this cluster, on average students scored higher on the pre-test than the post-test (M_{dif} = -0.67). A paired sample t-test with an α of .05 was used to compare the mean scores on awareness on filter bubbles and the influence on news on the pre-test (M = 8.87, SD = 2.95) and post-test (M = 8.80, SD = 2.70). The mean total scores on the pre- and post-test were almost equal, so there was no statistically significant

difference, $t(14) = 0.07$, $p = .95$. As well as for knowledge of filter bubbles and news, for awareness there was also a difference found on item level between news on news websites and on social media. Students answers revealed they became slightly more aware of personalisation of news on news websites, this was not the case for news selection on social media.

Three students were explicitly asked about the news they see online, whether they see a lot of news with a perspective similar or different from their own. Following this question, they were faced with a dilemma, which came down to whether they prefer 1) news websites to collect their personal information to give them personalized news or 2) for news websites not to collect their information and to see unfiltered news. All students answered this with different arguments; to get an insight in their reasoning all three argumentations will be discussed individually. When asked if he reads news online, L4 said he did not, he only looks at sport results. When presented with the dilemma he mentioned it being a though choice but decided to choose the second option of not collecting personal information, arguing: "Well, I mean I don't find it too bad, that they can see what I'm looking up, but I mean it's- it's not too bad- I think do like it better if they don't watch along, but it doesn't matter so much for me." (L4). Another student (L6) described how he reads news online and sees "a lot of different" articles. He was really clear and direct in choosing the 2nd option, explaining that he prefers unfiltered news, "otherwise you only see the same things […] I don't like if it constantly shows the same" (L6). The third student (L5) said that she sees a lot of similar messages and opinions online, and she did not really feel a need to change that. However, when faced with the dilemma she did opt for the 2nd option: "In that case I prefer unfiltered […] Because the news that seems- I find it important to know what is everywhere and not just the one thing for example that has my interest" (L5). The contradiction between her answers were discussed later in the interview, and elaborated on by the student:

> I don't really read the news, but I do watch the news every morning, with my dad on the couch. Cause it's on and I need to have breakfast anyways, so then I just sit there watching. So I don't really have that need, to change, because I get to see it anyways, but If didn't have the chance to watch the television, with my dad for example, than I would have liked to change it, because than I would be able to see it in a different way than on tv. (L5)

All three students opted and argued for the second option where no personal information is gathered, and they see unfiltered news online. Their arguments being either that they did not want that "they" can watch along, or that they do not want to see the same thing the whole time. This seems to suggest a high level of awareness of the pros and cons of filtered information. However, these answers are in contradiction to their own online behaviour as expressed in the rest of the

interviews. Two of them (L4 & L6) for example said that they always accept cookies, which would lead to more personalised news instead the unfiltered news they say they would prefer.

Knowledge of general strategies

This cluster consists of questions about students' familiarity with different settings in applications and internet browser to influence their filter bubbles, like deleting cookies or search history and changing advertisement settings. For this cluster, on average students scored higher on the post-test than the pre-test (M_{dif} = .53). A paired sample t-test with an α of .05 was used to compare the mean scores on knowledge of strategies to influence filter bubbles on the pre-test (M = 8.33, SD = 1.05) and post-test (M = 8.87, SD = 0.92). The mean score on the post-test was higher than on the pre-test. This difference was statistically significant, $t(14)$ = -2.48 , p = .027, and a medium effect of d = -0.54. Knowledge on how to delete cookies in browsers went from 40% to 60%, deleting cookies in application was new for more students and went from 27% to 47%.

These results were supported by the qualitative data as half of the interviewees mentioned specific settings that they learned about during the lesson. Students (L2 &L3) who said they did not learn something new about settings, were both found to already have quite some prior knowledge about settings. One of them showed clear understanding of how cookies and search history can affect the personalisation of internet: "You have history and you have cookies and then you can click that your history is made public. Then they will look at what you are mainly looking up. What do you like? What are the things you are often doing? And on that they select items to sell to you or to promote to 1) make more money themselves, because it is more personalised and 2) to make you at ease." (L3). So, even though no effect was found on students' general knowledge of strategies, effect was found on students' knowledge about strategies to influence their filter bubble.

