

Adolescents' reasoning to manage fake news

El razonamiento de los adolescentes para gestionar las noticias falsas

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ABSTRACT

This study draws on literature on argumentation and critical thinking. Its main goal is to analyse teenagers' critical thinking to manage scientific information in social networks. We analysed 95 ninth graders' quality of argumentation on their degree of agreement and their degree of credibility of a fake news item. The design included a dependent variable (argumentative competence), two independent variables (degree of agreement, degree of credibility) and a covariate (reading comprehension). A significant correlation was found between the degree of agreement and the degree of credibility. In addition, the degree of credibility decreases significantly as reading comprehension increases. Students who positioned themselves against the claim of the fake news and those who did not believe it showed higher argumentative quality in their texts than those who both agreed with and

believed it. These results bring evidence of the confirmation bias claim when we apply it to fake news. We tend to accept information that confirms our prior beliefs uncritically. Similarly, 83% of those who did not believe the content of the news would consult an additional text, compared to 62.5% of those who agreed with it. This is a result that highlights the urgency of implementing educational guidelines to help students develop critical skills to manage fake news.

Keywords: fake news, argumentation, confirmation bias, evidence use, counterargumentation, rebuttals, secondary education

RESUMEN

El objetivo principal del presente estudio fue analizar la capacidad crítica de los adolescentes respecto de la información científica procedente de las redes sociales. Para ello, se analizó la calidad de la argumentación escrita de 95 alumnos de 3º de la ESO, dirigida a justificar su grado de acuerdo y su grado de credibilidad con respecto de una noticia falsa. El diseño incluye una variable dependiente (competencia argumentativa), dos variables independientes (grado de acuerdo, grado de credibilidad) y una covariable (comprensión lectora). Se encontró una correlación significativa entre acuerdo y credibilidad. Asimismo, el grado de credibilidad disminuye significativamente a medida que aumenta la comprensión lectora. Se observó mayor calidad argumentativa en aquellos estudiantes que se posicionaron en contra de la tesis de la noticia falsa y de aquellos que no la creyeron, en comparación con aquellos que estuvieron de acuerdo y la creyeron. Nuestros datos también confirman resultados previos sobre el sesgo de confirmación, según el cual tendemos a aceptar acríticamente información que confirma nuestras creencias previas. Por otro lado, el 83% de los que no creyeron el contenido de la noticia consultarían un texto extra, frente al 62.5% de los que estaban de acuerdo. Estos resultados urgen a implementar pautas educativas para ayudar a los estudiantes a desarrollar habilidades críticas para manejar las noticias falsas.

Palabras clave: noticias falsas, argumentación, sesgo de confirmación, uso de evidencia, contrargumentación, réplica, educación secundaria

INTRODUCTION

The amount of misinformation has increased considerably with the birth of the digital society and with the presence, accessibility and spread of fake news in social networks (Barzilai & Chinn, 2020; Moran, 2020). The net has become disempowering for vulnerable uncritical minds (Gasser et al., 2012).

The presence of fake news on the net about controversial topics (such as the climate emergency or pandemic vaccines) is growing uncontrollably. This compels research on education to design possible interventions that can help students critically deal with fake news (Kendeou et al., 2019; Wineburg et al., 2016). The

critical analysis of information on the net is an urgent socioeducational need for the twenty-first century. Information about all controversial scientific topics can be found online. However, in some cases, much of the content is erroneous (i.e. misinformation), or/and intentionally misleading (i.e. disinformation). If digital information is erroneous, the construction of knowledge is compelled to be erroneous too. Given that social networks function as the adolescents' and young adults' main source of information, it is vital to be critically competent. Critical competence in the digital world is an old but renewed challenge. In a sense, the empowering potential of the digital society has been transformed into a dangerous disempowering tool (Gasser et al., 2012), due to the presence of fake news along with students' lack of skills to deal with new items critically.

Little is known about how adolescents critically evaluate disinformation that is spread on the internet, mainly through social networks. As published in *Info Libre*, based on UNESCO reports (Carrasco, 2021), more than half of the students cannot identify a fake news item and are prone to accept false information (Cheng et al., 2021). Senior high schoolers cannot differentiate between Wikipedia articles and other sources (Forte & Bruckman, 2008). Similarly, Buckingham (2019) highlights young adults' difficulty in differentiating mis- and disinformation from true and accurate news in online media. Individuals do not seem to evaluate information by assessing the content and source.

