TransInformação

ORIGINAL

Editor
Valéria dos Santos Gouveira Martins

Conflict of interest
The authors declare they have no conflict of interests.

Received
November 10, 2023

Final version
April 11, 2024

Approved
June 27, 2024

Solutions to face and combat disinformation: proposals in scientific literature from the web of science

Soluções para enfrentar e combater a desinformação: propostas na literatura científica da Web of Science

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How to cite this article: Silva, J. E.; Muriel-Torrado, E. Solutions to face and combat disinformation: proposals in scientific literature from the web of science. *Transinformação*, v. 37, e2510287, 2025. https://doi.org/10.1590/2318-0889202537e2510287

Abstract

This study examines the proliferation of false information within the context of post-truth and a society shaped by disinformation. The research question explores the potential answers in the scientific literature for addressing and combating disinformation. The study aimed to present solutions from Web of Science scientific literature for addressing and combating disinformation. As for the methodological procedures, the study is characterized as a bibliographical, exploratory research, with a qualitative and quantitative approach, as well as the use of content analysis. In addition, categorization is used to respond to the third specific purpose, with 289 scientific articles meeting the following requirements: (a) having an abstract and keywords; (b) identifying a solution to combat disinformation; (c) not being duplicated. As for the proposals, 340 solutions were identified, and 42 articles were obtained with more than one type of solution; we also observed the presence of 23 proposed solutions with higher incidence. (a) Science and scientific community; (b) States and governments; (c) Media and communications; (d) Platforms and algorithms; (e) Users and education; and (f) Others. The users and education category received the most proposals, with a considerable portion in different types of literacy. Next, there are media and communications, platforms and algorithms, science and the scientific community, and, finally, others. Therefore, this demonstrates that no single solution is universally effective or ineffective; rather, success depends on the application of a combination of Strategies tailored to the specific context.

Keywords: Disinformation. Fake news. Information. Misinformation. Post-truth. Scientific communication.

Resumo

Este estudo examina a proliferação de informações falsas no contexto da pós-verdade e de uma sociedade moldada pela desinformação. A questão de pesquisa explora as possíveis respostas presentes na literatura científica para abordar e combater a desinformação. O objetivo do estudo

foi apresentar soluções da literatura científica da Web of Science para enfrentar e combater a desinformação. Quanto aos procedimentos metodológicos, o estudo se caracteriza como uma pesquisa bibliográfica, exploratória, com abordagem qualitativa e quantitativa, além do uso de análise de conteúdo. Além disso, a categorização foi utilizada para responder ao terceiro objetivo específico, com 289 artigos científicos que atenderam aos seguintes requisitos: (a) possuir resumo e palavras-chave; (b) identificar uma solução para combater a desinformação; (c) não ser duplicado. Em relação às propostas, foram identificadas 340 soluções, e 42 artigos continham mais de um tipo de solução; também foi observada a presença de 23 propostas com maior incidência. As categorias definidas foram: (a) Ciência e comunidade científica; (b) Estados e governos; (c) Mídia e comunicações; (d) Plataformas e algoritmos; (e) Usuários e educação; e (f) Outros. A categoria Usuários e Educação recebeu o maior número de propostas, com uma parte considerável voltada para diferentes tipos de alfabetização. Em seguida, aparecem Mídia e Comunicações, Plataformas e Algoritmos, Ciência e Comunidade Científica e, por fim, Outros. Assim, isso demonstra que nenhuma solução isolada é universalmente eficaz ou ineficaz; em vez disso, o sucesso depende da aplicação de uma combinação de estratégias adaptadas ao contexto específico.

Palavras-chave: *Desinformação. Notícias falsas. Informação. Comunicação científica. Informação incorreta. Pós-verdade.*

Introduction

The 21st century is shaped in the contemporary society as being marked by significant social, economic, and political transformations. Technological advancement, improved development of algorithms, information overload, Artificial Intelligence (AI), human ignorance in evidence, lack of concern with the truth, manipulable policies, and human dependence on social media are some of the characteristics identified in the context and daily life of the contemporary century (Harari, 2018). From this, we can notice that there is an element in which the above-mentioned characteristics run through and that is part of people's habit of generating–consuming–sharing, which is information. Based on this, the idea of information as an important element in society gained notoriety after the World War II, especially due to technological development and the dissemination of computer networks. Information Science (IS) grew after the war period, mainly with the Cold War, as with the excess of originated information, the area growth became perceptible as a response to solve the problem generated by the accumulation of information, the lack of information management, hence, the need for a scientific discipline that could effectively deal with all this explosion of information and its recovery (Araújo, 2021a; Capurro; Hjorland, 2007).

Castells (1999) states that human beings are inserted in the information age, identifying information as raw material for individual and collective processes. The author defines a connected society, that is, a network society in which users quickly find themselves informatized and dialoguing through a social system with an increasing dependence on technology. Thus, an information society is recognized, in which Borges (2008) mentions that it is seen by the intense and direct use of information, knowledge and new information and communication technologies in people's daily lives. It is a society that increasingly uses computers to process data and to automate processes and access information. Kakutani (2018, p. 151) states that "the huge volume of data on the web allows people to carefully select facts, factoids, or non-facts that support their point of view, encouraging both academics and amateurs to find material to support their theories [...]". As a result of this contemporary scenario of excessive information without responsibility, the problem of disinformation arises. In order to facilitate the proliferation of the disinformation process, the larger context of this is the development of the post-truth phenomenon.

Post-truth is a phenomenon that has been developed in a scenario where the truth does not stand out from the lie; there is the use of emotions for the validity of a false discourse, as argued

by D'Ancona (2018), characterizing an emotional phenomenon that brings feelings and sensations above the truth and ignores the facts. That is, post-truth is the fundamental environment for disinformation processes and the proliferation of false information, as it experiences a society based on distrust of institutions, a crisis in traditional journalism, and a collapse of trust and simplification of thoughts (D'Ancona, 2018; Kakutani, 2018; Santaella, 2019). Disinformation is seen as demonstrably false or misleading information originated to provoke economic and social advantages to manipulate the public and cause harm to the population by threatening democratic processes, as "Disinformation erodes trust in institutions and in digital and traditional media and harms our democracies by hampering the ability of citizens to take informed decisions" (European Commission, 2018, p. 1). The term disinformation "[...] is generally used to refer to deliberate (often orchestrated) attempts to confuse or manipulate people through delivering dishonest information to them" (Organização das Nações Unidas para a Educação, a Ciência e a Cultura, 2018, p. 7).

This study aims to contribute to the scientific community by addressing challenges related to post-truth and disinformation, considering that the study product can contribute to the scientific lead on the subject. The presence of specialists and researchers in the phenomena occurring in contemporary society becomes relevant, as well as finding a measure that can mitigate, combat, or help social media users. Contemporary society lives in a scenario with the proliferation of false and distorted information, thus constituting a disinformation society. As well as, especially because of technological advances. As soon, as false information enters people's daily lives easily. Disinformation is a global problem, which influences political, social, economic, and public health issues. Therefore, the research question is: What are the possible answers in the scientific literature for facing and combating disinformation? Thus, the research purpose is to present proposed solutions for facing and combating disinformation through the Web of Science (WoS) scientific literature.