Usage of general strategies

This cluster of questions follows from the previous cluster and asked if students made use of the several different strategies. The average difference between pre-test and post-test equals zero. A paired sample t-test with an α of .05 was used to compare the mean scores on usage of strategies to influence filter bubbles on the pre-test (M = 19.47, SD = 3.68) and post-test (M = 19.93, SD = 3.71). The mean total scores on the post-test was slightly higher than on the pre-test, there was no statistically significant difference, $t(14)$ = -.60 , p = .56. In the post-test student were asked if they were *planning* on using any of the strategies. Overall, they are planning on deleting their search history and cookies in their browser more often, as well as changing their advertisement interests. In the pre-test 87% says to often or always accept cookies, in the post-test still 73% says to be planning to do so often or always.

There was a clear difference between the six students regarding knowledge and usage of strategies to influence their filter bubbles. Two students could clearly tell why and how they are

using certain strategies. One of them expressed how he consciously decided when to accept cookies on websites or not: "On websites where I am just briefly on, or that I don't really trust, like AliExpress or cheap websites from China, then I prefer not to (*accept cookies*)" (L3). The other told that he has "double security on a lot of things" (L2), referring to the use of 2-factor-authentication with the use of his phone. Two other student showed more limited knowledge, one of them said "I find it nice to always delete everything on Google" (L6) when talking about search history, whilst also stating that he always accepts cookies. The final two students both had a hard time finding settings within in a social media application when this was asked of them during the interview. One of them stated: "I just click 'accept cookies', but I actually don't really know what it is. I am not bothered by it. I also don't know what it really does" (L4). These varied answer of the six interviewees could be an explanation for the fact that no significant difference was found, as the variety of (prior) knowledge and usage in this sample was quite big.

Usage of news-related strategies

This cluster consists of two questions asking students about actions they take to influence the diversity of news online. For this cluster, on average students scored higher on the post-test than the pre-test (M_{dif} = .33). A paired sample t-test with an α of .05 was used to compare the mean scores of this cluster of knowledge on filter bubbles and the influence on news on the pre-test (*M* = 2.87, *SD* = 1.13) and post-test (*M* = 3.20, *SD* = 1.26). The mean score on the post-test was slightly higher than on the pre-test, but this difference was not statistically significant, *t*(14) = -0.79 , *p* = .44. Looking at item level revealed that in the pre-test five students were mentioning to already explicitly follow accounts with different opinions to see more varied messages. In the post-test three extra students mentioned to be planning to do so. In regard to news, six students were already looking for news with different opinions. Afterwards four other students mentioned to be planning to do so.

A student addressed that he was consciously accepting cookies from news websites because "then I can already see what I like, what I find interesting. Then I don't have to look further. If I want it differently, I can just look it up" (L3). Another student talked about how to use social media to get news, she showed how TikTok has a special button to click on the main page to go to a page with videos with COVID-19 updates. When asked whether she uses TikTok for this purpose, she replied: "It's not that I explicitly look for it, but when it shows it is interesting to watch. I think it is a nice way to see the news." (L5).

Total test score

A paired sample t-test with an α of .05 was used to compare the mean total scores on the pre-test (*M* = 66.47, *SD* = 5.99) and post-test (*M* = 66.93, *SD* = 8.53). The mean total scores on the pre- and post-test were almost equal, so there was no statistically significant difference, *t*(14) = -.20, *p* = .84.

Discussion

This study focussed on youth's knowledge and awareness of filter bubbles and their knowledge and usage of strategies to influence these filter bubbles. A specific focus was put on how filter bubbles influence the diversity of news seen online. Addressing filter bubbles in the context of news is important as filter bubbles might lead to "a situation where news that we dislike or disagree with is automatically filtered out […] this might have the effect of narrowing what we know" (Fletcher, 2020, para 4). This paper started with discussing digital citizenship, which is relevant in the context of online news consumption of youth as it concerns the ability to participate in online communities. In this discussion the results of this study will be put into the broader framework of digital citizenship again.