The main aim of the present research was to analyse how critical adolescents (ninth graders) are toward scientific information obtained from social networks. In addition, we aimed to explore potential factors related to this critical thinking. The rationale for this study drew on literature on argumentation and critical thinking, on confirmation bias, credibility and reading comprehension. We focused on adolescents' degree of credibility and degree of agreement with news from a social network and especially their ability to justify their agreement and credibility in an argumentative text.

ARGUMENTATION, CRITICAL THINKING AND CONFIRMATION BIAS

Current perspectives, such as that of Kuhn (2019) or Yacoubian and Khishfe (2018), emphasise the strong relation between argumentation and critical thinking. Based on Kuhn (1991), we define argumentative competence as the ability to integrate arguments into a framework of alternative evidence by means of a series of evidence-based justifications and counterargumentation. Through argumentation, students develop an assertion within the framework of justifications and counterarguments. Assertions are weighed by assessing the merit of the alternatives, and the evidence that they are grounded on. Therefore, the distinction between assertions and their justification, the assertions of others and ways of

coordinating and contrasting them to support or rebut a claim is essential for good reasoning (Kuhn, 2019). Argumentation, then, provides opportunities for students to filter relevant information by distinguishing it from irrelevant information, and allows connections to be made between content. It supports the explanatory capacity of students through quality reasoning (Grossman et al., 2009), which implies a general educational improvement and enhances students' development as critical citizens.

As stated in the classic literature on confirmation bias, readers, as partial information seekers, prefer to receive information that agrees with their points of view and tend to accept this information uncritically when it corroborates pre-existing views. When information comes from a source that opposes our views, it is likely to be ignored or questioned (Taber & Lodge, 2012). According to the confirmation bias literature (see Nickerson, 1998 for a review) humans are more inclined to accept information when it fits their opinions/theories. In an argument, evidence is typically employed to strengthen an arguer's claim. Consequently, evidence simply needs to "fit" the claim; no critical evaluation is demanded. In contrast, when the arguer thinks that the information is false, evidence must be used to weaken the claim and discard it. This is a much more demanding task, especially among secondary school students. It is well known that the identification of misleading information requires critical awareness to recognize poor justification of claims with weak evidence (Sperber et al., 2010). Critique becomes an important secondary education literacy skill (Henderson et al., 2015). Kiili et al. (2018) showed the difficulty that students across a range of developmental levels experience in critically evaluating online information. Secondary school students are prone to accept information without evaluation (Villarroel, et al., 2016) and without counterarguing.

Along with the confirmation bias literature, in Klaczynski and Gordon's work (1996), participants were more likely to identify the threat to validity when the information went against their view, and less likely to identify the same threat in the study that supported their view. The authors concluded that scepticism about opposing evidence when a person is reasoning may help overcome confirmation bias. Similarly, Taber and Lodge (2012) found that individuals spent more time processing disconfirming evidence than confirming arguments when they read texts about controversial issues on which they hold strong beliefs. In addition, when asked to write an argumentative text, participants were more critical about the arguments of the opposing side than about those of the same side and evidence.

Beyond the classic significant relation between prior stance and biased reasoning (Villarroel, et al., 2016), one of the focuses of the present study was to explore whether students' quality of reasoning through arguing was more influenced by the degree of agreement with or the degree of credibility of the information presented.

CREDIBILITY AND READING COMPREHENSION

For Kiili et al. (2018), credibility involves two different dimensions of the resource: expertise and trustworthiness. The term evaluation of credibility refers to students' evaluative arguments concerning either the author's expertise and/or the evidence they provide in relation to the trustworthiness of content in online resources (Kiili et al., 2018). This study compared the evaluation of online information (from a commercial vs. an academic source) by elementary school students and found that almost 50% of participants failed to question the credibility of the online commercial information. Kiili et al. (2018) also reported a small proportion of students providing multiple justifications for their credibility evaluations. These authors established that few students use the criteria of author expertise, credentials, affiliation and motives, along with document type, date and other elements to justify credibility. In a classic study, when neither internet nor social networks were as present as today, Tseng and Fogg (1999) analysed credibility about computers and established that people reach an assessment of credibility after applying expertise and trustworthiness to the interpretation of their reading process. Tseng and Fogg (1999) define expertise as knowledge, competence and reputation related to the online resource, while trustworthiness refers to readers' perceptions of well-intentioned, truthful, unbiased information capturing the goodness or morality of the content presented in an online resource. The issue here is whether trustworthiness and expertise combined have any relationship with agreement with the news, that is, by applying confirmation bias to the degree of believability: I will believe the news more if it aligns with my position.

