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A literacia em um mundo de pós-verdade

Literacy in a post-truth world

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Resumo: Este artigo teórico examina se a aquisição de melhores habilidades de literacia pode ajudar as pessoas a serem menos vulneráveis a vários tipos de desordem de informação, tais como notícias falsas e teorias conspiratórias. Começamos este empreendimento olhando, primeiro, para as relações entre vulnerabilidade a desordem de informação e literacia (ou, mais geralmente, educação formal), e segundo, para os efeitos de transferência induzidos pela literacia sobre as habilidades cognitivas. Em seguida, comentaremos algumas descobertas interessantes feitas no âmbito de um projeto experimental no qual examinamos adultos e adolescentes subletrados. Com base nesses resultados, conjecturamos sobre as relações entre literacia, raciocínio lógico pensamento crítico, e endosso de teorias conspiratórias.

Palavras-chave: Literacia. Raciocínio lógico. Pensamento crítico. Teorias conspiratórias.

Abstract: This theoretical paper examines whether acquiring better literacy skills may help people to be less vulnerable to various types of information disorders such as fake news or conspiracy theories. We start this venture by looking, first, at the relationships between vulnerability to information disorders and literacy (or, more generally, formal education), and second, at the literacy-induced transfer effects on cognitive skills. Then we will comment on some interesting findings made within the framework of an experimental project in which we examined subliterate adults and adolescents. Grounded on these results, we conjecture on the relationships between literacy, logical reasoning, critical thinking and endorsement of conspiracy theories.

Keywords: Literacy. Logical reasoning. Critical thinking. Conspiracy theories.

1 Introduction

It is often argued that we live in a post-truth era, namely a world of deceit and lies, in which beliefs and emotions play a bigger role than objective facts. In such an era people are often unable to discern facts from fiction. Hence, it is of utmost importance to equip people to deal with the pitfalls of "information disorders" (WARDLE; DERAKHSHAN, 2017), a generic term encompassing misinformation (information that is false, but not intended to cause harm), disinformation (false information that is deliberately created or disseminated with the express purpose to cause harm) and "malinformation" (genuine information shared to cause harm, often by moving information designed to stay private into the public sphere to harm a person or reputation; for definitions and discussion of these three concepts, see WARDLE; DERAKHSHAN, 2017; WARDLE *et al*., 2018).

As a matter of fact, evidence suggests that people may tend to be fooled by such information disorders (e.g., PANTAZI *et al*., 2021) as well as to endorse irrational or erroneous beliefs (FLYNN *et al*., 2017). For example, most people believe in "scientific" myths such as the idea that we use only 10% of our brain (SWAMI *et al*., 2012; 2015), and numerous individuals are still strongly influenced by the pseudo-scientific theories of creationism and intelligent design and hence believe, for instance, that we were created by God less than 10,000 years ago. This is particularly the case in countries such as Brazil, where education has long been targeted by state interference and where the creationist thesis (or its Siamese twin, the intelligent design) has been infiltrating politics and education for years (SILVA; PRADO, 2010), and in which the present situation is alarming (SILVA; PRADO, 2010; LIONÇO; MATTOS, 2021). The government of Jair Bolsonaro, under the banner of a pseudo-war against "ideological indoctrination" targeting "cultural Marxism" and "gender ideology" in educational institutions, and relying among others on the conservative project called *Escola sem Partido* ("Non-partisan school", e.g., LIMA; HYPOLITO, 2020, LIONÇO; MATTOS, 2021), has proposed a series of measures aimed at controlling teachers (e.g., opening a hotline for denunciations of issues "against morals, religion and ethics of the family", at the instigation of the Minister of Women, Family and Human Rights, Damares Alves, who is an evangelical pastor[1]) and has already succeeded in undermining from within the most important scientific and educational institutions, as illustrated by the fact that a creationist (Benedito Guimarães Aguiar Neto) was appointed as the head of the country most important agency for regulation and funding of science and high education (the *CAPES*, *Coordenação de Aperfeiçoamento de Pessoal de Nível Superior*). Neto defends the intelligent design thesis as a "counterpoint" to the theory of evolution and invites discussion of creationism in basic education.

