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Adolescents, Media Literacy, and Misinformation: The Cognitive Challenges of Fake News Detection

ABSTRACT

The spread of misinformation on social media among adolescents presents a critical societal challenge due to their cognitive vulnerabilities. This study examines whether analytical thinking influences fake news detection and whether this relationship is shaped by awareness of fact-checkers, following fact-checkers, and perceived credibility of fact-checkers. Using a quantitative approach, we surveyed 162 adolescents. The findings indicate a pronounced floor effect, with most participants exhibiting very low analytical reasoning and poor misinformation discernment. The lack of variance in these cognitive dimensions suggests that adolescents may rely more on heuristic processing rather than analytical reasoning when dealing and evaluating misinformation. This pattern raises concerns about their ability to critically assess online content, emphasizing the importance of cognitive skills in digital media literacy. These results highlight a systemic challenge in adolescent engagement with misinformation, reinforcing the need to address analytical reasoning deficits in educational contexts. Targeted educational interventions are needed to bridge these cognitive skills gaps and enhance misinformation resilience among adolescents.

KEY WORDS

Adolescents. Analytical Thinking. Fact-Checking. Media Literacy. Misinformation. Social Media.

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1 Introduction

The central issue of this study lies in the challenges adolescents face in verifying false information in the post-truth era. The spread of misinformation through social media is a global phenomenon that affects young people's perception of reality. Defined as fabricated information resembling journalistic content, but lacking accuracy and adhering to inadequate organizational processes (Lazer et al., 2018), fake news often aims to manipulate public opinions through emotional approaches (Damasceno et al., 2021; de Oliveira Santos, 2018). Adolescents are particularly vulnerable to information disorders due to their being in cognitive and critical development stages (Kiili et al., 2018; Nygren & Guath, 2018).

Several studies have demonstrated that the lack of fact-checking skills among adolescents significantly contributes to their vulnerability to fake news (Papapicco et al., 2022). These young individuals, often described as “news avoiders”, tend to consume information in a fragmented and selective manner, frequently opting for sources that confirm their pre-existing beliefs and avoiding those that contradict them (Papapicco et al., 2022; Shehata, 2016). Additionally, their typically impulsive nature and their intensive exposure to social media exacerbate the difficulty in discerning between true and false information (Corbelli et al., 2023).

Misinformation is a widely recognized problem by the scientific community, which points to its harmful consequences, not only in forming erroneous opinions but also in manipulating social and political behaviours (Tsati et al., 2020). Misinformation assumes various forms, including fake news, clickbait, satire, and manipulated content, which are disseminated with the intent of deceiving the public and creating distorted perceptions of reality (Rahadi, 2017).

Despite being highly familiar with technology, adolescents often lack the necessary skills to critically evaluate the information they consume online (Prensky, 2001; Sousa et al., 2018). The illusion of technological competence can lead young people to be overconfident in their ability to discern the truthfulness of information, thereby increasing their susceptibility to misinformation (Ripoll & Morelli Matos, 2017). Studies by Kuhn (2019) and Yacoubian and Khishfe (2018) highlight the importance of argumentation and critical thinking as essential tools for filtering relevant information and relating content meaningfully.

Literature indicates that continuous and intensive exposure to social media can impair young people's concentration and critical thinking abilities, as demonstrated by Corbelli et al. (2023). The fragmented nature of news consumption through social media contributes to the difficulty in distinguishing between true and false information, as young people frequently divide their attention between multiple devices and content (Meijer, 2007; Papapicco et al., 2022).

The relevance of studying this phenomenon is evident when considering the implications of misinformation for the formation of well-informed citizens and the health of democracy. Understanding the skills and limitations of young people in evaluating information and detecting fake news is crucial for developing educational interventions that promote media literacy and resilience against misinformation (Mihailidis, 2014; Wardle & Derakhshan, 2017). Critical media education and the ability to verify the truthfulness of information are essential skills for 21st-century citizenship (OECD, 2018).

Previous research on prebunking strategies, which aim to build cognitive resistance to misinformation before exposure, highlights the importance of relational strategies in countering misinformation. Orosz et al. (2024) demonstrated that engaging individuals through prosocial family-based interventions could significantly improve their ability to discern misinformation, particularly in highly centralized media environments. By softly empowering individuals to take on the role of a “prosocial expert” within their family, long-lasting cognitive and behavioural effects were observed, reinforcing the potential of prebunking in politically controlled media contexts. Similarly, D'Errico et al. (2024) showed that hybrid interventions combining media literacy education and mediated intergroup contact could reduce adolescents' vulnerability to racial misinformation by fostering critical thinking and promoting social responsibility. These

findings underscore the necessity of addressing misinformation not only through cognitive skills but also through social and relational dynamics. In the current study, we build on these insights by isolating analytical thinking as a key cognitive component among adolescents, focusing on their ability to resist misinformation in an increasingly complex digital environment.