As mentioned above, one of the interests of the present paper is to test the relationship between credibility and agreement, and their relationship with the quality of justification of the argumentative texts to justify both aspects in reference to fake news. In other words, is there a significant positive correlation between the degree of believability and the degree of agreement with the fake news? Does all of this together lead to a greater presence of confirmation bias in the students' argumentative texts?

A critical stance toward scientific information obtained from the internet is closely related to the degree of credibility and trustworthiness that the news online elicits in our minds. The increase in digital scientific (dis)information, with the increased access to digital information, requires a critical analysis by means of a dialogue between the process of review and counterargument, with the two processes closely related to the degree of credibility with which one interprets news online.

In addition, reading comprehension (Kintsch, 1998) has been studied as a potential factor for valuing credibility in relation to online resources (Kiili et al., 2018). Thus, Kiili et al. (2018) reported that reading comprehension was a significant

predictor for the evaluation of academic online resources. In a similar vein, Goldman et al. (2012) found that those with better reading comprehension used better comprehension-monitoring processes on reliable sites than on unreliable sites, and do so by a larger margin than poorer comprehenders. Therefore, it would be interesting to identify whether reading comprehension is related to the degree of credibility and agreement with the thesis of a news item and to the quality of the argumentation.

The present study

Given the increase in the fake news circulation on social networks, the present paper is a call of attention of the crucial need to develop critical thinking among adolescents, by means of showing their reasoning biases. This study amplifies the analysis of the Confirmation Bias (CB) effect that establishes the relationship between degree of agreement and quality of written argumentation, with a look at an extra variable, the degree of credibility. That is, we analyze the relationship between the degree of agreement and the quality of the written argumentation (CB), the degree of credibility and the quality of the written argumentations, and the relationship between these two variables: degree of agreement and degree of credibility.

The five research questions in the present study are:

- RQ1. Is there a correlation between agreeing with a news claim and the news credibility? That is, does a higher degree of agreement correspond with a higher degree of credibility?
- RQ2. Do participants justify better their degree of agreement when they position themselves against the claim of the news?
- RQ3. Do participants justify better their degree of credibility when they do not believe the news?
- RQ4. Is the quality of both argumentative texts (agreement and credibility) related to reading competence?
- RQ5. Is the intention to read an additional news item related to degree of agreement and/or degree of credibility?

Accordingly, we establish 5 hypotheses, one for each research question:

Hypothesis 1: The literature shows that credibility is defined by trustworthiness and expertise around the author and resource of the news (Tseng & Fogg, 1999). Therefore, we hypothesize that the higher the disagreement with the claim of the news, the lower the credibility.

Hypothesis 2: According to the literature (Villarroel et al., 2016), we expect to find that the higher the disagreement with the news, the better the quality of argumentation will be.

Hypothesis 3: The literature shows that the higher the scepticism (lower credibility), the better the quality of argumentation (less CB) (Taber & Lodge, 2012).

Hypothesis 4: Given that, according to the literature (Goldman et al., 2012), reading comprehension relates to better monitoring processes on reliable sites than on unreliable sites, we expect that those who do not believe the text will be the ones with better reading comprehension.

Hypothesis 5: Along with hypothesis 4, we expect that those who do not believe the text will show the need to look for extra information.

METHOD

Participants

Ninety-five ninth grade students (*M* age: 14.6 years) from two different but socially equivalent public schools in a Spanish urban environment took part in the study. The age of the sample was justified for two reasons: adolescence is an age when argumentation skills become established (Kuhn, 1991) and adolescence is the period in which the use of social networks as a reliable source of information starts to be more common. The gender distribution of the sample was balanced: male (*n* = 48) and female (*n* = 47).

Instruments

Reading comprehension test: the students' general level of reading comprehension was assessed by the Test of Comprehension Strategies (TEC; Vidal-Abarca et al., 2007). This norm-referenced reading test is designed for children aged 11 to 16. Students were asked to read two expository texts and then answer ten multiple-choice questions on each text. Cronbach's α for test reliability was .80.