Many people also believe in paranormal phenomena such as extraordinary life forms and witchcraft superstitions (e.g., AARNIO; LINDEMAN, 2005), tend to take horoscope into account in daily life (30% of the respondents across five European countries, MOCAN; POGORELOVA, 2017) and to use lucky charms (e.g., mascots, talismans, etc.) because they believe in their protective power (44% of all respondents of the European Values Survey made across 14 European countries and analyzed by MOCAN; POGORELOVA, 2017). This is the case, for instance, of the athletes who use the Power Balance® bracelet they believe to afford force, equilibrium and agility thanks to its holograms designed to resonate with and optimize their body's natural energy field (e.g., PORCARI *et al*., 2011). As explained by Porcari *et al*. (2011), in the pseudo-scientific tests designed to validate the performance of this kind of product, companies typically first test participants performing without the bracelet on, and later with the bracelet on. Invariably, participants perform better on the latter trial. Actually, three types of explanation may account for such a result: a genuine benefit of the bracelet, the fact that the subjects were warmed-up and/or more

[1] See numerous other examples in the *Manual de defesa contra a censura nas escolas*, "Defense manual against censorship in schools, https://www.manualdedefesadasescolas.org/manualdedefesa.pdf.

habituated to the task on the second trial, or a placebo effect (BEEDIE; FOAD, 2009). When confounds are eliminated, no benefit of the bracelet is observed (*e.g.*, PORCARI *et al.*, 2011).

In addition to these phenomena, there is a profusion of fake news and conspiracy theories (explanations of historical events based on the role of a small group of individuals acting in secret and with malevolent intentions, KEELEY, 1999), and both are endorsed by many people. Conspiracy theories are particularly difficult to verify as true or false because they are built through a narrative characterized by argumentative *mille-feuille*, a rhetorical technique of pseudo-demonstration that consists in combining many arguments which are individually of little value, but together give an impression of solidity of the thesis (BRONNER, 2013). Furthermore, counterarguments can be used as evidence of the conspiracy; for instance, if a media report refutes a conspiracy, the media can be accused of being part of the conspiracy.

All types of information disorders, in particular fake news and conspiracy theories, have serious societal consequences, as they damage the quality of public debate, promote misperceptions, foster greater hostility against political opponents, and undermine confidence in government and journalism (e.g., GUESS *et al*., 2020). Together with "bullshitting" (FRANKFURT, 2005), namely totally disregarding factual truth or falsity and seeking only an apparently solid impression (e.g., BRUM, 2018) and with "strategic ignorance", namely strategic mobilization of ignorance linked to nonaction or inaction as a form of power (MCGOEY, 2019; ORTEGA; ORSINI, 2020), they may be used to deliberately undermine public institutions and, more generally, democracy, as illustrated for instance by the communication strategy of Bolsonaro's Brazilian government (see ANONYMOUS *et al*. for examples and further discussion).

The problematic aspects of information disorders are amplified even more given that a large part of 15-year-old students (more than 90%, according to the Organization for Economic Cooperation and Development, OECD, 2019) is unable to demonstrate critical reflection on written information. Specifically, this population does not reach a level of reading proficiency that allows in-depth understanding of long texts, dealing with abstract or counterintuitive concepts, evaluating the coherence between various statements and discerning facts from opinions based on cues to the content or source of information. It is, therefore, essential to develop programs aimed at improving students' deep reading comprehension and critical reading skills (PACHECO; HÜBNER, this volume) to help them fight against information disorders.