Information, disinformation, fake news, and post-truth

Information is paramount for individuals, and it is considered a utility for social interaction, that is, "information is considered the fifth need of man, preceded by air, water, food, and shelter" (Octaviano, 1999, p. 175). With such strength, information is the highlight of contemporary society, as it is present in all sectors of society, such as in professions and in daily tasks, being considered vital for human survival (Yuexiao, 1988). According to Le Coadic (1996, p. 8), data is "the conventional codified representation of information in a form that allows it to be submitted to an electronic process", that is, data is a codified block of information, a block of content that generates the information. Information must have a sign (meaning), characteristics, it is a connotation for things, it needs a context, it has particular and fragmented aspects; overall, it is treated data that will be transmitted to a sign system that is language, however, information is transitory and momentary (Cintra *et al.*, 2002; Le Coadic, 1996). Knowledge, on the other hand, is an advanced, unique process, compared to decision-making, it has a structure, coherence, and has a long duration, as it is a cognitive stock (Cintra *et al.*, 2002).

For Capurro and Hjorland (2007, p. 155), information is seen in two ways, such as "[...] the act of shaping the mind and the act of communicating knowledge". Hoshovsky and Massey (1968) also describe information and the individual mind, since, according to the authors, information is a process that takes place in human thought and is the combination of a problem and data that are constructively joined. Information is found in abundance in the lives of individuals in contemporary society, generating an excess of information. This excess happens due to easy access or contact of individuals with information on a daily basis, known by the information age (Castells, 1999) or

information society; in some moments, the user does not even need to look for information, as they are bombarded from the moment they wake up until it is time to rest. It is through this context of truths and lies that the authors Bezerra, Capurro, and Schneider (2017, p. 379) reflect that "if it is not simple or even possible to define the truth, it is not that difficult to detect lies and their social construction".

Regarding disinformation and misinformation, Stahl (2006, p. 86) argues that: "The most important distinction between information and mis-information and dis-information is the question of truth". That is, both are identified as false information, but what changes is the sharing purpose; with misinformation, the individual does not know that they have provided false information, they can be considered an information naive, but with disinformation the user recognizes that it is a lie and still decides to share. It is important to observe that the literal English translation of "desinformação" (disinformation) is misinformation; however, it is necessary to be aware of its meanings depending on the context. International literature, such as the English literature, uses incorrect information without the intention of deceiving or harming anyone as misinformation; also, it exists in addition to national authors, international researchers also try to differentiate both terms (Fetzer, 2004; Lazer *et al.*, 2018; Stahl, 2006; Treen; Williams; O'neill, 2020).

Information and disinformation have opposite meanings, but they are part of the same process, as quoted by Demo (2000, p. 39): "Disinforming will, therefore, be a paramount part of the information process". On the other hand, it is necessary to understand that there are a series of strategies used to disinform individuals, resulting in the imbecility of individuals facing the information received. The disinformation process encompasses various techniques, such as manipulated information, rumours, alternative facts, and fake news, which are the favorable scenario for the post-truth phenomenon. Allcott and Gentzkow (2017, p. 213) conceptualize fake news as "[...] referring to viral posts based on fictitious accounts made to look like news reports"; meanwhile, Tandoc, Lim and Ling (2017, p. 138) define it as: "[...] referring to viral posts based on fictitious accounts made to look like news reports". These two definitions dialogue with the arguments from Habgood-Coote (2018) and Araújo (2021a), who claim that fake news usually have an apparently persuasive content because the intention is the reader not thinking that there is any falsehood, since its structure is similar to a true news. From another conceptual perspective, Bernando Menger (2019, p. 137) reports "by information disguised as the truth with the aim of deceiving the social entities participating in the various areas of discursive manifestations". Araújo (2021b) defines fake news as false news with the lying purpose of promoting deception and covering up the truth and that use the framework of journalism to legitimize the discourse.

What is perceived is that it does not matter if the information is true or not, it just needs to be in line with my emotions and, in this context, the "Post-Truth" appears. It is the word of the year chosen in 2016 by Oxford Dictionaries and means: "Relating to or denoting circumstances in which objective facts are less influential in shaping public opinion than appeals to emotion and personal belief" (Post-truth, 2016, *online*). In Brazilian territory, it is possible to observe the use of political disinformation to influence voters, as evidenced in the Brazilian presidential race between candidates Jair Messias Bolsonaro (PSL) and Fernando Haddad (PT). The PSL candidate flooded social media with disinformation and misleading claims against his PT opponent. This was facilitated by the use of social networks, where sharing is more practical. Examples of disinformation used by candidate Bolsonaro included the dissemination of false erotic books distributed in schools to children. The post-truth era has the idea that facts are no longer valid, what stands out in the discourse is the way of manipulating public opinion and refers to a denial of fighting for the truth and accepting what is

good for a certain group that the user supports or belongs to, that is, "you choose your own reality, as if from a buffet. You also select your own falsehood, no less arbitrarily" (D'Ancona, 2018, p. 57).

Araújo (2021a) mentions that there is a concern between the post-truth phenomenon with democracy and its foundations. In this context, education has been used to combat disinformation and minimize the effects of post-truth, to the extent that Buschman (2019) offers arguments for libraries to help combat disinformation and consequently strengthen the democratic society. Buschman (2019, p. 221) argues that "We need to recognize that the imaginative uses to which libraries are put do enrich civil society and the public sphere, whether the uses are explicitly political or not". Through education, it is possible to train receivers and users to be able to distinguish facts from lies when they read disinformation.

Methodology

The methodology guiding this study was a bibliographical, exploratory research approach, using qualitative and quantitative analysis through content analysis and categorization techniques. As for the methodological procedures, the documentation technique was used, which aims to identify and carry out a literature review, exploring source documents related to the research object in question, and extracting relevant information for the development of the study. It should be noted that the research universe for this study is WoS, covering the time interval from 1945 to 2019. We chose the WoS database, founded in 1997 and associated with the Institute for Scientific Information (ISI), which is maintained by Clarivate Analytics. The choice was justified by the breadth of the international scientific literature in which there is a greater production of research on the subject. This work is based on part of a master's dissertation entitled "title of master's thesis" (for ethical and peer review reasons, the citation will be made later). The research covered up to the year 2019. Starting from 2020, significant social, political, and economic transformations have occurred in society. Therefore, the analysis for 2020 requires a different approach, particularly considering the impact of the COVID-19 pandemic and the associated infodemic phenomenon. The WoS was searched for the keywords "disinformation" "post-truth" and "fake news", first using "fake news", then "disinformation" not "Fake news" and finally "Post-Truth" not "fake news" not "disinformation", as the aim was to have a wider range of articles that mentioned one of the keywords.