News: the fake news was adapted from a blogger's site. It had the appearance of an online document and included a picture of a frozen mammoth. It was titled "Do not be deceived: climate change is not your responsibility" and had 386 words (see Appendix A1). Its level of difficulty was considered suitable for middle-school students, according to the Flesch-Szigriszt Index of readability (INFLESZ; adaptation by Barrio-Cantalejo, 2008). The program measures the facility to read a text taking into account the total number of syllables, words and sentences, and the resulting index is adapted to the present day. An INFLESZ value above 55 is considered appropriate for this age group, and the value obtained was 61. As shown by the title, the main argument of the fake news was that climate change depends only on

natural processes. It provided three pieces of evidence on this issue: the warmth of the Antarctic from the second to the eleventh century, solar cycles and volcanic eruptions. It did not discuss the human impact on climate change.

Tasks: after reading the fake news—which students could consult as much as they wished—, students were required to provide some background information (age and gender), and answer the following questions on a sheet of paper:

1. Mark your degree of agreement with the news claim (on a scale from 0 to 10) and justify it writing an argumentative text.
2. Mark the degree of news credibility (on a scale from 0 to 10) and justify it writing an argumentative text.
3. Answer a yes/no question about whether you would consult an additional text on the topic.

Procedure

First, participants who had provided their informed consent completed the comprehension test. Then, they read the fake news and solved the tasks. The data were collected in a 45-min regular science class.

Design

The design was descriptive-correlational with a dependent variable (argumentative competence), two independent variables (degree of agreement and degree of credibility of the news claim) and a co-variable: reading comprehension.

Coding procedure: the independent variables “degree of agreement” and “degree of credibility” were categorised from the participants’ responses on a scale from 0 to 10. In addition, participants’ responses were recoded as “con” if they marked the scale from 0 to 3, “pro”, if they marked it from 7 to 10, and “neutral” if they marked the scale from 4 to 6. The same was done for credibility: from 0 to 3: do not believe it; from 7 to 10: believe it; and from 4 to 6: neutral.

Each argumentative text drawn up by the students (one for agree and one for credibility) was coded using a coding scheme adapted from the literature (Villarroel et al., 2016; Toulmin, 1958). Justification was described as segments that confirm student’s position about the news; counterargument as segments that disconfirm the position, and rebuttal as the segment that counterargues the counterargument, thus aligning with the initial argument. Justification, counterargument and rebuttal can all include evidence of diverse quality. Therefore, the level of evidence was assessed by means of a rubric (Miralda-Banda, 2021). Evidence in both responses respectively (agreement and credibility) was operationalised on three levels (see

Table A2 in the Appendix A2 for a detailed description): personal experience, socially shared knowledge and formal sources of information (statistical data, documentary information, academic or dissemination articles, scientific documentaries on the subject, etc.). In addition, evidence was coded as coherent or not coherent with the argumentation provided. Three raters coded 60% of each type of text argumentation. The reliability was 93.9% for the argumentative text for agreement and 91.3% for the argumentative text for credibility. Disagreements were solved by discussion and the remaining texts were coded.

RESULTS

The findings are presented following the order of the research questions. Since the data were not normally distributed, nonparametric tests were implemented.

RQ1: Is there a correlation between agreeing with the claim of the news item and news credibility? That is, does a higher degree of agreement correspond to a higher degree of credibility?

A significant Spearman's correlation between agreement ($M = 4.8$; $SD = 2.59$) and credibility ($M = 5.11$; $SD = 2.5$) was found ($Rho = .743$, $p < .001$).

We also looked at the distribution of frequencies once we had categorised the students' position (see the Coding procedure above). Table 1 shows the crosstabulation results.

Table 1

Crosstabulation of the distribution of frequencies for the degree of credibility and the degree of agreement (n = 94)*

Agreement	Credibility			Total
	No	Yes	Neutral	
Pro	0	23	9	32
Con	24	1	10	35
Neutral	5	6	16	27
Total	29	30	35	94

Note. * 1 participant did not mark the degree of credibility.

A total of 29 participants said that they did not believe the news. Out of these, 24 positioned themselves against it (*sceptical*, do not agree with or believe it), and

5 remained neutral. In contrast, out of the 30 who believed the news, 23 agreed with it (*confident*, do agree with and believe the news), and only one did not agree with it. The Chi-square analysis shows that there was alignment between agreement and believability, and between disagreement and unbelievability [$\chi^2(4) = 58.3, p = .001$].

RQ2. Do participants justify better their degree of agreement when they position themselves against the claim of the news?