One may wonder, however, whether the possibility to resist information disorders is limited to people who present specific educational characteristics, namely who benefited (or are still benefitting) for years from formal education, among which literacy is an essential component. What about other people, our less privileged peers? As a matter of fact, many individuals do not have access to formal education at all and remain illiterate or quasi-illiterate because they did not attend school, or only for a very short time. According to the United Nations Educational, Scientific, and Cultural Organization (UNESCO[2]), "Despite the steady rise in literacy rates over the past 50 years, there are still 773 million illiterate adults around the world, most of whom are women". In Brazil, according to UNESCO Institute for Statistics (UIS)[3], in 2018 there were still more than 6.5% of people aged 15 and above who could not read and write with understanding a short simple statement about their everyday life. The Brazilian Institute of Geography and Statistics (IBGE[4]) presented congruent data for 2019, with important regional variations, the Northeast Region displaying the highest illiteracy rate (13.9%). Even more dramatic, a recent Brazilian study released by the "All for Education" program (TODOS PELA EDUCAÇÃO, 2021), based on a National Household Sample Survey (Pnad), showed that, in 2021, 41% of the 6- and 7-years-old Brazilian children were not able to

[2] http://uis.unesco.org/en/topic/literacy
[3] http://uis.unesco.org/
[4] https://educa.ibge.gov.br/jovens/conheca-o-brasil/populacao/18317-educacao.html

read and write, which represents 2,4 million children. This is the highest illiteracy rate recorded in the country since 2012. According to some analyzes (BRASIL DE FATO, 2022[5]), this situation, which strongly reinforced the difference between white children and the others, and between public and private schools, would be due to the absence of public education policies in the face of the COVID-19 pandemic, which worsened the preexisting reality of inequity in terms of access to knowledge: The process of remote learning is hard, if not impossible, in poor environments, and children from poor families cannot find books at home.

Very worrying is also the fact that beyond fully or almost fully illiterate unschooled people, many schooled people are subliterate (or "functional illiterates", according to UNESCO's nomenclature, UNESCO 1979[6]), namely do not have the minimum level of competence in reading and writing necessary to deal with the complex demands of daily life and of most work (UNESCO, 1979). Although the exact proportion of subliterate and/or functional illiterates is debated (see for instance the fact checking "Full Fact" site[7]), sub-literacy concerns millions of people over the world, including in supposedly WEIRD (Western Educated Industrialized Rich Democratic, cf. HENRICH *et al*., 2010) societies. For instance, in Germany, in 2012 there were 14.5 % of subliterate adults between 18 and 64 years, which means 7.5 million people (GROTLÜSCHEN; RIEKMANN, 2012, cited by BOLTZMANN *et al*., 2016), a percentage that can be reduced to 10% at most if one excludes people whose native language is not German (BULAJIC *et al*., 2019).

It is therefore important to understand whether acquiring better – although still relatively basic – literacy skills may help these people to be less vulnerable to information disorders. Furthermore, grounded on preliminary results from an experimental project in which we examined subliterate adults (for details, see ANONYMOUS *et al*.) and adolescents, we conjecture on the mechanisms of this effect. We start this venture by looking, first, at the relationships between vulnerability to information disorders and literacy (or, more generally, formal education), and second, at the literacy-induced transfer effects on cognitive skills. Then we will comment on some interesting findings from our project.

2 Why is vulnerability to information disorders associated to poor formal education and literacy?

Numerous studies have reported a negative relationship between vulnerability to misinformation and education level (*e.g.*, ALLCOTT; GENTZKOW, 2017; DOUGLAS *et al*., 2016; FREEMAN, BENTALL, 2017; GEORGIOU *et al.*, 2019; 2020; LANTIAN *et al*., 2021; MANCOSU *et al*., 2017; VAN PROOIJEN, 2017; USCINSKI; PARENT, 2014), including the ability to deal with basic numerical concepts (ROOZENBEEK *et al.*, 2020). Hence, the more people are educated and literate, the less they are vulnerable to information disorders.

As discussed by Arnal *et al*. (2022), this correlation can be interpreted in two different (but not necessarily incompatible) ways. The first explanation focuses on specific socio-economic and/or socio-cultural positioning. For instance, lack of trust in official institutions and narratives (*e.g.*, FRANKS *et al*., 2017; LANTIAN *et al*., 2016) and a sense of a lack of control over one's own life (*e.g.*, IMHOFF; BRUDER, 2014) are powerful drivers of conspiracy belief, namely of people's general predisposition (GOERTZEL, 1994; WOOD et al., 2012) to prefer conspiracy explanations in order to account for complex social situations or problems (*e.g.*, BROTHERTON *et al*., 2013; USCINSKI; PARENT, 2014). Such feelings are more likely to be experienced by the most socioeconomically

[5]See also https://www.redebrasilatual.com.br/educacao/2022/02/analfabetismo-volta-a-crescer-e-expoe-falta-de-politicas-publicas-de-educacao/

[6] We prefer the term "subliterate" because it is more general. Indeed, it has been proposed to restrict the use of the term "functional illiterates" to people who do not possess the basic literacy skills to deal with everyday life requirements despite having adequate formal education, namely despite having completed compulsory education (VÁGVÖLGYI *et al*., 2019; see also BOLTZMANN *et al*., 2019; BULAJIC *et al*., 2019).