Inclusion criteria were scientific articles indexed in scientific journals presenting a solution to combat disinformation and covering up to the year 2019. In total, 1,419 scientific articles were retrieved from the database. To work with the data, Microsoft Excel was used, a spreadsheet editor where information was placed. WoS allows researchers to extract data from the database directly into Microsoft Excel, facilitating data processing, which will occur through bibliographical research. Table 1 shows the first results in WoS.

From this, a reading was carried out according to what Bardin (2016) determines as pre-analysis, that is, "[...] this first phase has three missions: Choosing the documents to be submitted to analysis, formulating hypotheses and objectives, and the elaborating indicators that support the final interpretation" (Bardin, 2016, p. 125). The expected results in this specific objective are a set of retrieved scientific articles that present a solution to disinformation. The research in this pre-analysis had three basic criteria: (a) having an abstract and keywords; (b) identifying a solution to combat disinformation; and (c) not being duplicated. Thus, in order to promote a better visualization of the research methodological procedures, Figure 1 has been developed with the objective of graphically demonstrating how the research stage was carried out, from data collection to data analysis.

Table 1 – Web of Science search results.

Search steps	Search filters	Search term	Results
Collection 1	Any field; Period: 1945-2019 Document: Scientific articles	"fake news"	731
Collection 2	Any field; Period: 1945-2019 Document: Scientific articles	"disinformation" (not "Fake news")	341
Collection 3	Any field; Period: 1945-2019 Document: Scientific articles	"post-truth" (not "fake news" not "disinformation")	347
Total			1,419

Source: Prepared by the authors (2022).

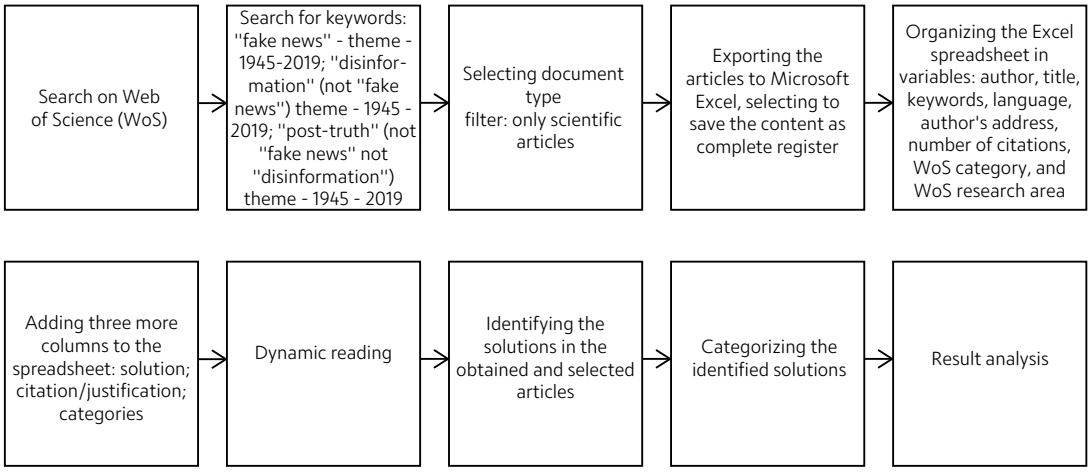

Figure 1 - Research steps.
Source: Prepared by the authors (2023).

With that, it was necessary to build an order of reading priorities, that is, some kind of script that served as a dynamic reading for the complete analysis of the articles to identify a solution towards combating disinformation: 1) reading the article title; 2) reading of the abstract and keywords; 3) interpretation of the final considerations; 4) reading and interpretation of research results; 5) reading the methodology and methodological procedures; and, finally, 6) reading the introduction. A categorization of the solutions identified in the first specific objective is carried out. However, a content analysis and a description are made, especially in relation to the characteristics of each category; the aim is to list different types of categories based on a scientific methodology of the categorization that is being studied. Moraes (1999) and Bardin (2016) comment that content analysis allows the process of categorization of information identified in the research, facilitating the investigation and observation process.

Therefore, with the data obtained via content analysis and with the solutions listed more generically, categories were created by uniting common solutions, based on who/what that solution is focused on. Therefore, we decided to build the categories by following an ad-hoc construction. As for the choice criterion, they were based on the criteria of Bardin (2016), opting for the lexicon categories, that is, "classification of words according to their meaning, with pairing of synonym and close meanings" (Bardin, 2016, p. 147). Six categories were built, and they are solutions for: 1. Users and Education; 2. Platforms and Algorithms; 3. States and Governments; 4. Media and Communications; 5. Science and Scientific Community; and 6. Others. The choice of categories is

justified by the fact that they represent the type of approach that the solution aims for and who it wants to help in facing and combating disinformation.

Results and Discussions

The final sample of articles with solutions to disinformation is 289, however, 42 articles contain more than one type of solution. Therefore, the proposal sample to combat disinformation is 340 solutions. With the categorization process, we were able to quantify which categories have the highest number of solutions. Regarding the results, 23 types of solutions appeared more than once during the content analysis performed, thus totaling a sample of 198 most frequent solutions to combat disinformation. As for top solutions, 13% are fact-checking organizations; 12% believe that information literacy is the way to fight disinformation; media literacy appears at 11%; 10% are the properties of journalism to face disinformation; critical thinking appears with 9%; 8% corresponds to regulation of the digital environment; the use of algorithms to identify false information refers to 6%; the development of digital and media literacy are represented by 4%; at 3% is education, awareness, scientists, digital literacy, libraries, and science; 2% represent AI, blockchain, governments, critical literacy, literacy, and education campaign; and finally with 1% are technology solutions, metaliteracy, and health literacy. Figure 2 was created to show the frequency and quantity of solutions that were found above two variations.