The quality of the argumentative texts to justify agreement ranged from 0 to 13 (maximum punctuation students could achieve was 15) (M number of words = 43.2; SD number of words = 28.2) (see Table 2).

Table 2

Distribution of means (SD) for the quality of argumentation to justify the degree of the agreement (n = 90)*

Agreement	n	Mean	SD
Pro	30	2.83	2.0
Con	35	4.37	2.6
Neutral	25	3.64	2.5

Note. *5 participants did not provide the argumentative text to justify agreement.

To test differences according to the participants' agreement with the news claim, we performed Kruskal-Wallis test for between-subjects groups ($\chi^2(2) = 6.5, p = .039$). We observed greater argumentative quality in the texts of students who positioned themselves against the news claim.

To identify the characteristics of the texts that caused significant differences, we focused on two indicators of quality (Kuhn, 2005): counterarguments and rebuttals. Regarding counterarguments, there were 40 participants (42%) who made at least one counterargument to justify their degree of agreement with the claim of the text. Out of them, 16 disagreed, compared to 13 who agreed and 11 who were neutral. For the second indicator of quality (rebuttals), only 11 participants made at least one rebuttal (12%): of those, 6 disagreed, 1 agreed and 5 were neutral.

Regarding the type of evidence used, only 59 participants (62.1%) used evidence in their argumentation. This was distributed as follows: 10.2% was type 1 (personal experience), 76.3% type 2 (socially shared knowledge), and 13.6% type 3 (formal sources of information; see Table A2 in the Appendix A2).

RQ3: Do participants justify better their degree of credibility when they do not believe the news?

The mean (and SD) number of words for the argumentative text to justify credibility was lower, 27.08 (16.3). The quality of the argumentative texts ranged from 0 to 9 (see Table 3).

To test differences according to the participants' assessment of credibility of the news claim, the Kruskal-Wallis test was carried out ($\chi^2(2) = 4.36$, *ns*). However, when we removed the neutrals, and keep only participants who did not agree with the news claim and did not believe it either (sceptical), and compare the quality of their argumentative text with those who agreed with the news claim and believed it (confident), we observed significant differences ($U = 194.5$, $p = .017$; see Table 1 for n). We noted that the quality of the argumentative text to justify the degree of credibility was higher for those who neither agreed with it nor believed it (sceptical) ($M = 3.5$, $SD = 1.9$) compared to those who both agreed with and believed it ($M = 2.19$; $SD = 1.4$) (confident). We observed that the sceptical participants showed a better credibility argumentative text than the confident participants.

Table 3

*Distribution of means (SD) for the quality of argumentation to justify the degree of credibility (n = 88)**

Credibility	n	Mean	SD
Believe	29	2.41	1.88
Do not believe	29	3.24	1.99
Neutral	30	2.27	1.78

Note. *7 participants did not provide the argumentative text to justify credibility.

Additionally, the degree of credibility was analysed according to the type of evidence used. Only 40% of participants used evidence (38/95). The distribution of the type of evidence used by these participants was: 17% type 1, 73.2% type 2 and 9.8% type 3 (see Table A2 in the Appendix A2).

RQ4: Is the quality of both argumentative texts related to reading competence?

Participants' performance in the reading competence test showed a mean of 12.47 ($SD = 3.9$). Given that the standard mean for the test validation is 13.3, we assume that our sample is around the population mean.

When the statistical relation between reading comprehension and the degree of credibility was computed, we observed a significant trend. The degree of credibility

decreased significantly as the reading comprehension increased. The estimate β for Reading skills is was -0.0647 , $p = .028$ (see Table A3).

As for the influence of reading comprehension on the texts on agreement and credibility argumentation, as a co-variable, we observed minor, non-significant effects. The mean argumentative quality appeared constant and independent of reading comprehension (see Table A3 for the beta regression model in Appendix A3).

RQ5: Is the intent to read an additional news item related to participants' degree of agreement and/or assessment of credibility?

Students who either disagreed (30/36, 84%) or were neutral about the news claim (23/27, 85%) were more likely to consult another text than those who agreed with the news (18/32, 56%) [$\chi^2(2) = 8.7$, $p = .013$]. In contrast, the relation was not observed when the degree of credibility was cross tabulated with intent to read a similar text. We observed that 25/29 (86%) believed the news and would consult a second text. Similarly, 20/30 (66%) who did not believe it and 25/35 (71%) who were neutral about believability would also read another text (see Table 4 and Table 5). These distributions did not yield significant differences [$\chi^2(2) = 3.2$, ns].