[7] https://fullfact.org/news/are-one-five-british-adults-illiterate/

disadvantaged and hence least educated and least literate people (FOSTER; FRIEDEN, 2017; GOUBIN; HOOGHE, 2020). Indeed, by offering a simple vision of complex social realities, conspiracy theories do look as if they would feed the hope that the world is understandable, predictable, and therefore potentially controllable.

According to the second explanation, the negative correlation between education level and vulnerability to misinformation may reflect the fact that more educated people read more and have more access to information, have greater tendency to use analytical reasoning processes and lesser to use simple and intuitive solutions in order to understand social situations and complex problems, and are more strongly motivated to form beliefs based on logic and evidence (*e.g.*, DOUGLAS et al., 2016; MANCOSU *et al.*, 2017; VAN PROOIJEN, 2017). Analytical thinking, inference, evaluation, as well as deductive and inductive reasoning do contribute importantly to the set of cognitive skills often called *critical thinking* (see discussion in *e.g.*, ANONYMOUS *et al.*). Critical thinking would allow reflexive, reasonable thinking directed towards what to believe in or do and hence would support the correct assessing of statements and acts planning (ENNIS, 1962; 1980). Critical thinking is therefore considered as essential to fight against information disorders.

In short, education improves critical thinking and therefore helps people to resist information disorders. Notably, it has been shown that there is a significant positive correlation between analytic thinking (as evaluated by the "Cognitive Reflection Test", CRT, which measures the ability to inhibit a prepotent incorrect response and engage in additional reflection leading to the correct response, FREDERICK, 2005[8]) and the ability to distinguish between fake news and real news (PENNYCOOK; RAND, 2019; see also GUESS *et al*., 2020). On the other hand, Farley and Elmore (1992) reported a positive relationship between reading comprehension and critical thinking, the latter being evaluated through the Cornell Critical Thinking Test (CCTT, ENNIS *et al*., 2005), a test which assesses induction, deduction, credibility, identification of assumptions through a narrative text (for more details on the CCTT, see *e.g.*, ANONYMOUS *et al*.).

3 Literacy effects on cognitive skills

Literacy acquisition has been shown to induce far transfer effects, shaping not only language processing and conceptualization (for a review, see *e.g.*, KOLINSKY, 2015) but also memory processes (for reviews see *e.g.*, DEMOULIN; KOLINSKY, 2016; GABRIEL *et al*., 2016; 2022). As a matter of fact, auditory verbal memory is much weaker in illiterate adults compared to literate ones. This is the case in immediate repetition of pseudo-words (*e.g.*, CASTRO-CALDAS *et al*., 1998) and serial recall of word lists (*e.g.*, KOSMIDIS *et al*., 2011; MORAIS *et al*., 1986), especially for the memory of items' order (KOLINSKY *et al*., 2020; SMALLE *et al*., 2019). Literacy also boosts working memory (KOSMIDIS *et al*., 2011; ANONYMOUS *et al*., submitted), which is measured through more complex tasks than mere immediate or delayed repetition. One of them is the listening span task, in which a series of unrelated simple sentences is presented on each trial, and participants are required to remember only the last word of each sentence to the aim of repeating them at the end of the series, in the order in which they had occurred. Throughout these experiments the set size (i.e., the number of sentences presented before recall) is usually increased.

Literate people also use different syntactic structures than illiterate people, because written speech is quite different from the illiterates' oral speech. In written texts, cohesion is established by means of complex syntactic structures that make connectives explicit and highlight the relationships between propositions by means of grammatical subordination. Oral language is, on the contrary, additive and aggregative (*e.g.*, ONG, 1982).