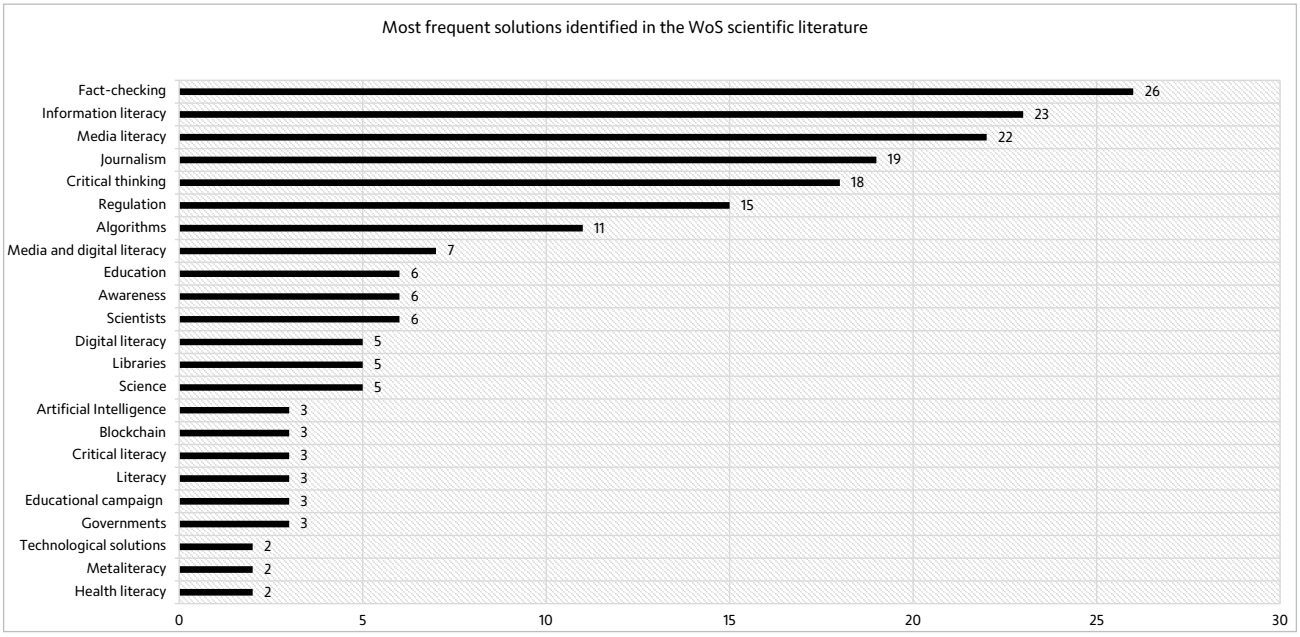

Figure 2 – Most frequent solutions identified in the WoS scientific literature.
Source: Prepared by the authors (2023).

Therefore, with the identified solutions the categorization process can proceed. Category "Science and Scientific Community" was built based on the number of solutions that place science and researchers as responsible agents in the fight against disinformation. Categories have a purpose for some specific group, in this case, it brings together the scientific solutions to face disinformation. On the other hand, there is another part of the solutions bringing researchers and scientists into the public debate as important elements in the fight against disinformation. The scientific method, and

the permanent search for truth and objective facts, may have helped to think of scientists as active protagonists in the process of confronting disinformation. It is observed that scientific solutions indicate the need for the scientific community to participate in the public sphere, not as superiors in the process of disseminating validated information, but in using science in favor of people to combat disinformation.

The "States and Governments" category was developed based on solutions guided by the responsibility of the States and the government to try to reduce the effects of disinformation. The purpose of this category is to present what countries and governments are doing or proposing to try to curb false information in the digital environment, whether through regulation or privacy proposals in the digital environment. Bringing regulatory solutions together, offering states and governments a legal outcome. Regulation has been a way that authorities have been suggesting reducing the unbridled proliferation of false information. This category brings together solutions ranging from regulation of digital platforms to legislative oversight of online content and algorithms.

The "Media and Communications" category is responsible for covering solutions related to the use of communication in the fight against disinformation. The purpose of this category is to reveal that the means of communication, such as journalism and media professionals, have peculiarities that help confronting false information. This category has the function of filling the gap in the role of media professionals and studies in social communication as active actors in the process of identifying false news and disseminating corrected disinformation. It is worth noting that journalism has an investigative bias, so it has attributes that can lead to the location of untruths in digital content. Another important issue is the difference between fact-checking and journalism; the first is a niche of journalism and organizations focused on the methodology to verify information on social networks. While journalism has other goals, such as collecting and informing users of phenomena. In general, due to the market and society demands, journalism needed an objective response to disinformation, thus, factual organizations have emerged to fill this gap.

The "Platforms and Algorithms" category was built to encompass technology-driven solutions and how platforms can use algorithms to combat disinformation. The application of technology in identifying false information has revealed that the sophistication of algorithms plays a relevant role. The name choice for this category makes use of the considerable number of different ways that an algorithm can be used to find, flag, and exclude falsehood. Technology solutions only work with the participation of an agent that is programmed to perform a specific task, which is the algorithm. Solutions offered by technology range from improved algorithms for classifying false information to identifying the network where the dubious content was shared for the first time. Technology has been increasingly offering positive answers, such as the use of AI and blockchain in computational models for disinformation.

The "Users and Education" category is based on the demonstration of solutions that are involved in educational activities and the promotion of skills that can lead the user to identify false information. Therefore, the Users and Education category does not need an agent performing the action of finding disinformation, as it happens in the other categories whose function is to seek ways to offer quality information to the user, either through an algorithm, regulation, or the application of science. In this category, the user has the responsibility and ability to recognize information based on facts or falsehoods.

Different types of programs, literacy, and pedagogical strategies are presented to promote active users in facing false information. We observed the presence of different types of literacy as proposed solutions, this only proves the strength that education has in the facing of the problem.

There are literacy programs focused on different contexts, from the classroom to the elderly. It is important to observe that solutions based on education do not have an immediate effect – as it occurs in the quick identification of false information through an algorithm – since education solutions are long-term solutions.

The difference between "States and Governments"; "Science and Scientific Community" is 6%. Thus, we can observe that the category involving Science is seen as not a priority when it comes to producing ways to combat disinformation. To the extent that the difference between the last category, "Others," is only 1%. Therefore, Figure 3 was built, presenting the occurrences of solutions in the six categories.

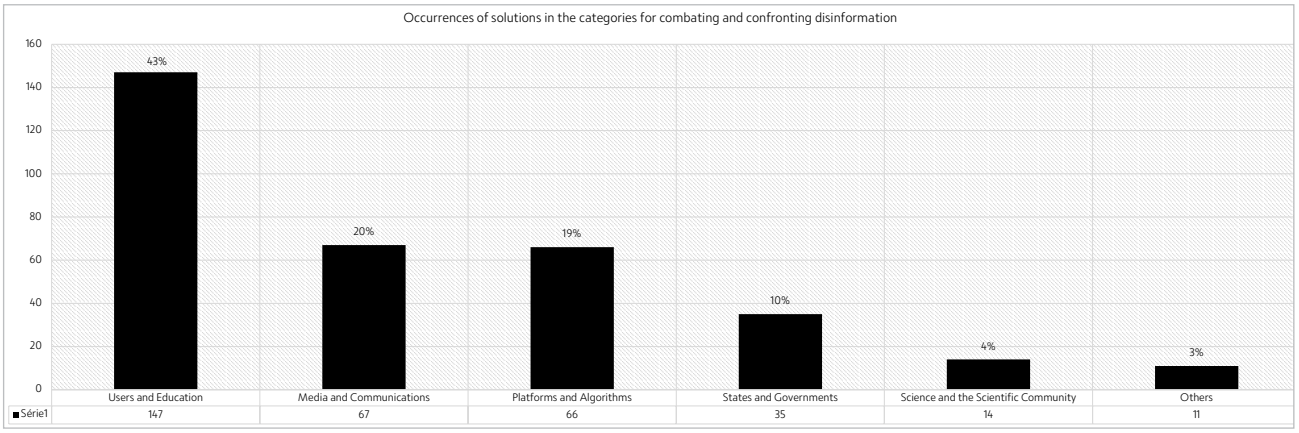

Figure 3 – Occurrences of solutions in the categories for combating and confronting disinformation.
Source: Prepared by the authors (2023).

