



HAL
open science

Teachers' views on disinformation and media literacy supported by a tool designed for professional fact-checkers: Perspectives from France, Romania, Spain and Sweden

Thomas Nygren, Divina Frau-Meigs, Nicoleta Corbu, Sonia Santoveña-Casal

► To cite this version:

Thomas Nygren, Divina Frau-Meigs, Nicoleta Corbu, Sonia Santoveña-Casal. Teachers' views on disinformation and media literacy supported by a tool designed for professional fact-checkers: Perspectives from France, Romania, Spain and Sweden. SN Social Sciences, 2022, 2 (4), pp.40. <10.1007/s43545-022-00340-9>. <hal-03861125>

HAL Id: hal-03861125

<https://hal.science/hal-03861125v1>

Submitted on 19 Nov 2022

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



HAL Authorization

**Teachers' views on disinformation and media literacy
supported by a tool designed for professional fact-checkers:
Perspectives from France, Romania, Spain and Sweden**

Corresponding author: Thomas Nygren

Department of Education, Uppsala University, Uppsala, Sweden

ORCID 0000-0003-1884-3252

thomas.nygren@edu.uu.se

Divina Frau-Meigs

Sorbonne Nouvelle University, France

[0000-0002-0369-4226](https://orcid.org/0000-0002-0369-4226)

divina.frau-meigs@sorbonne-nouvelle.fr

Nicoleta Corbu

ORCID 0000-0001-9606-9827

Sonia Santoveña-Casal

Acknowledgements

This study is part of the Youcheck! project, funded by the European Commission programme “Media Education for All”, 2019-2020. www.youcheck.com. We are truly grateful to all the teachers who accepted to participate in this study.

Teachers' views on disinformation and media literacy supported by a tool designed for professional fact-checkers: Perspectives from France, Romania, Spain and Sweden

Abstract

In this study, we ask teachers in four countries (N=36) about their views on disinformation and how they perceive a professional tool for fact-checking as a resource in education. Inspired by design-study research, we investigate perspectives of teachers about potentials and challenges in different contexts. In light of theories of transliteracy and education, we find that teachers view different challenges in France, Romania, Spain and Sweden. The media situation and resources to counter disinformation in education differ, especially between Romania and Sweden. From the point of view of teachers, we see a lack of connection between formulations in guidelines and the arena of realizations. Teachers identify a lack of media and information literacy in education and they find that a digital tool for professional fact-checking needs to be redesigned or followed by pedagogical instructions to fit into the complexity of practice. Our findings highlight how a digital tool against disinformation may be perceived as useful or useless in education depending on the design and previous knowledge among teachers.

Keywords: Misinformation, media and information literacy, fact-checking tools, teaching and learning

Introduction

Disinformation in the shape of “fake news” has attracted public attention on the dual needs for fact-checking and for media literacy (Frau-Meigs, 2018). A number of fact-checking initiatives and tools have emerged as a response from the media professionals. Such tools are mostly geared to journalists, not to teachers, students or citizens at large. Research reveals additional gaps: the focus is mostly on text-based “fake news”, much

less on visual “fake news”, though these are among the most prominent in social media; building resilience implies to navigate online information in new ways, as professional fact-checkers do (Lewandowsky, Ecker, & Cook, 2017; Wineburg & McGrew, in press). For this, people seem to need a mix of content knowledge, constructive attitudes and digital skills as underscored by theories of media literacy as transliteracy (Frau-Meigs 2012) and technocognition (Nygren, Brounéus, & Svensson, 2019; Nygren & Guath, 2019).

Faced with challenges of information disorder (Wardle & Derakhshan, 2017) and infodemics, there is a loud call for educational actions to support citizens when flooded by information of various quality in multimodal formats (European Commission, 2018; World Health Organization, 2020). Education is described as key since automated fact-checking hold important limitations, not least when it comes to debunking visual images and deep fakes (García Lozano et al., 2020; Neekhara, Hussain, Jere, Koushanfar, & McAuley, 2020). Disinformation, defined as inaccurate, manipulative or falsified information that is deliberately designed to mislead people, is hard to detect. So is its amplification that can be powered by all sorts of stakeholders, young people included, and arguably explains the perceived novelty and virality of the “fake news” phenomenon. Not least since disinformation is often a mix of credible, biased and false information – or a selection of facts presented to support a false narrative. Education is necessary to deal with this complicated issue, but education is not a quick fix (Nygren, 2019), and implementing digital tools to support citizens may hold special challenges. Introducing a professional tool for fact-checking in education may have little effect if the tool is not understood or found useless by teachers and students. Therefore, it is central to understand better how teachers view the problems of disinformation and perceive how a digital tool designed to fact-check multimodal information may be

helpful in education. Additionally, considering how context matters for teaching and learning, we find it important to collect teachers' views across cultural borders to support a design process that rises to the challenge of the transborder nature of the Internet (Frau-Meigs, 2019a), as its contents is not hindered by natural frontiers or national sovereignty.

In this study we asked teachers in France, Romania, Spain and Sweden to test and reflect upon the usefulness of a digital fact-checking tool, InVID, in teaching. InVID is a plug-in that can be downloaded by users to check images and videos. It offers several functionalities, like image similarity, image reverse search, metadata analysis, video keyframes automated extraction and image forensics. We analyse teacher responses in relation to their views on disinformation in society and schooling in light of theories of media literacy. A first set of questions dealt with their understanding of the “fake news” concept, perceived incidence of the phenomenon, possible effects, and prior knowledge and use of similar tools. A second set of questions was focused on the fact-checking tool itself (see template of focus group in appendix).

To process and interpret the results we drew on a combination of theories from media and information literacy (MIL), civic online reasoning and education. MIL as “transliteracy” (Frau-Meigs, 2012) was used to articulate the multi-media dimension of fake news (across mass and social media) and the trans-domain convergence of information as computation (data), communication (media) and curation (documents). Transliteracy in MIL combines the agency and autonomy of the user with the capacity to navigate and discriminate online sources, especially when dealing with (meta)data and media. Transliteracy tends to focus on interactions between users and screens. As such, it ties in a complementary manner with online reasoning as it looks for heuristics and technocognition to make sense of human interactions with online content,

particularly apt in the phenomenon of fake news. Additionally, education theories about curricular processes were brought in, to understand teachers' views of their scope of action in "the arena of realizations" (Lundgren, 1990). Theories of Goodlad (1979) and Klafki (1995) underpin how teaching and learning is a complex matter where teachers reflections from practice are central. These approaches converge in their emphasis on the need for teacher agency, and their legitimacy in identifying what needs to be done and how (Lindensjö & Lundgren, 2000).