[8] The following problem illustrates the CRT: "A bat and a ball cost $1.10 in total. The bat costs $1 more than the ball. How much does the ball cost?" Many people give the first answer that comes to their mind (10 cents) without realizing that this cannot be right (the bat would then have to cost $1.10, and the total cost would be $1.20).

Consequently, illiterate adults have difficulties understanding spoken sentences such as “If a girl watching a man drawing pictures of a young boy runs away, who runs away?”: Their understanding is based on the order and contiguity of the salient terms (29% answer: “the boy”, SCHOLES; WILLIS, 1987; see also CORRÊA, 1991; KATO *et al*., 2009).

More generally, literacy is a “mindtool” that facilitates access to information and the acquisition of new knowledge. As such, it increases and diversifies the individuals’ knowledge database. For instance, literacy boosts the knowledge and precision of semantic concepts (KOLINSKY *et al.*, 2014). Literacy and formal education also provide stronger exposure to books, both through extra-curricular reading and at school. Exposure to school textbooks is already in itself an important source of vocabulary and conceptual enrichment. Many encyclopedic terms related to academic knowledge are rarely used in spoken language (e.g. “Uranus”, “vector”). A French study (LIEURY; LORANT, 2013) showed that the rate of acquisition of such terms doubles approximately every year between the 6th and 9th grades: 2500 new words are acquired at the end of Grade 6 and 17000 at the end of Grade 9 ! Thus, literacy increases the richness and precision of concepts.

Although this has been less studied in a controlled way, literacy seems to also impact high-level processes such as cognitive control, reasoning abilities and problem solving (for reviews and discussions, see *e.g.*, HUETTIG; MISHRA, 2014; KOLINSKY; MORAIS, 2018; MORAIS; KOLINSKY, 2020). In two separate studies, we recently made two observations that are consistent with this idea. First, in Brazilian adults with varying (but always modest) education and literacy levels we observed that literacy has a specific impact on some aspects of cognitive control, namely on the dynamic micro-adjustments of cognitive control invoked by the commission of incidental errors (ANONYMOUS *et al*., submitted). Usually, following an error, we adapt our behavior and strategically begin to respond slower on the next trial to gain better performance. We observed that this effect is far stronger in more literate participants and posited that this may be due to the fact reading powerfully trains the predictive system (for a review: HUETTIG; PICKERING, 2019). Second, in Belgian subliterate participants, we observed a significant correlation between literacy and reasoning abilities, as evaluated in a task requiring them to decide whether they believed or not in the conclusion of syllogisms (for a more detailed description: ANONYMOUS *et al*.).

4 Other results from our project

Since 2018, we are developing a project, titled “The Socio-Cognitive Impact of Literacy”, to foster and examine critical thinking in subliterate people, and to check who are these subjects in terms of literacy-related skills, including reading habits and attitudes, as well as in terms of critical thinking and endorsement of conspiracy theories, plus the relationships between these skills (for details: ANONYMOUS *et al.*).

In addition to subliterate adults, who were students of adult basic education or literacy classes and displayed reading skills equivalent to those of Grade 3 and 4 children, at least as regards regular word reading (ANONYMOUS, in press), we examined adolescents from vocational classes. As a matter of fact, students from disadvantaged backgrounds are predominantly directed to vocational classes that place less emphasis on reading comprehension and (critical) analysis of written texts, compared to students from advantaged social groups, who predominantly remain in general education classes (ARUM *et al*., 2007; LAFONTAINE *et al*., 2015). Now we had the opportunity to examine 57 subliterate adults and about 100 adolescents from vocational classes (attending at least Grade 3). Whenever possible, we also tested control adults (204 participants with at least the secondary school degree) and adolescents from general education classes (18 students attending at least Grade 3).