Within the solutions in the category "Users and Education", 147 (*N*=100%), there are: "Information literacy," corresponding to 23 (16%); "Media literacy" was identified with 22 (15%); "Critical thinking" appears 18 (12%) times; following with 6 (4%) solutions each are "Education" and "Digital and media literacy"; with 5 solutions each (3%) there are "Awareness", "Libraries," and "Digital Literacy"; "Educational campaign," "Critical literacy," and "Literacy" correspond to 3 (2%) solutions each, and finally "Metaliteracy" and "Health literacy" with 2 (1%) solutions each. There were 44 solutions that only appeared once. For better visualization and strategy, Figure 4 was built from solutions with more occurrences. Eight solutions with more incidences are represented by some type of literacy (66 solutions) as a way of combating disinformation, representing 45% of the total.

The final sample of articles with solutions to disinformation is 289, but, as already seen, there are 42 articles containing more than one type of solution. Therefore, the proposal sample to combat disinformation is 340 solutions. With the categorization process, we were able to quantify which categories have the highest number of solutions. It is important to report that there are six articles that have different solutions for the same category, these articles are from Casini (2018); López-Borrull, Vives-Gràcia and Badell (2018); Lor (2018); and Wardle (2018), Navarro, Oleart and García (2019); and Rodríguez-Ferrándiz (2019). Chart 1 presents the authors with the solutions in the same category.

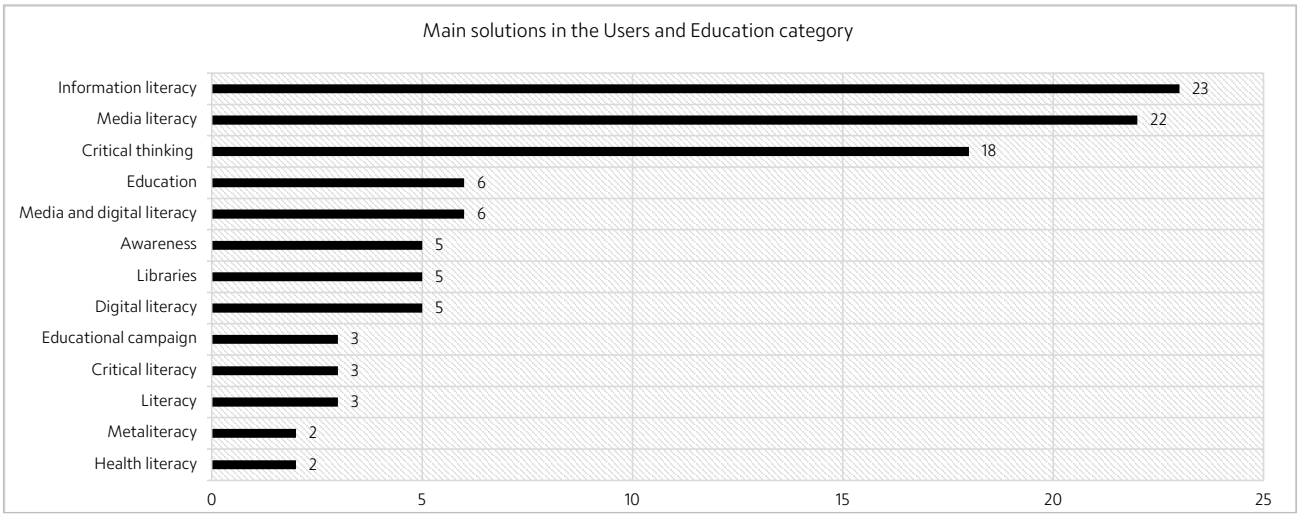

Figure 4 – Main solutions in the Users and Education category.
Source: Prepared by the authors (2023).

Chart 1 – Articles with more than one solution idea in the same category.

Author	Solution	Category
Navarro, Oleart and García (2019)	Journalism Promotion of alternative frameworks.	Media and Communications
Rodríguez-Ferrándiz (2019)	Regulation Algorithm supervision.	States and Governments
Casini (2018)	Law of Global Governance Create official platforms where fact checking, and review of fake news can be realized	States and Governments
López-Borrull, Vives-Gràcia and Badell (2018)	Control mechanisms by platform managers Legislative	States and Governments
Lor (2018)	Information literacy Libraries	Users and Education
Wardle (2018)	Fact-checking Journalists and academics	Media and Communications

Source: Prepared by the authors (2022).

Chart 2 illustrates the categorization process employed in the analysis. It presents the authors, article titles, identified solutions within each study, and the corresponding assigned categories. The structure of the table facilitates the understanding of the proposed solutions by clearly demonstrating the relationship between the article content and the established analytical categories.

Chart 2 – List of proposals identified in the articles indexed in WoS regarding disinformation, emphasizing the author, title, solution, and category.

1 de 2

Author	Title	Solution	Category
Jang *et al*. (2018)	A computational approach for examining the roots and spreading patterns of fake news: Evolution tree analysis	Algorithms	Platforms and Algorithms
Papadopoulou *et al.* (2019)	A corpus of debunked and verified user-generated videos	Automatic verification	Platforms and Algorithms
Shao *et al*. (2018a)	Anatomy of an on-line misinformation network	Hoaxy system	Platforms and Algorithms
Tandoc *et al*. (2017)	Audiences' acts of authentication in the age of fake news: A conceptual framework	Media literacy	Users and Education

Chart 2 – List of proposals identified in the articles indexed in WoS regarding disinformation, emphasizing the author, title, solution, and category.