Previous research

The importance of media and information literacy (MIL) has been emphasised by scholars in theory and practice (Frau-Meigs, 2019b; Kahne & Bowyer, 2017; Mihailidis, 2018). MIL has risen in public policy decisions all over Europe, especially spurred by the 2015 wave of terrorist attacks followed by the 2016 wave of "fake news", where propaganda and other information troubles lead politicians to realise the threat to democracy posed by lack of MIL (Frau-Meigs et al, 2017). Consequently MIL has become an indispensable part of the new public policies introduced and aligned with the democratic standards of the EU, as the European Directive of Audiovisual Media Services, of 2018 makes it an obligation for states to implement it and digital platforms to support it. However, public policies differ a lot across Europe, affecting the arena of formulations, from school curricula and resources that fully incorporate MIL (France, Sweden) to others that tend to consider it as a second curriculum (Romania, Spain) and leave it to non-school actors in civil society or the private sector.

In relation to the arena of formulations, the approach of Hallin and Mancini can cast a light on the media literacy situation. According to Hallin and Mancini (2004, revised 2011), there are four main models for media policy: "the Polarised pluralist model",

specific of the Mediterranean countries (among which, France and Spain), the “Democratic corporatist model”, characteristic of the North/Central European countries (i.e. Sweden), the “Liberal model” that is being developed in the North Atlantic countries, to which a fourth model, that is the “Hybrid model” of post communist countries has been added (Romania is a typical example); the East-European countries are arguably hybrid models, as they have experienced recent political and institutional reforms from the authoritarian to the multi-party parliamentary system, free elections and the rule of law, as well as liberalisation of economy. The four dimensions across which Hallin and Mancini (2004; 2011) built their theory are related to the structure of the media market, political parallelism (that is how much political oriented media are in each country), professionalization of the journalistic field, and the role of the state.

Matović, Juraitė & Gutiérrez (Matović, Juraitė, & Gutiérrez, 2017) have added a fifth dimension, MIL, to Hallin and Mancini’s model. The additional criteria they consider for the validity of this fifth dimension are: the level of professionalization of teachers, the degree of state intervention, the presence of MIL in the school curricula and the role of actors outside schools (civil society) as well as the presence and acceptance of ICTs in schools. This fifth dimension thus incorporates the arena of formulations and the arena of realizations, to provide country profiles for media literacy implementation.

Research on teachers’ views, affecting the arena of realizations, is less considered and yet they have to incorporate the multiple levels of interplay between school managers, teachers and society at large (especially parents and families, as disinformation seems to be partly embedded at home). Teachers’ views on news may affect their teaching (Clark, Schmeichel, & Garrett, 2020) and what teachers do in the classroom may definitely impact students abilities to navigate misinformation in updated ways (McGrew, 2020; McGrew, Smith, Breakstone, Ortega, & Wineburg, 2019). However,

very interested teachers may also struggle to teach students to evaluate digital news (McGrew, 2020). Teaching students to determine credibility of digital news has been noted to hold multiple challenges, not least students lack of media and information literacy (Nygren, Folkeryd, Liberg, & Guath, 2020).

This problem can be linked to notions about how hard it is to navigate information in a post-truth era (Lewandowsky et al., 2017). Not least young people growing up in digital era have a hard time separating credible news from misleading information (Breakstone et al., 2019; Ku et al., 2019; McGrew, Breakstone, Ortega, Smith, & Wineburg, 2018; Nygren & Guath, 2019). Navigation in clever ways needs to be supported by digital resources. Experts determining credibility of news use digital tools to aid them and citizens could also benefit from this (Wineburg & McGrew, in press). In light of previous research it is evident that citizens need cognitive abilities adapted to technology to navigate information in an era of disinformation (Lewandowsky et al., 2017; Rich, 2018). However, previous research has not investigated to what extent digital tools can be used to support teachers and students. Previous research has noted that teachers views are essential when implementing new technology in classrooms (Heath, 2017; Sugar, Crawley, & Fine, 2004). Teachers may have different priorities which impacts how and if they use digital tools to support learning (Cuban, Kirkpatrick, & Peck, 2016; Kurt, 2012).

Noting how teachers' perspectives are key when implementing new technology in classrooms and how their perceptions of news credibility may influence their teaching, we find it is central to get their views on news and disinformation, and potentials and pitfalls with using a tool for professional fact-checkers in classrooms. Taking into account the various European models for policy integration (Polarised pluralist,

Democratic corporatist and Hybrid) may also enable comparisons across cultures and point to alternative cross-country solutions.

Digital tools in teaching

Today it is possible for almost anyone to produce and share texts, images and videos hard to be fact-checked for people and machines (Kim et al., 2018; Neekhara et al., 2020). New media and modern journalism can support democracy but at the same time they facilitate the spread of exaggerations and lies in various ways (Del Vicario et al., 2016; Guess, Nagler, & Tucker, 2019; Vosoughi, Roy, & Aral, 2018). Noting how in many cases it is not possible for people to separate a fake video from a credible video calls for a combined approach where MIL develops critical thinking with the support of a technological artefact that is not just a simple tool, as MIL tends to question the strictly operational and instrumental approach to education, preferring devices to be nested in sense-making practices and tasks (Frau-Meigs, 2013, 2019b; Nygren, 2019).

Transliteracy accommodates this tool entry in the case of InVID as the plug-in has embedded cognitive processes in its multiple functionalities. InVID is designed to make it possible to (a) retrieve metadata about videos and images, (b) fragment videos into key-frames to allow image-similarity search in other contexts, (c) perform advanced search queries on Twitter, Facebook and YouTube, (d) compare the efficiency of search engines (Google, Yandex, Baidu...), (e) look inside images through a magnifying lens, and (f) analyse an image with forensic filters (to detect alterations within its structure such as quantization, frequencies, colours, pixel coherence). All these itemized functionalities correspond to cognitive processes such as retrieve, fragment, search laterally, compare across data sets, and apply filters.