Without delving into the details of the results, it is worth mentioning that both the adolescents from vocational courses and the subliterate adults were poorer on critical thinking, as measured by the CCTT

(ENNIS *et al.*, 1985), than the adolescents from general education classes. The two subliterate groups also endorsed conspiracy theories more strongly than the control adults, as revealed by the fact that, in a French version (LANTIAN *et al*., 2016) of the Generic Conspiracist Belief Scale (BROTHERTON *et al*., 2013), they considered as true, more often than the Controls, sentences such as "Secret organizations communicate with extraterrestrials but keep this fact from the public" or "A small, secret group of people is responsible for making all major world decisions, such as going to war". Conspiracy belief was thus stronger in the subliterate participants.

Also interesting were the literacy results. First, it is worth noting that, as expected, both the adolescents from vocational courses and the subliterate adults underperformed adolescents from general education classes on two literacy tests, one examining simple text reading comprehension and one evaluating spelling skills. Second, we observed interesting results when analyzing participants' responses to the questionnaire about reading habits and attitudes. This included, in addition to quantitative measures (e.g., number of books at home), items that participants had to rate on a Likert scale (e.g., from "strongly disagree to "fully agree"). A principal component analysis revealed two main components, one that we called "like reading" and the other "light reading". The first component included quantitative measures such as number of fiction books read per year for pleasure, as well as qualitative items such as, for instance, "Before going to sleep, I usually read a few pages", "I think that reading for pleasure is not a waste of time", and "Reading is my favorite hobby". The second component seems to reflect exposure to relatively "light" and unfiltered information, as found in magazines or on the Internet, as it includes measures such as the number of magazines read per month for pleasure, and the frequency of reading daily news via computer or smartphone. On the like reading component, the adolescents from vocational courses and the subliterate adults did not differ from each other and presented lower scores compared to the adolescents from general education classes and control adults (who did not differ from each other either). Thus, the two subliterate groups read less and enjoyed less reading than the others, at least as regards fiction books. On the contrary, on the light reading component the subliterate adults presented higher scores than all other groups, meaning that, for instance, they were reading more frequently news on the internet than the other participants.

The pattern of correlations (and multiple regressions) was also quite exciting. Literacy measures as well as the "like reading" component correlated positively with critical thinking, but not at all with conspiracy belief. In fact, conspiracy belief did not correlate with critical thinking, neither (in adults[9]) with syllogistic reasoning, although the latter was correlated positively with both literacy measures and critical thinking. Yet, conspiracy belief correlated positively with the "light reading" component, meaning that for instance, the more participants read daily news via computer or smartphone, the more they were prone to endorse conspiracy theories. Conspiracy belief also correlated negatively with number of school years in infancy.

5 Discussion

Contrary to what we were expecting, conspiracy belief does not seem to be related to literacy skills *per se*, although formal schooling helps to lower it, probably via the acquisition of knowledge. The pattern of correlation further suggests that reading is in fact not always good for fighting conspiracy belief. What matters is, in fact, the quality of read materials, and probably how they are read, namely whether the reader engages (or not) with it critically (« deep reading », PACHECO; HÜBNER, this volume). Our results suggest that special caution should be taken to avoid "light reading", namely exposure to relatively "light" and unfiltered information. In this regard, it is worth noting that many of the subliterate adults of our study acknowledged that, in their case, "reading daily news via computer or

[9] Adolescents were not presented with syllogisms.

smartphone" meant … consulting "news" on *FaceBook*.

Therefore, we believe that educators should stimulate not only deep reading but also *media literacy*, namely the ability to understand, analyze, and evaluate media messages presented in a wide variety of ways (e.g., ARKE; PRIMACK, 2009) as well as *source evaluation* (also called *sourcing*), that is the ability to attend to, evaluate, and use available information about the sources of textual content. Indeed, as argued by Anonymous (submitted), effective assessment of the credibility of a source may help distinguishing more trustworthy from more questionable information. As such, sourcing may be considered as one of the multiple skills that contribute to critical thinking. Training these skills through appropriate school curricula (including in adult literacy and vocational courses) can contribute to the achievement of the new directions proposed by the UNESCO.