Author	Title	Solution	Category
Lewandowsky *et al*. (2017)	Beyond Misinformation: Understanding and Coping with the Post-Truth Era	Technocognition	Users and Education
Ferreira *et al*. (2019)	Counteracting the contemporaneous proliferation of digital forgeries and fake news	Digital forensics	Platforms and Algorithms
Zollo (2019)	Dealing with digital misinformation: a polarised context of narratives and tribes	Regulation	States and Governments
Brogly and Rubin (2018)	Detecting Clickbait: Here's How to Do It	lit.RL Clickbait Detector	Platforms and Algorithms
Boididou *et al*. (2018)	Detection and visualization of misleading content on Twitter	Detection and visualization of misleading content on Twitter	Platforms and Algorithms
McDougal *et al*. (2019)	Digital literacy, fake news and education	Digital literacy	Users and Education
Rubin (2019)	Disinformation and misinformation triangle	Regulation	States and Governments
Aird *et al*. (2018)	Does truth matter to voters? The effects of correcting political misinformation in an Australian sample	Fact-checking	Media and Communications
Rezende *et al*. (2018)	Exposing computer generated images by using deep convolutional neural networks	Detecting computer generated images	Platforms and Algorithms
Vizoso and Vázquez-Herrero (2019)	Fact-checking platforms in Spanish. Features, organisation and method	Fact-cheking	Media and Communications
Lotero-Echeverri *et al*. (2018)	Fact-checking vs. Fake news: confirmation journalism as a tool of media literacy against misinformation	Fact-checking	Media and Communications
Tandoc *et al*. (2018)	Fake news as a Critical Incident in Journalism	Journalism	Media and Communications
Balod and Hhameleers (2019)	Fighting for truth? The role perceptions of Filipino journalists in an era of mis- and disinformation	Journalism	Media and Communications
Pennycook and Rand (2019a)	Fighting misinformation on social media using crowdsourced judgments of news source quality	Algorithms	Platforms and Algorithms
Caridad-Sebastián *et al*. (2018)	Infomediación y posverdad: el papel de las bibliotecas	Libraries	Users and Education
Vázquez-Herrero *et al*. (2019)	Innovación tecnológica y comunicativa para combatir la desinformación: 135 experiencias para un cambio de rumbo	Fact-checking	Media and Communications
Pennycook and Rand (2019b)	Lazy, not biased: Susceptibility to partisan fake news is better explained by lack of reasoning than by motivated reasoning	Analytic thinking	Education and Users
Martínez-Cardama and Algora-Cancho (2019)	Lucha contra la desinformación desde las bibliotecas universitarias	Information literacy	Users and Education
Romero-Rodriguez *et al*. (2019)	Media competencies of university professors and students. Comparison of levels in Spain, Portugal, Brazil and Venezuela	Media competencies	Users and Education
McDougall (2019)	Media Literacy versus Fake News	Media Literacy	Users and Education
Lewandowsky *et al*. (2013)	Misinformation, Disinformation, and Violent Conflict from Iraq and the "War on Terror" to Future Threats to Peace	Resilience against narratives"	Users and Education
Vicario *et al*. (2019)	Polarization and Fake news: Early Warning of Potential Misinformation Targets	Detection of possible future topics for fake news	Platforms and Algorithms
Nikolov *et al*. (2019)	Quantifying Biases in Online Information Exposure	Algorithms	Platforms and Algorithms
Hameleers (2019)	Susceptibility to mis- and disinformation and the effectiveness of fact- checkers: Can misinformation be effectively combated?	Fact Checking	Media and Communications
Vázquez-Herrero *et al*. (2019)	Technological and communicative innovation to fight misinformation: 135 experiences for a change of direction	Fact-checking	Media and Communications
Janks (2018)	Texts, Identities, and Ethics: Critical Literacy in a Post-Truth World	Critical literacy	Users and Education
Romero-Rodríguez and Aguaded (2016)	The economic dis-information in Spain: case study of BFA-Bankia and its IPO	Role of the press	Media and Communications
Jang and Kim (2018)	Third person effects of fake news: Fake news regulation and media literacy interventions	Media Literacy	Users and Education
Shao *et al*. 2018b	Tracking and Characterizing the Competition of Fact Checking and Misinformation: Case Studies	Fact Checking	Media and Communications

Source: Prepared by the authors (2023).

Conclusion

At the beginning of technological development, public debate was involved in issues of information democratization and the growth of people's level of knowledge. While the discussions focused on the benefits of technology to promote the breakdown of physical and communication barriers, there was another side, where actors in society and companies used technology to manipulate data and information. Technology has promoted globalization, breaking down borders, increasing reach, and favoring the growth of social networks. On the other hand, malicious companies began to use social networks to favor customers, creating a manipulated information environment. This manipulation was characterized by the use of disinformation to generate profit or for political or media purposes. Therefore, the information society has turned into a disinformation society. False information found fertile ground to proliferate due to two factors: the growth of improved technology and the use of social networks, leading to the creation of bubbles and personalized feeds.

The most effective strategy against disinformation today is likely not one single solution, but a combination of strategies presented in this study. While it is important to reinforce the educational aspect, technology can help prevent false information from having devastating effects on democracy. At the same time, media and platforms have room for improvement and should seek to prevent the spread of disinformation. States also have a responsibility to carefully regulate environments so that malicious actors cannot profit from causing harm to society. Science, in turn, must regain its prestige in society, become more present, and be closer to the population, which may have forgotten the great scientific advancements of the last century.

We suggest that future research focus on the types of literacy mentioned in this study and provide a deep analysis of their differences and similarities. Therefore, both researchers and users need to adopt an active and responsible stance in combating disinformation, as there is no single, ideal solution. Instead, a series of integrated measures must be employed together to reduce its effects on society.

References

Aird, M. J. *et al.* Does truth matter to voters? The effects of correcting political misinformation in an Australian sample. *Royal Society Open Science*, v. 5, n. 12, p. 1-14, 2018. Doi: http://dx.doi.org/10.1098/rsos.180593.

Allcott, H.; Gentzkow, M. Social media and fake news in the 2016 election. *Journal of Economic Perspectives*, v. 31, n. 2, p. 211-236, 2017. Doi: http://dx.doi.org/10.1257/jep.31.2.211.

Araújo, C. A. A. A pós-verdade como desafio central para a ciência da informação contemporânea. *Em Questão*, v. 27, n. 1, p. 13-29, 2021a. Doi: http://dx.doi.org/10.19132/1808-5245271.13-29.

Araújo, C. A. A. Novos desafios epistemológicos para a ciência da informação. *Palabra Clave (La Plata)*, v. 10, n. 2, p. 1-15, 2021b. Doi: http://dx.doi.org/10.24215/18539912e116.

Balod, H. S. S.; Hameleers, M. Fighting for truth? The role perceptions of Filipino journalists in an era of mis- and disinformation. *Journalism*, v. 22, n. 9, p. 2368-2385, 2019. Doi: http://dx.doi.org/10.1177/1464884919865109.

Bardin, L. *Análise de Conteúdo.* São Paulo: Edições 70, 2016.

Bernardo Menger, J. Signo ideológico e enunciado na construção e disseminação de fake news. *Revista Heterotópica*, v. 1, n. 2, p. 136-155, 2019. Doi: https://doi.org/10.14393/HTP-v1n2-2019-50166.

Bezerra, A. C.; Capurro, R.; Schneider, M.. Regimes de verdade e poder: dos tempos modernos à era digital. *Liinc em Revista*, v. 13, n. 2, p. 371-380, 2017. Doi: http://dx.doi.org/10.18617/liinc.v13i2.4073.