In this discussion the research questions will be dealt with, by addressing the contrast between students' awareness of filter bubbles and their usage of strategies to influence them. Based on other studies, three possible explanations for this contradiction are discussed. The overall effectiveness of the intervention will also be discussed as well as any suggestions for further development.

Awareness of filtering versus actual online behaviour

Awareness. When faced with the dilemma of news filtering all interviewees opted and argued for the second option where news websites collect no personal information and they see unfiltered news, instead of the first option where personal data is collected and personalized news is shown. There were two themes to be recognised in the argumentations in favour of the second option. The first argument was not wanting that 'they can watch along', a quite abstract statement referring to online surveillance. It is not strange that the students use such abstract terms, as online surveillance is made as implicit, hidden and invisible as possible (Tufekci, 2014). It is known that browser and software companies collect information about users, however for most people it is unclear and inaccessible to which extend this is happening (Tufekci, 2014).

The other arguments for choosing the second option of unfiltered news were about not wanting to always see the same and finding it important to know what is going on in the world around them. These arguments seem to suggest awareness of the pros and cons of filtered news. As the filtering of news can narrow what we know (Fletcher, 2020), the fact that these students instead prefer unfiltered news is hopeful. Encountering more diverse news makes people more understanding and tolerant towards ideas of others, as well as better able to provide reasoning behind their political ideas (Price et al., 2002).

Online behaviour. However, these answers are in contradiction to their own online behaviour as expressed in the rest of the interviews. Several interviewees stated for example that they always accept cookies. Afterwards still 73% said to be planning to always or often accept

cookies. Also concerning the usage of other strategies to influence their filter bubble, little effect was found. Actions like accepting cookies, contribute to peoples' filter bubbles and within their filter bubble people are more often exposed to news with a standpoint that is close to their own (Zuiderveen Borgesius et al., 2016).

Awareness vs. online behaviour. So, there seems to be a contradiction between the awareness that students showed and their online behaviour. This contradiction was illustrated by more of the results. When students gave examples of how they noticed their filter bubble, the majority of the examples was related to YouTube, whilst this was not the media platform students said they used most. However, YouTube was the platform that was most salient in the lesson. This suggests that students understood the explanations and examples in the lesson, but do not seem to apply this new knowledge to their own media behaviour. Three possible explanations for this contradiction between awareness and own online behaviour will be discussed here.

A first possible explanation it that it is ignorance, that is, these students still lack an understanding of how this fictitious scenario relates to reality. In a study on sex education, McKee, Watson and Dore (2014) found that teenagers have the tendency of seeing knowledge that is taught in school as irrelevant for real life. This might be a tendency that teenagers have concerning more topics, including filter bubbles, for which they do not see how the knowledge is relevant in real-life.

Another possible explanation for this contradiction between students' awareness and actual actions could be that these actions, like always accepting cookies, are the more easy and convenient choices. This behaviour could be explained by the term 'privacy pragmatists'. 'Privacy pragmatist' was the mindset Raynes-Goldie (2010) found to be most salient in a group of Canadian college students of whom she studied their Facebook related privacy concerns. Privacy pragmatism refers to 'people who are concerned about their privacy but are willing to trade some of it for something beneficial' (Raynes-Goldie, 2010, "not your mother's privacy", para 3). In regard to filter bubbles this could mean that whilst students are aware of how personalisation and filtering affect their privacy, they still choose to go for easy and convenient actions, such as accepting cookies. It must be added that even if people have privacy concerns, companies such as Facebook make it really hard for people to change privacy settings since using people's personal data is how they gain commercial benefit (Blank, Bulsover, & Dubois, 2014; Hull, 2015).