Table 4

Distribution of frequencies for crosstabulation of Question 4 (degree of agreement) and Question 6 (consult an extra text) (n = 95)

Agreement	No	Yes
Con	6	30
Pro	14	18
Neutral	4	23

Table 5

*Distribution of frequencies for crosstabulation of Question 5 (just degree of credibility) and Question 6 (consult an extra text) (n = 94)**

Credibility	No	Yes
Believe	4	25
Do not believe	10	20
Neutral	10	25

Note. *1 participant did not mark the degree of credibility

Considering the categories of *sceptical* and *confident* participants, we observed that sceptical people were more likely to consult a second source of information (84%), while confident people were less likely (only 62%). The cross comparison between sceptical and confident people yielded a marginally significant result [$\chi^2(2) = 2.64, p$ (one tailed) = .048] (see Tables 4 and 5 for frequencies).

DISCUSSION

We highlight five groups of results corresponding to the five research questions and respective hypotheses: (RQ1, H1) the high correlation (almost identification) between degree of agreement and degree of credibility; (RQ2, H2) the relation between lower agreement and better quality of argumentation; (RQ3, H3) the relation between lower credibility and better quality of argumentation (sceptical and confident); (RQ4, H4) the relation between high level of reading comprehension and lower credibility of the fake news, but lack of significant relation between reading comprehension and degree of agreement, and also, lack of significant relation between reading comprehension and textual argumentative quality; (RQ5, H5) only half of the participants saying that they would read a second text on the topic. These results were significantly higher among the sceptical people.

In relation to the first group of results, we confirm that the more people agree with a news item, and the more they believe it, the less critically it is analysed. In the crosstab analysis we observed that only one participant out of 35 who disagreed with the claim did believe the news item, and out of those who agreed with the news (32), all believed it. We observed a significant relation between agreeing with the claim of the news item and believing it. This confirmed the following claim: The more I agree with the claim of a news item, the more I believe it. The opposite was also true: the more I believe a news item, the more I agree with it. However, although the two parameters of agreement and credibility are different, the students could have taken them as equivalent. In fact, in some of their answers for credibility, they said: "I already answered that" (referring to the text on agreement). This could explain why the texts to justify credibility were a little shorter and, in general, included less evidence.

As for the second and third group of results, the classic confirmation bias literature establishes that we tend to accept information that confirms our prior beliefs uncritically, but when the news item goes against our views, it is likely to be ignored or questioned (Ditto & Lopez, 1992; Nickerson, 1998; Sperber et al., 2010; Taber & Lodge, 2012; Villarroel et al., 2016). Our results confirm the first part of the claim. We observed that the more students agreed with a claim, the worse their argumentative quality was: that is, they argued less and gave less evidence. In contrast, we noted that students who positioned themselves against the claim of

the news item were more critical, and hence showed higher argumentation quality. Students are not critical with regard the information that fits their ideas, regardless of whether it is fake news or not. These results align with those in Klaczynski and Gordon (1996), which established that participants' scepticism is higher (along with lower confirmation bias) when they deal with opposing evidence. That is, the threat to validity is more likely to be identified when the evidence goes against one's view. As Klaczynski and Gordon (1996) claim, scepticism about opposing evidence when we are reasoning may help overcome confirmation bias. In addition, Taber and Lodge's (2012) research on dealing with controversial issues, such as that presented in this research, claimed that students tend to spend more time and are more critical when they address disconfirming evidence than when they address confirming evidence. Although we did not control time, the fact that the texts of students who did not agree with the claim of the news included more counterarguments and more rebuttals is a sign that they devoted more effort to disconfirming evidence.

These results lead to speculation about the possibility that the confirmation bias phenomenon applied to the biased relation between agreement and poor argumentation could apply to the degree of believability. That is, the more I agree with a news item, the poorer my quality of argumentation will be; and the less I believe it, the better the quality of my argumentation. Once we remove the neutral participants, we can say that our results confirm this result. That is, the participants' quality of argumentation to justify the degree of believability is better when they do not agree with the news.