Boididou, C. *et al.* Detection and visualization of misleading content on Twitter. International Journal of *Multimedia Information Retrieval*, v. 7, n. 1, p. 71-86, 2018. Doi: http://dx.doi.org/10.1007/s13735-017-0143-x.

Borges, M. A. G. A informação e o conhecimento como insumo ao processo de desenvolvimento. *Revista Ibero-Americana de Ciência da Informação*, v. 1, n. 2, p. 175-196, 2008. Doi: https://doi.org/10.26512/rici.v1.n2.2008.1249.

Brogly, C.; Rubin, V. L. Detecting Clickbait: Here's How to Do It / Comment détecter les pièges à clic. *Canadian Journal of Information and Library Science*, v. 42, n. 3, p. 154-175, 2018.

Buschman, J. Good news, bad news, and fake news: going beyond political literacy to democracy and libraries. *Journal of Documentation*, v. 75, n. 1, p. 213-228, 2019. Doi: https://doi.org/10.1108/JD-05-2018-0074.

Capurro, R.; Hjorland, B. O conceito de informação. *Perspectivas em Ciência da Informação*, v. 12, n. 1, p.1-60, 2007. Doi: https://doi.org/10.1590/s1413-99362007000100012.

Caridad-Sebastián, M. *et al.* Infomediación y Posverdad: el papel de las bibliotecas. *El profesional de la información*, v. 27, n. 4, p. 891-898, 2018. Doi: http://dx.doi.org/10.3145/epi.2018.jul.17.

Casini, L. Googling Democracy? New technologies and the law of global governance: afterword to Eyal Benvenuti's foreword. *European Journal of International Law*, v. 29, n. 4, p. 1071-1077, 2018. Doi: http://dx.doi.org/10.1093/ejil/chy072.

Castells, M. *A sociedade em rede*. São Paulo: Paz e Terra, 1999.

Cintra, A. M. M. *et al. Para entender as linguagens documentárias*. 2. ed. São Paulo: Polis, 2002.

D'Ancona, M. *Pós-verdade*: a nova guerra contra os fatos em tempos de fake news. Barueri: Faro Editorial, 2018.

Demo, P. Ambivalências da sociedade da informação. *Ciência da Informação*, v. 29, n. 2, p. 37-42, 2000. Doi: https://doi.org/10.1590/S0100-19652000000200005.

European Commission. *Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions*: Tackling online disinformation: a European Approach. Brussels: European Commission, 2018. Disponível em: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52018DC0236. Acesso em: 29 mar. 2025.

Ferreira, A. *et al.* Counteracting the contemporaneous proliferation of digital forgeries and fake news. *Anais da Academia Brasileira de Ciências*, v. 91, n. 1, p. 1-19, 2019. Doi: http://dx.doi.org/10.1590/0001-3765201820180149.

Fetzer, J. H. Information: does it have to be true? *Minds And Machines*, v. 14, n. 2, p. 223-229, 2004. Doi: http://dx.doi.org/10.1023/b:mind.0000021682.61365.56.

Habgood-Coote, J. Stop talking about fake news! *Inquiry*, v. 62, n. 9-10, p. 1033-1065, 2018. Doi: http://dx.doi.org/10.1080/0020174x.2018.1508363.

Hameleers, M. Susceptibility to mis-and disinformation and the effectiveness of fact-checkers: can misinformation be effectively combated? *Studies in Communication and Media*, v. 8, n. 4, p. 523-546, 2019. Doi: http://dx.doi.org/10.5771/2192-4007-2019-4-523.

Harari, Y. N. *21 lições para o século 21.* São Paulo: Companhia das Letras, 2018.

Hoshovsky, A. G.; Massey, R. J. Information Science: its ends, means LK: opportunities. *In*: *American Society for Information Science* (59th, 1996, Baltimore, Md). Proceedings [...]. Columbus: Ohio, 1968. p. 47-55.

Jang, S. M. *et al.* A computational approach for examining the roots and spreading patterns of fake news: evolution tree analysis. *Computers in Human Behavior*, v. 84, p. 103-113, 2018. Doi: http://dx.doi.org/10.1016/j.chb.2018.02.032.

Jang, S. M.; Kim, J. K. Third person effects of fake news: fake news regulation and media literacy interventions. *Computers in Human Behavior*, v. 80, p. 295-302, 2018. Doi: http://dx.doi.org/10.1016/j.chb.2017.11.034.

Janks, H. Texts, identities, and ethics: critical literacy in a post-truth world. *Journal of Adolescent & Adult Literacy*, v. 62, n. 1, p. 95-99, 2018. Doi: http://dx.doi.org/10.1002/jaal.761.

Kakutani, M. *A morte da verdade*: notas sobre a mentira na era trump. Rio de Janeiro: Intrínseca, 2018.

Lazer, D. M. J. *et al.* The science of fake news. *Science*, v. 359, n. 6380, p. 1094-1096, 2018. Doi: http://dx.doi.org/10.1126/science.aao2998.

Le Coadic, Y. F. *A Ciência da Informação*. Brasília: Briquet de Lemos, 1996.

Lewandowsky, S.; Ecker, U. K. H.; Cook, J. Beyond misinformation: understanding and coping with the "post-truth" era. *Journal of applied research in memory and cognition*, v. 6, n. 4, p. 353-369, 2017. Doi: http://dx.doi.org/10.1016/j.jarmac.2017.07.008.

Lewandowsky, S. *et al.* Misinformation, disinformation, and violent conflict: from iraq and the "war on terror" to future threats to peace. *American Psychologist*, v. 68, n. 7, p. 487-501, 2013. Doi: http://dx.doi.org/10.1037/a0034515.

López-Borrull, A.; Vives-Gràcia, J.; Badell, J. I. Fake news, ¿amenaza u oportunidad para los profesionales de la información y la documentación? *El Profesional de La Información*, v. 27, n. 6, p. 1346-1356, 2018. Doi: https://doi.org/10.3145/epi.2018.nov.17.

Lor, P. J. Democracy, information, and libraries in a time of post-truth discourse. *Library Management*, v. 39, n. 5, p. 307-321, 2018. Doi: http://dx.doi.org/10.1108/lm-06-2017-0061.

Lotero-Echeverri, G.; Romero-Rodríguez, L. M.; Pérez-Rodríguez, M. A. Fact-checking vs. Fake news: periodismo de confirmación como componente de la competencia mediática contra la desinformación. *Index. Comunicación*, v. 8, n. 2, p. 295-316, 2018.

Martínez-Cardama, S.; Algora-Cancho, L. Lucha contra la desinformación desde las bibliotecas universitarias. *Profesional de la Información*, v. 28, n. 4, 2019. Doi: https://doi.org/10.3145/epi.2019.jul.12.

McDougall, J. Media literacy versus fake news. *Medijske Studije*, v. 10, n. 19, p. 29-45, 2019. Doi: http://dx.doi.org/10.20901/ms.10.19.2.