The UNESCO has indeed significantly expanded its definition of literacy in the last decades. Now, besides the capacity to decode a script and reproduce it within a given tradition, which allows individuals to function and communicate effectively in their community, literacy should also embrace the capacity to use these skills for personal development, contextual awareness and critical reflection. In this perspective, "Reading is no longer mainly about extracting information; it is about constructing knowledge, thinking critically and making well-founded judgements" (SCHLEICHER, 2018, p. 14). In fact, we should use the term "literacy" (or "reading literacy", according to PISA, OECD, 2018) instead of the term "reading", as the latter focusses exclusively on decoding or knowledge of written words, whereas "literacy" emphasizes the broader and deeper cognitive competencies we commented on, as well as engagement (motivation to read, interest in and enjoyment of reading, a sense of control over what one reads, involvement in the social dimension of reading, and diverse and frequent reading practices) and a variety of metacognitive skills and appropriate strategies when processing texts, such as thinking about, monitoring and adjusting reading activity for a particular goal (OECD, 2018).

It is also worth commenting further on the fact that, at least among the participants of our study, the propensity to endorse conspiracy theories does not seem to be related to a lack of critical thinking, as estimated through the CCTT, nor to a weakness of logical reasoning *per se*, as evaluated by a syllogistic reasoning test. Although somewhat surprising, this double null result may reflect the fact that the CCTT only includes cognitive components of critical thinking, namely logical skills grounded on induction, deduction, credibility, and identification of assumption. Yet, it is not enough to have good critical thinking skills of this kind, it is also necessary to be willing to apply these skills, and vice-versa (being positively disposed toward critical thinking does not assure that one is skilled in critical thinking, FACIONE *et al*., 2000): Motivation and attitudes may be as important (or even more important) than cognitive skills *per se*. Future work should thus also examine participants' motivation and attitudes, such as give time to think, openness and impartiality, inquisitiveness, flexibility, propensity to seek reasons, desire to be well informed, respect for and willingness to maintain various viewpoints, and consider broader perspectives. Nonetheless, whatever their critical thinking attitude, it was also alarming to see that all the participants of our study (and not only the subliterate ones) displayed very poor scores on the CCTT. Compared to a Grade 8 US sample of more than 1100 students from 11 schools in upstate New York (ENNIS *et al*., 2005), the adolescents from general education classes displayed scores corresponding to the 25th percentile (15th for the adolescents from vocational classes).

In any case, the fight against information disorders must also take other, multiple psychological and socio-cultural emotional facets into account. As we have already commented on, and as discussed by Arnal *et al*. (2022), conspiracy thinking is not merely a poor thinkers' pathology. In addition to be driven by socially situated negative feelings such as lack of trust in official institutions and narratives (e.g., FRANKS *et*

al., 2017; LANTIAN *et al*., 2016) and a sense of loss of control over one's own life (e.g., IMHOFF; BRUDER, 2014), conspiracy beliefs may also be positively associated to sensation seeking, namely to preference for exciting, intense, experiences leading people to perceive them as entertaining, and hence to endorse them (VAN PROOIJEN *et al*., 2022). Furthermore, at least as regards vulnerability to political misinformation, Pantazi et al. (2021) pointed to "the combined operation of two opposing psychological constructs: excess gullibility on the one hand and excess skepticism and vigilance on the other" (PANTAZI *et al*., 2021, p. 267). Indeed, "mistrust and skepticism, traditional indicators of 'vigilance', may paradoxically render citizens more gullible (…) if it is misdirected towards trustworthy and reliable sources of information" (PANTAZI *et al*., 2021, p. 286). "As a result, both the 'gullible' and the 'skeptical' side of human psychology may make citizens particularly prone to believe misinformation" (PANTAZI *et al*., 2021, p. 270). We may further speculate that these two constructs interact with the socio-cultural and emotional factors already discussed.

In conclusion, formal education seems to assist people in being able to resist information disorders, but literacy *per se* is far from enough. Reading may even lead people to be more prone to conspiracy beliefs if it is limited to accessing Internet sites. Neither is logics by itself enough to explain conspiracy beliefs. This does not mean that we do not need these abilities: logical and literacy skills are certainly useful, as is, more generally, knowledge. Yet, the other sociocultural and emotional drivers of conspiracy beliefs or, more generally, of excess gullibility (or excess skepticism, as we saw) should be considered as well.

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