We define argumentative competence as the ability to integrate arguments into a framework of alternative evidence by means of a series of evidence-based justifications and counterargumentation. Through argumentation, students develop an assertion within the framework of justifications and counterarguments (Kuhn, 1991). We observed that this greater argumentative quality comes from the fact that those who disagreed made more counterarguments and more rebuttals, and the evidence they provided was better grounded than that of the rest of the participants. Tseng and Fogg (1999) established that people tend to assess *credibility* by applying the criteria of knowledge, competence and reputation related to the authors' online resource expertise, "while trustworthiness involves readers' perceptions of well-intentioned, truthful and unbiased information" (p. 535). In contrast, Macedo-Rouet et al. (2019), claimed that a very low percentage of students used the criteria of the authority of the document to critically assess the content of the news (evidence type 3). In our study, only 13.6% of participants used this criterion to justify the degree of agreement and 9.8% to justify the degree of credibility. In both texts (agreement and credibility), we observed that the highest percentage of evidence was type 2 (reference to socially shared, non-formal knowledge). Our results are in line with Kiili et al. (2018) in highlighting the

difficulty secondary education students have when dealing with misinformation. As Tseng (2018) also found, students need to have appropriate scientific reasoning and literacy skills to position themselves against a news item. These skills are difficult to find even among higher education students.

The fourth group of results confirm the importance of reading comprehension in critically evaluating the news. According to Goldman et al. (2012) and Kiili et al. (2018), reading comprehension is a significant predictor of evaluation of the academic online resource. We observed a (marginally) significant relation between reading comprehension, the degree of agreement and the degree of credibility. Thus, we can say that as reading comprehension increases, the degree of agreement and the degree of credibility decreases. The better participants read, the more critical their position was. However, we could not confirm the influence of reading comprehension as a co-variable for argumentative quality. Some research has found that people with better comprehension tend to write better synthesis texts (Nadal et al., 2021). However, since our coding scheme was centred specifically on the content of the argumentative texts, we did not code for written aspects that tend to be assessed, such as structure, coherence, cohesion, etc., that are more tied to linguistic aspects. This interpretation deserves future analyses.

Finally, our last group of results are in line with those of Kiili et al. (2018) on secondary school students' critical competence to deal with fake news. A total of 83% (20/24) of those who neither agreed with or believed the text would consult an extra text, compared to 62.5% (15/24) of those who agreed with the claim of the news or believed it. This is a striking result that highlights the urgency of implementing educational guidelines to help students develop critical skills to manage fake news. We must take into account that misinformed adolescents are future misinformers.

Educational implications

From an educational and communication point of view, we conclude that we should present students with texts that contain discrepant evidence to help identify threats to validity, and to teach them how to build counterarguments and rebuttals, rather than justifying arguments. In addition, we should teach them to use the International Federation of Library Associations and Institutions (IFLA) criteria to identify the validity of the information that is presented (IFLA, 2017).

Since misinformation can lead to inaccurate thinking, and changing those inaccuracies is difficult (McCrudden, 2019), students must be taught to see the difference between agreeing with arguments and the credibility of the information. Students must also be shown that the degree of agreement has to be justified through valid evidence while the degree of credibility has to be justified through criteria such as the source, alternative opinions, clues, etc. In spite of the research efforts

to inject training of critical-information skills into primary and secondary schools, it is not clear whether such efforts improve assessments of information credibility or if any such effects will persist over time. There is a great need for rigorous program evaluation of different educational interventions (Lazer et al., 2018).

Many educational institutions began to include in their curriculum simple clues such as IFLA's "source, unprofessional and sloppy clues, a second opinion, browser plugins, ask the librarian" (Parra-Valero & Oliveira, 2018, p. 70), to help students detect fake news. From the perspective of education and communication, we conclude that we must teach students to construct counterarguments and refutations, so that they are able to do more than justify arguments. They need to do this with any kind of news items, not only with news that contrasts with their own perspective.

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APPENDIX A1. THE NEWS AS PRESENTED IN THE TASK (TRANSLATED INTO ENGLISH)

<http://reflexionesmarginales.com/3.0/la-falacia-del-calentamiento-global/>

Jesús Manuel Araiza

DO NOT BE DECEIVED: CLIMATE CHANGE IS NOT YOUR RESPONSIBILITY

It may seem surprising, but Trump was right when he said “I don’t think so” about the climate change report.



A person could easily feel empathy and accept the thesis that human beings are the cause of the so-called global warming because those who have proclaimed the defense of this idea appear as scientists with a concern that no reasonable and sensible person could stop taking care of our habitat and planet in order to preserve humanity. Who would be opposed to this need, and to the faith that deaths and natural catastrophes would be avoided?