McDougall, J. *et al.* Digital literacy, fake news and education / Alfabetización digital, fake news y educación. *Cultura y Educación*, v. 31, n. 2, p. 203-212, 2019. Doi: http://dx.doi.org/10.1080/11356405.2019.1603632.

Moraes, R. Análise de conteúdo. *Revista Educação*, v. 22, n. 37, p. 7-32, 1999.

Navarro, J. T.; Oleart, Á.; Bouza García, L. Actores Europeos y Desinformación: la disputa entre el fact checking, las agendas alternativas y la geopolítica. *Revista de Comunicación*, v. 18, n. 2, p. 245-260, 2019. Doi: https://doi.org/10.26441/rc18.2-2019-a12.

Nikolov, D. *et al.* Quantifying biases in online information exposure. *Journal of the Association for Information Science And Technology*, v. 70, n. 3, p. 218-229, 2019. Doi: http://dx.doi.org/10.1002/asi.24121.

Octaviano, V. L. C. A informação na atividade técnico-científica: um enfoque pós-moderno. *Transinformação*, v. 11, n. 2, 1999.

Organização das Nações Unidas para a Educação, a Ciência e a Cultura. *Journalism, fake news & disinformation*: handbook for journalism education and training. Paris: Unesco Publishing, 2018.

Papadopoulou, O. *et al.* A corpus of debunked and verified user-generated videos. *Online Information Review*, v. 43, n. 1, p. 72-88, 2019. Doi: http://dx.doi.org/10.1108/oir-03-2018-0101.

Pennycook, G.; Rand, D. G. Fighting misinformation on social media using crowdsourced judgments of news source quality. *Proceedings of the National Academy of Sciences*, v. 116, n. 7, p. 2521-2526, 2019a. Doi: http://dx.doi.org/10.1073/pnas.1806781116.

Pennycook, G.; Rand, D. G. Lazy, not biased: susceptibility to partisan fake news is better explained by lack of reasoning than by motivated reasoning. *Cognition*, v. 188, p. 39-50, 2019b. Doi: http://dx.doi.org/10.1016/j.cognition.2018.06.011.

Post-truth. *In*: English Oxford Living Dictionaries. Oxford: Oxford University Press, 2016. Disponível em: https://languages.oup.com/word-of-the-year/2016/. Acesso em: 1 maio 2020.

Rezende, E. R. S. *et al.* Exposing computer generated images by using deep convolutional neural networks. *Signal Processing: Image Communication*, v. 66, p. 113-126, 2018. Doi: https://doi.org/10.48550/arXiv.1711.10394.

Rodríguez-Ferrándiz, R. Posverdad y fake news en comunicación política: breve genealogía. *Profesional de la información*, v. 28, n. 3, 2019. Doi: https://doi.org/10.3145/epi.2019.may.14.

Romero-Rodríguez, L. M.; Aguaded, I. The economic dis-information in Spain: case study of BFA-Bankia and its IPO. *Communication & Society*, v. 29, n. 1, p. 37-51, 2016. Doi: https://doi.org/10.15581/003.29.35932.

Romero-Rodríguez, L. M.; Contreras-Pulido, P.; Pérez-Rodríguez, M. A. Media competencies of university professors and students. Comparison of levels in Spain, Portugal, Brazil and Venezuela. *Cultura y Educación*, v. 31, n. 2, p. 326-368, 2019. Doi: http://dx.doi.org/10.1080/11356405.2019.1597564.

Rubin, V. L. Disinformation and misinformation triangle. *Journal of Documentation*, v. 75, n. 5, p. 1013-1034, 2019. Doi: http://dx.doi.org/10.1108/jd-12-2018-0209.

Santaella, L. *A pós-verdade é verdadeira ou falsa?* Barueri: Estação das Letras e Cores, 2019.

Shao, C. *et al.* Anatomy of an online misinformation network. *Plos One*, v. 13, n. 4, p. 1-23, 2018a. Doi: http://dx.doi.org/10.1371/journal.pone.0196087

Shao, C. *et al.* Tracking and Characterizing the Competition of Fact Checking and Misinformation: case studies. *Ieee Access*, v. 6, n. 1, p. 75327-75341, 2018b. Doi: http://dx.doi.org/10.1109/access.2018.2881037

Stahl, B. C. On the difference or equality of information, misinformation, and disinformation: a critical research perspective. *Transdiscipline*, v. 9, p. 083-096, 2006. Doi: http://dx.doi.org/10.28945/473.

Tandoc, E. C. *et al.* Audiences' acts of authentication in the age of fake news: a conceptual framework. *New Media & Society*, v. 20, n. 8, p. 2745-2763, 2017. Doi: http://dx.doi.org/10.1177/1461444817731756.

Tandoc, E. C.; Jenkins, J.; Craft, S. Fake News as a critical incident in journalism. *Journalism Practice*, v. 13, n. 6, p. 673-689, 2018. Doi: http://dx.doi.org/10.1080/17512786.2018.1562958.

Tandoc, E. C.; Lim, Z. W.; Ling, R. Defining "Fake News". *Digital Journalism*, v. 6, n. 2, p. 137-153, 2017. Doi: http://dx.doi.org/10.1080/21670811.2017.1360143.

Treen, K. M. D.-'I.; Williams, H. T. P.; O'neill, S. J. Online misinformation about climate change. *Wires Climate Change*, v. 11, n. 5, p. 1-20, 2020. Doi: http://dx.doi.org/10.1002/wcc.665.

Vázquez-Herrero, J.; Vizoso, A.; López-García, X. Innovación tecnológica y comunicativa para combatir la desinformación: 135 experiencias para un cambio de rumbo. *Profesional de la Información*, v. 28, n. 3, 2019. Doi: https://doi.org/10.3145/epi.2019.may.01.

Vicario, M. *et al.* Polarization and Fake News: early warning of potential misinformation targets. *Acm Transactions on the Web*, v. 13, n. 2, p. 1-22, 2019. Doi: http://dx.doi.org/10.1145/3316809.

Vizoso, A.; Vázquez-Herrero, J. Fact-checking platforms in Spanish. Features, organisation and method. *Communication & Society*, v. 32, n. 1, p. 127-142, 2019. Doi: http://dx.doi.org/10.15581/003.32.37819.

Wardle, C. The need for smarter definitions and practical, timely empirical research on information disorder. *Digital Journalism*, v. 6, n. 8, p. 951-963, 2018. Doi: http://dx.doi.org/10.1080/21670811.2018.1502047.

Yuexiao, Z. Definitions and sciences of information. *Information Processing & Management*, v. 24, n. 4, p. 479-491, 1988. Doi: http://dx.doi.org/10.1016/0306-4573(88)90050-7.

Zollo, F. Dealing with digital misinformation: a polarised context of narratives and tribes. *Efsa Journal*, v. 17, p. 1-15, 2019. Doi: http://dx.doi.org/10.2903/j.efsa.2019.e170720.

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