Such an approach can be used against the spread of misinformation, “combined with a cognitively inspired program to educate the public and improve journalistic practices” (Lewandowsky et al., 2017, p. 362). Using digital tools when corroborating information is also emphasized in theories of civic online reasoning (McGrew, Ortega, Breakstone, & Wineburg, 2017). It underscores the high potential for developing updated digital heuristics, in the teaching body as much as in the student body.

In design-based research it has been noted how it is essential, and also a research challenge, to have a dialogue with teachers about information and communication technology in education when trying to solve real world problems (Akkerman, Bronkhorst, & Zitter, 2013). Thus, new technology needs to be carefully implemented with greater attention paid to teachers’ views and to teachers’ interactions with cognitive artefacts.

Methodology: design-based research

With inspiration from design-based research, we find it important to study how teachers perceive the tool in light of their experiences. In line with most design-based research (also known as design research, design study and design experiments), we investigate the possibilities for educational improvement with an aim to develop new methods and materials useful in the complexity of everyday classroom practices (Anderson & Shattuck, 2012; Kelly, 2004). Design-based research has been criticized for being a top down process where interests of researchers are prioritized over teachers’ and students interests (Engeström, 2008). To deal with this issue, we include teachers in the design process and discuss their views in this paper. We also designed a “tranlisterate situation”, as we asked them to test the tool and to respond to their interactions with the tool with an accompanying lesson plan on disinformation and attendant activities, implying the trans-domain areas of curation (documents), computation (data) and

communication (media). We expected to see their interactions and constraints as they had to deal with a new device, as each cognitive act is affected by the level of agency and finality of the specific activity (Delamotte, Liquète et Frau-Meigs, 2014).

Interviewing teachers and having them test the tool makes it possible for us to pay attention to their wisdom of practice (Shulman, 2004). Having professional teachers perspectives on disinformation and the digital tool for fact-checking can provide us with important insights in the process of working collegially with the aim to “test and build theories of teaching and learning, and produce instructional tools that survive the challenges of everyday practice” (Shavelson, Phillips, Towne, & Feuer, 2003). Testing and developing digital tools that may hold new dimensions and practices is often at the core of design-based research (Anderson & Shattuck, 2012).

In this paper, we present an early and crucial stage in a design process moving towards classroom interventions. The meetings with teachers will be followed by design iterations where the methods and materials will be further developed in collaborative processes, tested in classroom interventions and evaluated for further developments, and finally, if found useful in the complexity of practice, shared with teachers in open-access. However, this all starts (and ends) with the key actors in education, the teachers.

The complexity of implementation

Our meetings with teachers are guided by an analytical framework inspired by Goodlad (1979) and his description of implementation as a matter of multiple levels of curricula in constant interplay with each other and society at large (Goodlad, 1979). We perceive implementation of international guidelines (such as the Audiovisual Media Services Directive (AVMS) in the case of media education) as far more than just a top-down process (Nygren, 2016). It is a matter of interaction with transactions, interpretations or the lack thereof. International ideas formulated in multiple ideological curricula may be

included in formal curricula in different countries and implemented in the classrooms by teachers in diverse ways, or not all. Bottom up influences are also part of this process, previously described as two levels of curriculum, one where the guidelines are formulated (arena of formulations) and one where teaching is carried out (arena of realization) (Lundgren, 1990). It is important to note in detail what teachers see as relevant regarding contents, methods and goals of education in reforms formulated since they are central on the level where teaching and learning happens in schools (Klafki, 1995). In parallel, it is important that teachers are given legitimacy in identifying what needs and can be done (Lindensjö & Lundgren, 2000).

Accordingly, we decided to go to teachers to get their perspectives on disinformation in society, their views on the guidelines for MIL they receive and if a tool for debunking fake news may be used in education to support students in the arena of realizations. Bearing in mind the central role teachers play to make learning happen, we focus on the arena of realizations and place this in relation to international formulations about education against disinformation and teachers' views of disinformation in society.

Sample

To safeguard a variety of input in the process we decided to get contributions from teachers in very different settings. The sample is non-random and all participants volunteered to participate in focus groups about misinformation and media literacy. We acknowledge that participants may be more interested in media literacy than other teachers may be since they agreed to participate. Participants in Romania (N=9) were all teachers in upper-secondary schools across Bucharest teaching history, geography, psychology, informatics and mother tongue education. All schools are non-vocational schools, media literacy not being part of their curricula. Teachers in Sweden (N=9) were

also teachers in upper-secondary schools from different schools in Uppsala teaching civics, history, geography, religious studies, informatics. The range of schools have many students with multicultural backgrounds and students come from a mix of families with highly educated middle class parents as well as parents with very little education. Teachers in France (N=9) were all working in different school documentation centres in Toulouse and its outer region, as librarians in France are entrusted with media literacy together with partner teachers in history, technology and languages. In Spain (N=7) teachers come from different university departments in Madrid training teachers in critical pedagogies, ICT in education, communication, digital culture, public relations and information science. Overall, our sample consisted of 12 men and 22 women. Thus, the range of perspectives stretch from in-service secondary and upper-secondary classrooms in France, Sweden and Romania to initial teacher training centres in Spain.

Focus group interviews and data collection

To understand teachers' views and understanding of the role of digital tools in developing media literacy aptitudes for their students, we used focus group interviews. Focus groups have been proven to be an effective method to explore "people's experiences, opinions, wishes and concerns", while allowing them to "pursue their own priorities, in their own terms, in their own vocabulary" (Kitzinger, Barbour, & Barbour, 1999, p. 5). In the MIL field, this method is embraced more and more as an in-depth method of investigation, as "there is a strong trend towards increasingly in-depth qualitative methods" in the field (Livingstone, Van Couvering, & Thumim, 2005, p. 58). One specific feature of focus groups is that it helps reveal groups consensus, where it exists, while at the same time offering insights into not only what participants think,

but also why they think in that particular way (Cyr, 2016). However, sometimes consensus might be socially desirably driven, therefore the experience of the researcher conducting the focus group is key in addressing the pitfalls of the method.

Additionally, working with artefacts in interviews may elicit important perspectives, especially in a context where materials and methods for teaching is considered (Barton, 2015). To stimulate conversation and get direct feedback we had teachers use and discuss the digital tool designed for fact checkers, InVID. In the focus group interviews, we used a fixed set of questions across all groups. This semi-structured approach made it possible for each group to discuss questions about news consumption, fake news, fact-checking and test of the InVID tool as part of the conversation while also inquiring about their perception of MIL and their experiences with MIL in their institutions. Questions were designed to get teachers' perspectives on the surrounding society, the arena of formulations and especially map out a spectrum of views from the arena of realizations.