A third possible explanation is offered by Tufekci (2008), in a study on students' privacy boundaries on social media networks. In the study she wanted to move beyond the dichotomy of "they don't know" or "they don't care". Tufekci (2008) offered another possibility, proposing that students *do* try to manage the boundary between publicity and privacy, but they do not do this by total withdrawal because they would then forfeit a chance for publicity. Relating it to the context of the current study would suggest that students do try to find a balance between engaging with

filtered and unfiltered content, but they do not do that by withdrawing fully from all filtered media sites and platforms. Tufekci (2008) adds that this possibility does not mean that students have taken all possible pros and cons in consideration, but this does show the complex dilemmas that students face online.

Based on other research, three different suggestions were given that could explain the contradiction between student's awareness of online filtering and their actual behaviour. In all cases more help in applying the knowledge to practice could be helpful, which can help students to deal with the dilemmas of the online world. With extra focus on these aspects, educating youth on filter bubbles can really contribute to their digital citizenship and therefor to their participation in society (online).

Effectiveness of the intervention and suggestions for further development

The findings seem to demonstrate that students already had quite some knowledge about filter bubbles and related concepts. It is possible that this was specific for the school from which the sample was taken as media literacy has been discussed before at this school. At the same time, students' definitions of filter bubbles before (as well as after) the intervention still showed quite a variety in understanding. Although there was no significant improvement in knowledge about filter bubbles, students' knowledge about strategies to influence their filter bubbles increased significantly. Overall, the level of prior knowledge was higher than expected when the application was developed, which could explain the limited effect that was found for this intervention. When further developing the intervention, the knowledge level should be critically re-evaluated and adjusted to the knowledge of the youth. The results of this current study can be used as an indication of which aspect of filter bubbles students do not seem to grasp yet, such as: how not only algorithms enforce personalisation, so does their own behaviour or how news personalisation is not only happening on news websites but also on social media. However, it must also be taken in consideration that this quite complex topic probably cannot be taught and understood completely in a single lesson. It would be advisable to incorporate the lesson in a long-term media literacy learning goal and project.

In the interviews the students showed that they already had clear ideas about their own news consumption before the intervention, which could explain why there was no effect for usage of news-related strategies. Possibly, this is a topic that youth do not really want advice about. However, Craft, Maksl and Ashley (2013) argue that students should learn about how to connect their knowledge about online (news) media to their own news consumption. Only then they can really be in control of their own news consumption (Craft et al., 2013). When future lessons can be given in real-life, small group discussions should be considered as they are found to be preferred by students as ways to engage them in the material (Hamann, Pollock, & Wilson, 2012). For further development

of this application, and other media literacy intervention, attention should be given to how to teach students to connect their new knowledge to their own online news consumption and everyday internet behaviour.

Limitations

The fact that the intervention lesson had to be taught digitally, due to the COVID-19 outbreak, might have made the lesson less effective. Since not being able to see the students whilst teaching, makes it harder to get students involved and to know whether they understand the explanation. Digital lessons also limit the possibility of class discussions, therefore it would be interesting for further research to see if lively discussions in a real-life lesson would make the intervention more effective.

The questionnaire was developed by the researchers and when tested, most of the subcategories turned out to not be reliable. This could explain why so little significant effects were found when looking at the different clusters of questions. A further developed and tested questionnaire could give more specific results of the effect of the intervention on the different aspects of filter bubbles.

Conclusion

To conclude, the youth in this study already seemed to have quite some prior knowledge about the aspects of filter bubbles that were discussed in this intervention. However, at the same time they did not seem to apply this knowledge and awareness to their own online behaviour, especially concerning their online news consumption. It must be added that companies like Facebook do not make it easy for people to change settings, as part of their commercial strategies. Still, the contradiction between awareness and behaviour is important as being able to access, use and critically evaluate information is an important part of media literacy and therefore of digital citizenship. Therefore, in further development of the application and when teaching students about online filter bubbles, attention should be given to helping students see how they can put their knowledge to practice, so that youth will be able to actively participate in and contribute to their communities as digital citizens.

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