However, we cannot ignore the fact that one thing is to take care of the environment and habitat, and a very different one, the cause of climate change. Human beings are certainly responsible for the former; whereas for the second, exclusively or almost exclusively, nature is.

By saying that human beings are responsible for climate change rather than nature is to ignore those things that can only be caused by nature. To attribute the cause of climate change to human beings is as absurd as claiming that we are also responsible for the movement of the Sun, the movement of the Earth and its cycles, volcanic eruptions, earthquakes and tsunamis, storms and meteorological alterations, and the natural catastrophes that all this entails. All this has happened repeatedly in other times regardless of human action. As Nasif Nahle (2011) of the Biology Cabinet Organization points out, the reconstruction of the temperature in Antarctica shows a period from 110 AD to 1020 AD, during which the atmosphere was much hotter. Undoubtedly, this fact cannot be attributed to human activity, but to natural causes. Global warming can be explained by changes in solar activity. Volcanic eruptions and ocean currents also change the climate. So, probably we should start accepting that Trump is right when he questions the positions that say global warming and climate change depend on human activity.

APPENDIX A2. RUBRICS TO CODE THE QUALITY OF ARGUMENTATION

The score for argumentative quality (maximum fifteen points) was calculated as a result of the sum of: a) the three fundamental moves in argumentative discourse: justification, counterargumentation and rebuttal (one point for each move present in the argumentative texts); b) the quality of the evidence (students could add evidence for each move, and the quality of that evidence was scored attending the rubric in Table A2-maximum three points for evidence provided per move-); c) the evidence could also be coherent, or not, with the position explained in each of the argumentative moves. When it was coherent, we scored one additional point for the evidence.

Table A2

Rubrics to code the quality of evidence with examples from argumentative texts

Evidence level			
0	1	2	3
Does not provide evidence to justify degree of credibility/agreement with the news	Evidence comes from references to personal experiences	Reference to socially shared, non-formal knowledge	Reference to formal sources of information (statistical data, documentary information, academic or dissemination articles, scientific documentaries on the subject, etc.)
	“Because the main causes (as far as I know) are caused by humans and now we are going to put the blame (blame) on nature”.	“I think we’re to blame (politicians mostly). Because we already know that many plant things can be created, but they are not sold, because oil makes a lot of money. There are water engines, but they are not sold.”	“I am a great fan of astronomy, and I am informed that the current solar cycle is at a low activity stage. If, now that we are about to approve measures for the degrees of excess, we are in a stage of low activity, it is not due to the solar cycle’s high activity.”

APPENDIX A3. BETA REGRESSION MODELS

As we observe in Table A3, a score of 10 on the literacy competence scale was associated with a mean (95% CI) of 5.4 (4.7; 6.1) on the degree of agreement with the thesis of the news. In contrast, a score of 20 on the literacy competence scale was associated with a score of 5.0 (3.7; 6.2) on the degree of agreement with the thesis of the news.

A score of 10 on the literacy competence scale was associated with a mean (95% CI) of 5.8 (5.1; 6.4) on the degree of credibility with the thesis of the news, whilst a score of 20 was associated with a score of 4.2 (3.0; 5.4) on the degree of credibility.

Regarding the relation between reading skills and text argumentative quality (agreement and credibility, respectively), neither of the two relations were significant. A score of 10 on the literacy competence scale was associated with a mean (95% CI) of 3.65 (3.1; 4.3) on the argumentative quality of agreement. In contrast, a score of 20 was associated with a level of 3.71 (2.7; 4.8) on the argumentative quality of agreement. For credibility, a score of 10 on the literacy competence scale was associated with a mean (95% CI) of 2.6 (2.0; 3.1) on the argumentative quality of agreement; whilst a score of 20 was associated with a level of 2.4 (1.5; 3.3) on the argumentative quality of agreement.

Table A3

Beta regression models

Degree of agreement	Estimate	Standard error	p-value
Intercept	0.3339	0.3996	.403
Reading skills	-0.0171	0.0305	.574
Degree of credibility			
Intercept	0.9629	0.3825	.012
Reading skills	-0.0647	0.0294	.028
Argumentative quality of agreement			
Intercept	-1.1563	0.3164	<.001
Reading skills	0.0022	0.0237	.926
Argumentative quality of credibility			
Intercept	-1.5042	0.3508	<.001
Reading skills	-0.0075	0.0264	.775