The focus groups took place in February 2020, a neutral moment in the year just before the COVID-19 extreme infodemics. They met in educational settings and lasted between 66 and 90 minutes. Conversations were directed by experienced researchers and recorded by digital audio recorders. All participation was voluntary and participants gave written consent about their willingness to participate as anonymous respondents, in line with ethical recommendations of each country.

Results

The teachers in four different countries overall showed acute awareness of their own news consumptions patterns as well as of their students' and a lucid perception of the incidence of the "fake news" phenomenon and its possible effects.

Teachers' news consumption in a society of disinformation

News consumption patterns have dramatically changed in the last decade, especially for the younger generations. They tend to differ based on personal characteristics and interests, and also from one cultural context to the next. The patterns of news consumption of teachers in France, Romania, Spain and Sweden are no exception, and we could perceive different levels of interest in social and political news among them. Generally speaking, teachers from all countries are interested in following news on various media outlets, with Spanish and Swedish teachers specifically mentioning this being very important to them, stating for instance how “it would be embarrassing as a social studies teacher not to follow the news every day” (Sweden). Romanian teachers are less interested in general (with some “confessing” they do not follow news on a daily basis), but spontaneously mentioning, as important, to follow professional news (that is news from the education field). Their Swedish counterparts may avoid following news covering school issues, finding the debate ignorant and that the “school debate is never reality-based”.

As far as the type of media outlets, there are some notable differences between and within the four contexts. Romanian teachers prefer rather traditional outlets, TV being their first choice, followed by online sources, rarely social media, with patterns of incidental news exposure or ‘news-find-me’ phenomenon. Somewhat similarly, teachers from Spain prefer more “traditional” media, mainly radio and online press, and very rarely social media. In Sweden, teachers also prefer traditional and well-established print media in combination with public service radio, TV and online press, but also mention podcasts as important. Podcasts from traditional media outlets are equally important for teachers in France. In contrast to teachers in other countries, the French teachers also follow news and updates on social media (Twitter, Facebook,

Instagram, but also Snapchat and YouTube for younger ones). To keep up with the habits of the students, they add this to the many traditional outlets that they follow. As a particularity for this country, none of the interviewees watches news on TV.

Teachers views on mis- and disinformation

In their understanding of the “fake news” concept, informants from all countries agree that this is difficult to define, as “the vocabulary shifts even without us noticing it” (France). Some mention various avatars of “fake news”, such as “partially invented news”, out of context news, distorted information (Romania), “camouflaging informational realities”, “falsehood and manipulation” (Spain). Teachers from Romania, Spain and Sweden discuss intentions behind news as important in delimiting concepts. Spaniards and Swedes consider that only news constructed with a clear intention to deceive could fall under the umbrella of “fake news”: “when we talk about news or false information we are obviously talking about information that has an interest” (Spain); “Fake news is strategical and deliberate with a hidden intention. The publisher knows it is false, this is true for disinformation. Misinformation feels more random and accidental based on carelessness or ignorance” (Sweden). Romanians, on the other hand, seem to accept both misinformation and disinformation as “fake news”, as “both [mis- and dis- information] are fake news. Nobody knows anymore what the intention was” (Romania).

In Romania and Spain, “fake news” is spontaneously linked by the respondents to the idea of manipulation. Biased news is rather considered a form of misinformation in Sweden, “you only see one angle, it goes too fast or you come in without proper background information [or] you may not have the correct filter to be able to read since you have an incorrect road map. In this case it doesn’t have to be strategic” (Sweden), but hyper-partisan news are only mentioned as a form of fake news in Romania: “It is

fake news, as it distorts information to make it advantageous for someone.” (Romania). However, during the discussion respondents concluded that hyper-partisan news should not ultimately be considered “fake news” because there would be no more “normal news” in this case, referring to the highly polarized media environment in Romania. Parody and satire as types of fake news are also mentioned as possible forms of fake news in Romania, but only if not perceived as intended by the audience. Otherwise, parody and satire are not seen as “fake news” but rather associated with it (Nielsen & Graves, 2017; Tandoc Jr, Lim, & Ling, 2018).

Concerning the prevalence of fake news in society, respondents from France and Romania consider its incidence as “very high”, with Romanians offering estimates of 80% of all news, and superlative expressions from French teachers (“it is so enormous in my institution that I don’t pay attention outside anymore”). In Spain, respondents say they are “indeed exposed to false news every day”. Responses from Sweden are more nuanced, the teachers considering that (accidental) misinformation is more common (especially due to the pressure of time), disinformation not so much. Additionally, they consider that people are more aware of the phenomenon, and therefore new phenomena such as troll factories, for example, are more and more reported nowadays.

The effects of the “fake news” phenomenon are discussed at both personal and society level. People from Romania mostly focus on the personal level, suggesting implications for real life acting and implications for personal health, with a discussion about anti-vaccination public debate: “I have a student who participates in all public protests; he got beaten by the police, because he thought... I tried to explain things, that the truth is always in between, but my explanations were in vain, as he kept going to all public gatherings.”; “And all the stories about vaccination... I thought these stories were the most dangerous ones for the population” (Romania). Also at personal level, the French

teachers discuss a general feeling of anxiety about the incapacity to escape the phenomenon: “they create a breach for fear as in the case of rumour”; “there is an omnipresence of this anguish, no means to escape it” (France). Spaniards are mostly concerned with reputation effects at both individual and society level, considering that fake news affects reputation of “individuals, groups, or even the media” (Spain), while Swedes talk about altering personal or social world views, especially related to events reported in news: “Hard to get a fact based world view. Not fake news but biases and sections of focus is a great problem, perhaps greater than fake news” (Sweden).

Teachers’ views on MIL and ways to fight disinformation

About ways to fight disinformation, interviewees from Romania and Spain mention the importance of media education, echoed by the role of developing critical thinking in France and Spain, and better journalism in Spain and Sweden. Additionally, legislative measures are seen as a possible solution in Romania, and developing an active state of vigilance by raising awareness in France

Teachers from all countries also highlighted the need to improve media and information literacy (MIL) for both teachers and students. French and Spanish teachers are especially concerned about this issue. Spanish teachers identified the lack of visual and audio-visual literacy in education in schools as a central problem in society plagued by multimodal disinformation. French teachers, in particular, criticize the role of the administration in this lack of training, and are also concerned about the lack of awareness of the need to use these tools at school, for instance stating that “When I ask for tools, I am told that they are secondary, that there is no time”. This is an obstacle to the search and retrieval of information for French teachers. Furthermore, they emphasize that “media education is not well dispensed”, which hinders adequate

training in this area by teachers (France). As the Romanian teachers affirm, the tool is useful in some contexts, but what is most relevant is the development of critical thinking skills. Without the ability to question the information received, no tool will be useful. In the Swedish context, where teachers found disinformation as less of a problem, the importance of MIL was discussed primarily as a matter of critical thinking and of students not following the news as a habit. Teachers expressed concerns that young people do not learn from their parents to follow the news anymore, making them an easy target of misinformation.

Teachers' views on INVID as a fact-checking tool in education

Usefulness

In terms of tool perception, InVID is perceived by teachers in all countries as a useful cognitive artefact for professionals, but not necessarily for the general public or youth in schools. For instance Spanish teachers stated that InVID may be useful for professionals in education, communication and journalism and the Romanian teachers noted that InVID can be used in different professional fields: “politics, journalism, but also anthropologists, psychologists, teachers, statisticians” may find it useful.

Participating teachers had little or no previous experience of using digital fact-checking tools. Prior experience of using fact-checking tools was entirely absent in Romania, very limited in Sweden (one teacher mentions TinEye), and in Spain (one teacher mentions Google reverse image search) and somewhat limited in France (where some teachers mention TinEye and fact-checking sites). French teachers found a number of difficulties in using the tool at the junior educational level: “I don’t see myself doing it at my junior high”. It is a tool that requires initial training before using it in schools: “It would be necessary to have media education ... Establish a real continuity along the

curriculum” (France). Swedish teachers stated that clearer guidance is needed to adapt the tool to teaching before it can be used in this field. With the current design, Swedish teachers found that it may be used as an artefact highlighting how professional journalists today have to work very hard to detect fake news. “I find this tool a nice digital environment to display to students the complexity of journalists face today to fact-check information. Just letting students see a tool like this may be good for many students [to see that] this is for real!”

When discussing the usefulness of InVID, Romanian teachers focused on how it could help their students fact check misleading information, and also as a means to help young people cope with depression: “I think of the young girls, and their depression caused by Instagram pictures. Seeing all the pictures currently promoted on Instagram, all young girls dream of looking like that. If they find out that it was not real, that the picture [...] was altered in Photoshop, that they starved for nothing. [...] Clearly, the tool has features related to images and videos, and it is clearly helpful in these kinds of contexts” (Romania). Swedish teachers also discussed usefulness from the students’ point of view and found the tool “interesting but hard to understand” underscoring how “students will find this super hard to use”. Teachers in Sweden stated that “we as teachers need to show students this is what you can do” if they should be able to use it in the current design.

The Spanish teachers stated that they would only use it for specific cases, but not to obtain information on a daily basis. In contrast, French, Romanian and Swedish teachers showed interest in using the tool in the future teaching, provided some improvements are incorporated. Romanian teachers found it “too complicated, but would [try to] use it” in classroom despite the complexity of the tool. Teachers in Romania found that InVID in the current design should preferably be introduced by an expert, which may

also “matter a lot for [students] motivation to use it”. Among French teachers, the cognitive tool is also perceived to be “a good tool for popular education associations and for the police”. French, Romanian and Swedish teachers highlighted the need to match the tool to content in schools and disciplines, and Romanian teachers also proposed developing an app for students to use. Swedish teachers, positive to try the tool in classrooms, called for more scaffolds for teachers and students. One teacher stated that “I would personally need more instructions like: 1 do this, 2 do this, 3 do this” and other teachers called for more simple instructions and examples for students. It could also be useful to fact-check students’ biased news from YouTube and when they come into the classroom with biased or false news from areas of conflict (Sweden).

Adapting the tool to the arena of realizations

In relation to the improvements that the tool would require to be useful in classrooms, the French, Romanian, Spanish and Swedish teachers commented both on the limitations of InVID for analysing texts, and on the information that the tool returns once the news analysis has been carried out. Some aspects that could be added are a glossary, a discussion box (chatbot), error messages and discussions with the developers of the plugin, and the inclusion of a soundtrack in the videos (France). Romanian teachers suggested that it could be developed into a mobile app “[...] because, you know, the kids, they are always on their phones, and rarely in front of a computer. If it were available on smartphone, then it might get interesting, they might be tempted to click and click, and to discover more” (Romania). Furthermore, they emphasize that more practice examples should be added, since having “more practice examples would help them [the kids] to be more thorough, more organized, to value quality” (Romania). This is also highlighted by a teacher in Sweden who found “interactive [one of the sections of the plug-in] to be useful with examples. This was interesting and also

instructive with fixed examples to engage with.” Along these lines, another teacher stated that ““if you give students a set of carefully selected images to do forensic [one of InVID’s functionalities] on they should be able to use the tool for this and make some sense out of the analysis, but just going to ordinary current news seems too difficult. Ambiguity is a great challenge in non-curated digital news feeds. It would of course be great to have students dig into the most current but this is hard, they may end up with nothing if they do the search themselves.”

In sum, teachers from different countries agree that the tool should be improved to facilitate its use, improve its usability, make changes that facilitate its use by young people and provide guidelines for adapting the tool to teaching. Difficulties with navigation menus have been highlighted in all contexts, as well as limitations for text analysis, in contrast to the utility of the cognitive tool for analysing images. In a nutshell, an artefact like InVID was perceived as interesting for cognitive support, but it should provide more intuitive technical and navigation features to be more useful in education.

Discussion

The European arena of formulations is relatively favourable to media education, fact checking with the European Commission Plan of Action against disinformation (2018) underscoring the importance of MIL to safeguard citizens and the AVMS Directive making Media Education a member state obligation. When we go to the arena of realizations, we find that ideas formulated in such ideological curricula (Goodlad, 1979) come with diverse challenges of implementation in different contexts across Europe.

MIL in different European contexts – formulations disconnected from realizations

Teachers' views, stemming from the arena of realizations, reflect elements of Hallin and Mancini's model as revisited by Matović, Juraitė and Gutiérrez for MIL. It is evident that teachers live in countries with more or less support when educating students to become critical thinkers able to navigate in new digital environments. In our sample, Spain is part of polarised pluralist model as is France (though the latter is borderline with the democratic corporatist model), Sweden is part of democratic corporatist model and Romania pertains to the hybrid model. Sweden and Romania appear to be at the two extreme poles, in terms of realizations, while France and Spain offer mitigated situations.

Perspectives of Romanian teachers' highlight how the media situation makes it difficult for them and their students to follow credible news. They also identify how they have little resources to support students' media literacy. This is in sharp contrast to the arena of realizations in Sweden where teachers find the media situation in society manageable and in education they find a lot of support in the national curricula for MIL. In Sweden, most students also have one-to-one computers making the ICT situation better than in many other countries. This contrast highlights how students with some of the greatest challenges of disinformation may be provided with the least support from education to counter this, while the opposite seem to be true for Swedish students. This does however not mean that Swedish students are skilled at navigating digital news. Previous research actually points to the opposite. Especially over-confident students in Sweden may struggle to separate credible news from disinformation (Nygren & Guath, 2019). However, the educational challenge seems far greater in the arena of realizations in Romania than in Sweden.

The development of MIL in France and Spain seem to hold more possibilities than in Romania but less than in Sweden. This reflects the polarised pluralist model where the level of professionalization of teachers is key to their sense of competence to address the issue of disinformation and the degree of state intervention is expected to play an important role for guidelines and tool provision. Also these teachers see media literacy as an activity that can be shared outside schools, by popular education CSOs or journalists and other actors. This can explain why they feel limited in their realizations because of lack of support from their authorities and from lack of initial or continuous training in using digital tools in education. Consequently, they are not over-confident over their ability to deal with disinformation but paradoxically show a keen interest in self-training and keeping abreast of students' uses and practices, as if to compensate, at their level of realizations, the gaps they feel in their educational system.

Teachers also express concerns about a social and digital divide between students with different backgrounds. To take on this challenge teachers in France have started following news in the social media outlets where students may find information and disinformation. They see great challenges and call for more support especially for students with poor socio-economic backgrounds. Swedish teachers see a similar challenge today when their students do not live with parents reading the morning newspaper, passing on constructive news habits to the younger generation. Teachers note how the digital has made some productive habits less visible and schools need to make it evident where and how to find reliable news.

The lack of presence of MIL in the school curricula is bemoaned, as is the lack of teacher training in these areas, not least when it comes to visual and audio-visual information. This is especially true for teachers in contexts where teachers see disinformation as a problem not addressed in the curricula. As for the criteria by

Matovic et al, they are confirmed: the level of professionalization of teachers is perceived as needing much improvement. Teachers note the role of parents and the degree of state intervention as problematic. Especially teachers in Rumania seem to lack resources and support in the curricula. They also seem to be more restricted by national guidelines making it more difficult to add important dimensions of MIL in their teaching, when they find this necessary. In contrast, Swedish teachers seem to have more freedom to decide what to do in their classrooms and be critical towards the educational policies. Among French and Spanish teachers, they offer many perspectives on MIL activities in the arena of realizations, but they also express that they often see a lack of support from the arena of formulations. French teachers were the most explicit, in adopting a critical position when making their comments towards the educational administration – indicating that they lack some of the support that Swedish teachers may have and also that they may have more room than Romanian teachers to be critical towards the state.

In light of these results, the promotion of MIL to counter disinformation underscored in formulations by the European Commission (2018) seems to be disconnected from the arena of realizations, especially in Rumania. “Improving citizens’ media literacy to understand how to spot and fend off disinformation” (European Commision, 2018, p. 10) will need more support with a nuanced consideration about the different challenges teachers may face in different countries and contexts.

A professional tool in education to promote technocognition and transliteracy against disinformation

The technocognition of teachers regarding fact checking in digital environments did not match well with the tool designed for and used by professional fact-checkers. Without the knowledge and skills of fact-checkers, they struggled to use it and see the purpose of

what they find out when using it. As noted by Lewandowsky et al., 2017, technology and cognition need to go hand in hand to counter disinformation. Just handing the latest technology to teachers and students may not be productive in this way. Across borders, teachers consider the tool difficult to implement in its current design in education. Teachers point out several challenges when using a tool like InVID in the arena of realizations: students' and teachers' lack of training in MIL, technical difficulty of the tool, or lack of interest on the part of public administrations or the teachers themselves. Teachers' perspectives on using InVID highlights how implementation is possible and may trigger interest among students (Sun, Siklander, & Ruokamo, 2018).

Nevertheless, teachers and students seem to need hard and soft scaffolds and updated heuristics to be able to use such artefacts in constructive ways (Frau-Meigs 2019b; Nygren, Sandberg, & Vikström, 2014; Nygren & Vikström, 2013; Saye & Brush, 2004). Teachers find this new technology complicated and without much added value unless it is updated to better fit into the context of teaching and learning about disinformation.

This view needs to be considered in light of their previous lack of experience in using fact-checking tools and also in light of their relative lack of transliteracy competences, especially in the converging threads of visual media literacy and data literacy. Teachers note that using a tool like InVID comes with issues of distraction, time consuming technical problems, lack of subject specific knowledge and added stress from technology. What the teachers underscore as challenges are in line with previous research on ICTs in education (e.g. Kirschner & De Bruyckere, 2017; Nygren & Vikström, 2013).

Teachers also note the potential of fact-checking images and videos in updated ways that points to an appetite in updating their skills and knowledge in MIL. Using a tool like InVID in teaching seems to hold great potential if the tool can be redesigned to

better fit the technocognition and the transliteracy skills of diverse users. Greater usability would ask less from teachers' skills and digital expertise when using it in practice. The complexity of the tool can also be levelled out in practice by better MIL among teachers and students, with InVID being embedded in online civics and sense-making practices for digital citizenship. This should be addressed in future design cycles with classroom interventions, that will provide lesson plans on disinformation at large, with InVID as one of the featured tools for visual literacy. Like Akkerman, Bronkhorst and Zitter (2013), we confirm that dialogue with teachers about technology is essential in educational design research. It is evident that in order to face the social disruption of disinformation we need to consider multiple challenges in diverse contexts. Tools for fact-checking may be constructive to use in education, if implemented with careful considerations about technocognition and in correlation with transliteracy.

In conclusion, when asked if a tool to discredit fake news can be used in education and thus support students in their ability to function in the digital society, teachers have all responded positively, though it is still lacking in the educational systems of their countries. Teachers describe the need to improve media literacy from two perspectives: by improving the practical ability in the use of specific cognitive tools, and by reinforcing the ability to think critically and thus to differentiate true and false information.

Therefore, to study how to incorporate cognitive artefacts as means to face the social challenges of disinformation and do it successfully, technological, educational and cognitive aspects come into play—aspects that have been highlighted as essential by authors such as Lewandowsky, Ecker and Cook (2017) and Frau-Meigs (2013; 2019b).

We find that teachers identify important disconnects between the arena of formulations about how education should counter disinformation and what is possible in the arena of realizations. This may be a hindrance to building resilience to fake news at early stages, among young citizens-to-be.

References:

- Akkerman, S. F., Bronkhorst, L. H., & Zitter, I. (2013). The complexity of educational design research. *Quality & Quantity*, 47(1), 421-439.
- Anderson, T., & Shattuck, J. (2012). Design-Based Research: A Decade of Progress in Education Research? *Educational Researcher*, 41(1), 16-25. doi:10.3102/0013189x11428813
- Barton, K. C. (2015). Elicitation Techniques: Getting People to Talk About Ideas They Don't Usually Talk About. *Theory & Research in Social Education*, 43(2), 179-205. doi:10.1080/00933104.2015.1034392
- Breakstone, J., M., S., S., W., A., R., J., C., M., G., & Saavedra, A. (2019). *Students' civic online reasoning: a national portrait*. Retrieved from <https://purl.stanford.edu/gf151tb4868>
- Clark, C. H., Schmeichel, M., & Garrett, H. J. (2020). Social Studies Teacher Perceptions of News Source Credibility. *Educational Researcher*, 0013189X20909823. doi:10.3102/0013189X20909823
- Cuban, L., Kirkpatrick, H., & Peck, C. (2016). High Access and Low Use of Technologies in High School Classrooms: Explaining an Apparent Paradox. *American Educational Research Journal*, 38(4), 813-834. doi:10.3102/00028312038004813
- Cyr, J. (2016). The pitfalls and promise of focus groups as a data collection method. *Sociological methods & research*, 45(2), 231-259.
- Delamotte, E, Liquète, V. Frau-Meigs, D. (2014).« La translittératie dans les cultures de l'information : supports, contextes et modalités » *Spirale* 53, 145-156.
- de Cock Buning, M., Allen, R., Bargaoanu, A., Bechmann, A., Curran, N., Dimitrov, D., Frau-Meigs, D. . . Gniffke, K. (2018). A multi-dimensional approach to

- disinformation: Report of the independent high level group on fake news and online disinformation.
- Del Vicario, M., Bessi, A., Zollo, F., Petroni, F., Scala, A., Caldarelli, G., . . . Quattrociocchi, W. (2016). The spreading of misinformation online. *Proc Natl Acad Sci U S A*, 113(3), 554-559. doi:10.1073/pnas.1517441113
- Engeström, Y. (2008). *From design experiments to formative interventions*. Paper presented at the Proceedings of the 8th international conference on International conference for the learning sciences-Volume 1.
- European Commission, E. (2018). *Action Plan against Disinformation. Joint communication to the European parliament, the European council, the council, the European economic and social committee and the committee of the regions*. . Brussels Retrieved from https://ec.europa.eu/information_society/newsroom/image/document/2018-49/action_plan_against_disinformation_26A2EA85-DE63-03C0-25A096932DAB1F95_55952.pdf
- Frau-Meigs, D. (2019a). Information Disorders: Risks and Opportunities for Digital Media and Information Literacy? *Medijske studije*, 10(19), 10-28.
- Frau-Meigs, D. (2019b). A curriculum for MIL teaching and learning, in U. Carlsson (ed), *Understanding MIL in the Digital Age, a question of democracy*. Goteborg: UNESCO, 57-66
- Frau-Meigs, D. (2013). Transliteracy: sense-making mechanisms for establishing e-presence, U. Carlsson (ed) special issue on « Media and Information Literacy and intercultural dialogue » Goteborg, Clearinghouse, 175-189.
- Frau-Meigs, D (2012).« Transliteracy as the new research horizon for media and information literacy » *Media Studies*, Special issue on Critical insights in European media literacy research and policy 2 : 5-25.
- Frau-Meigs, D, Velez, I and Michel J (eds) (2017). *Public Policies in Media and Information Literacy in Europe: Cross country Comparisons*. London: Routledge.
- García Lozano, M., Brynielsson, J., Franke, U., Rosell, M., Tjörnhammar, E., Varga, S., & Vlassov, V. (2020). Veracity assessment of online data. *Decision Support Systems*, 129, 113132. doi:<https://doi.org/10.1016/j.dss.2019.113132>

- Goodlad, J. I. (1979). *Curriculum Inquiry. The Study of Curriculum Practice*. New York: McGraw Hill.
- Guess, A., Nagler, J., & Tucker, J. (2019). Less than you think: Prevalence and predictors of fake news dissemination on Facebook. *Science advances*, 5(1), eaau4586.
- Hallin, D. C., & Mancini, P. (2011). *Comparing media systems beyond the Western world*: Cambridge University Press.
- Heath, M. K. (2017). Teacher-Initiated One-to-One Technology Initiatives: How Teacher Self-Efficacy and Beliefs Help Overcome Barrier Thresholds to Implementation. *Computers in the Schools*, 34(1-2), 88-106. doi:10.1080/07380569.2017.1305879
- Kahne, J., & Bowyer, B. (2017). Educating for democracy in a partisan age: Confronting the challenges of motivated reasoning and misinformation. *American Educational Research Journal*, 54(1), 3-34.
- Kelly, A. (2004). Design research in education: Yes, but is it methodological? *The journal of the learning sciences*, 13(1), 115-128.
- Kim, H., Garrido, P., Tewari, A., Xu, W., Thies, J., Nießner, M., . . . Theobalt, C. (2018). Deep Video Portraits. *arXiv preprint arXiv:1805.11714*.
- Kirschner, P. A., & De Bruyckere, P. (2017). The myths of the digital native and the multitasker. *Teaching and Teacher Education*, 67, 135-142.
- Kitzinger, J., Barbour, R., & Barbour, R. (1999). *Introduction: the challenge and promise of focus groups*. London: Sage.
- Klafki, W. (1995). Didactic analysis as the core of preparation of instruction (Didaktische Analyse als Kern der Unterrichtsvorbereitung). *Journal of Curriculum Studies*, 27(1), 13-30. doi:10.1080/0022027950270103
- Ku, K. Y., Kong, Q., Song, Y., Deng, L., Kang, Y., & Hu, A. (2019). What predicts adolescents' critical thinking about real-life news? The roles of social media news consumption and news media literacy. *Thinking Skills and Creativity*, 33, 100570.
- Kurt, S. (2012). How do teachers prioritize the adoption of technology in the classroom? *Teachers and Teaching*, 18(2), 217-231. doi:10.1080/13540602.2012.632271

- Lewandowsky, S., Ecker, U. K., & Cook, J. (2017). Beyond misinformation: Understanding and coping with the “post-truth” era. *Journal of Applied Research in Memory and Cognition*, 6(4), 353-369.
- Lindensjö, B., & Lundgren, U. P. (2000). *Utbildningsreformer och politisk styrning*: HLS förlag.
- Livingstone, S., Van Couvering, E., & Thumim, N. (2005). Adult media literacy: A review of the research literature. London: LSE.
- Lundgren, U. P. (1990). Educational policymaking, decentralisation and evaluation. In M. Granheim, M. Kogan, & U. P. Lundgren (Eds.), *Evaluation as policymaking: Introducing evaluation into a national decentralised education system* (pp. 23-41). London: Jessica Kingsley Publishers.
- Matović, M., Juraitė, K., & Gutiérrez, A. (2017). The role of non-governmental actors in media and information literacy: a comparative media systems perspective. In Frau-Meigs, D, Velez, I and Michel J (eds). *Public Policies in Media and Information Literacy in Europe: Cross country Comparisons*, Routledge (pp. 159-193),
- McGrew, S. (2020). Learning to evaluate: An intervention in civic online reasoning. *Computers & Education*, 145, 103711. doi:<https://doi.org/10.1016/j.compedu.2019.103711>
- McGrew, S., Breakstone, J., Ortega, T., Smith, M., & Wineburg, S. (2018). Can students evaluate online sources? Learning from assessments of civic online reasoning. *Theory & Research in Social Education*, 1-29.
- McGrew, S., Ortega, T., Breakstone, J., & Wineburg, S. (2017). The Challenge That's Bigger than Fake News: Civic Reasoning in a Social Media Environment. *American Educator*, 41(3), 4-9.
- McGrew, S., Smith, M., Breakstone, J., Ortega, T., & Wineburg, S. (2019). Improving university students' web savvy: An intervention study. *British Journal of Educational Psychology*.
- Mihailidis, P. (2018). Civic media literacies: re-Imagining engagement for civic intentionality. *Learning, Media and Technology*, 43(2), 152-164. doi:10.1080/17439884.2018.1428623

- Neekhara, P., Hussain, S., Jere, M., Koushanfar, F., & McAuley, J. (2020). Adversarial Deepfakes: Evaluating Vulnerability of Deepfake Detectors to Adversarial Examples. Retrieved from <https://arxiv.org/pdf/2002.12749>
- Nielsen, R. K., & Graves, L. (2017). "News you don't believe": Audience perspectives on fake news.
- Nygren, T. (2016). UNESCO Teaches History: Implementing International Understanding in Sweden. In *A History of UNESCO*, Springer (pp. 201-230)
- Nygren, T. (2019). Media and Information Literacy in News Feeds and Education. In U. Carlsson (Ed.), *Understanding Media and Information Literacy (MIL) in the Digital Age*. University of Gothenburg, UNESCO.
- Nygren, T., Folkeryd, J., Liberg, C., & Guath, M. (2020). *Students assessing digital news and misinformation* Paper presented at the MISDOOM 2020, 2nd Multidisciplinary International Symposium on Disinformation in Open Online Media, Leiden.
- Nygren, T., & Guath, M. (2019). Swedish teenagers' difficulties and abilities to determine digital news credibility. *Nordicom review*, 40(1), 23-42.
- Nygren, T., Sandberg, K., & Vikström, L. (2014). Digitala primärkällor i historieundervisningen: En utmaning för elevers historiska tänkande och historiska empati. *Nordidactica: Journal of Humanities and Social Science Education*(2), 208-245.
- Nygren, T., & Vikström, L. (2013). Treading old paths in new ways: upper secondary students using a digital tool of the professional historian. *Education Sciences*, 3(1), 50-73.
- Rich, M. D. (2018). *Truth decay: An initial exploration of the diminishing role of facts and analysis in American public life*: Rand Corporation.
- Saye, J. W., & Brush, T. (2004). Scaffolding Problem-Based Teaching in a Traditional Social Studies Classroom. *Theory & Research in Social Education*, 32(3), 349-378. doi:10.1080/00933104.2004.10473259
- Shavelson, R. J., Phillips, D. C., Towne, L., & Feuer, M. J. (2003). On the science of education design studies. *Educational Researcher*, 32(1), 25-28.
- Shulman, L. S. (2004). *The wisdom of practice: Essays on teaching, learning, and learning to teach* (Vol. 8): Jossey-Bass Inc Pub.

- Sugar, W., Crawley, F., & Fine, B. (2004). Examining teachers' decisions to adopt new technology. *Educational Technology & Society*, 7(4), 201-213.
- Sun, L., Siklander, P., & Ruokamo, H. (2018). *How to trigger students' interest in digital learning environments: A systematic literature review*. Paper presented at the Seminar. net.
- Tandoc Jr, E. C., Lim, Z. W., & Ling, R. (2018). Defining “fake news” A typology of scholarly definitions. *Digital Journalism*, 6(2), 137-153.
- Wardle, C., & Derakhshan, H. (2017). *Information Disorder: Toward an interdisciplinary framework for research and policymaking*. Strasbourg: Council of Europe Publishing.
- Wineburg, S., & McGrew, S. (in press). Lateral reading and the nature of expertise: Reading less and learning more when evaluating digital information. *Teachers College Record* in press.
- World Health Organization, W. (2020). *Responding to community spread of COVID-19: interim guidance, 7 March 2020*. Retrieved from
- Vosoughi, S., Roy, D., & Aral, S. (2018). The spread of true and false news online. *Science*, 359(6380), 1146-1151.