Fact-checkers also play a fundamental role in rectifying misconceptions, although they face significant challenges due to the diversity of approaches and variation in public trust (Amazeen, 2013; Tandoc et al., 2018). In Portugal, initiatives such as Observador's Fact Check, Público's Prova dos Factos, and SIC's Polígrafo have stood out in promoting transparency and verifying information, using different classification scales to diagnose types of false information (Mestre, 2021).

The credibility of fact-checkers is a complex and multifaceted dimension, influenced by factors such as competence, reliability, neutrality, transparency, and intentionality (Curry & Stroud, 2021; Rieh & Danielson, 2007). Studies reveal that the perception of the credibility of fact-checkers can mediate the effectiveness of corrective messages in reducing pre-existing beliefs in false information (Liu et al., 2023). Trust in the source of the corrective message is crucial for recipients to adjust their beliefs and behaviours in response to misinformation (Jennings & Stroud, 2023; Walter et al., 2020).

However, fact-checking faces significant limitations, especially in correcting already established false beliefs. Flynn et al. (2017) indicate that fact-checking may not be effective in altering well-rooted misconceptions, highlighting the need for a more holistic approach that considers the emotional and cognitive factors influencing human judgment (Kahneman, 2012; Nickerson, 1998).

Reading comprehension and argumentation skills are critical factors in evaluating online information. Studies by Goldman et al. (2012) and Kiili et al. (2018) demonstrate that individuals with higher reading comprehension apply more effective methods for evaluating the credibility of information, suggesting that developing these skills can improve young people's resilience to misinformation (Castells et al., 2022).

Media literacy is defined as the ability to access, analyze, evaluate, and create media across various forms (Martens & Hobbs, 2015). In the context of the digital age, media literacy plays a crucial role in enabling individuals to critically engage with the information they encounter online, particularly in distinguishing between credible news sources and misinformation. While media literacy encompasses a range of skills, including technical proficiency and critical thinking, this study focuses on analytical thinking as an isolated cognitive dimension. Analytical thinking is essential for adolescents, as it equips them to methodically evaluate news content, overcome intuitive biases, and detect misinformation – skills that are critical in today's media environment. This is a particularly important dimension, as it relates directly to their ability to assess and deconstruct the information they encounter online. Analytical thinking is thus not only a cognitive skill but also a key aspect of digital literacy, enabling young people to critically evaluate media and resist the intuitive biases that fake news often exploits.

In Portugal, media literacy education remains relatively underdeveloped compared to other European countries, despite the critical role it plays in equipping young people with the necessary tools to navigate digital spaces. While there have been efforts to introduce media literacy concepts in schools, these initiatives are often fragmented and lack a cohesive national framework (Pereira & Moura, 2019). One of the main challenges is the limited integration of media literacy into the standard curriculum, meaning that students are frequently exposed to media and digital technologies without adequate guidance on how to critically engage with these sources.

Portuguese adolescents, like their counterparts in other countries, are heavy consumers of social media, where misinformation circulates rapidly (Simões et al., 2013). This constant exposure to potentially misleading content, combined with a lack of formal media literacy training, makes it difficult for young people to develop the analytical skills required to distinguish between credible information and falsehoods. This study contributes to understanding these challenges

by highlighting the gap in adolescents' analytical thinking skills, which are crucial for evaluating the veracity of the information they encounter.

Moreover, the practice of media literacy education in Portugal faces additional barriers, including a lack of teacher training and resources dedicated to this field. Educators often struggle to incorporate media literacy into their teaching due to time constraints and insufficient support, which limits the effectiveness of media literacy initiatives (Pinto & Pereira, 2018). Given these challenges, there is an urgent need for more structured media literacy programs that prioritize critical thinking and fact-checking as core components, especially within the school setting.

Analytical thinking emerges as a fundamental competence since it involves breaking down complex information into simpler, comprehensible parts, allowing for detailed and substantiated analysis (Thaneerananon et al., 2016). Analytical thinking refers to the process of carefully weighing information or viewpoints and interpreting them to make sound and independent judgments. The willingness to deconstruct thought and subject it to rigorous testing is essential for enhancing analytical capacity (Elder & Paul, 2020). Research shows that individuals who engage in analytical reasoning are more capable of evaluating the credibility of information and avoiding cognitive traps, such as confirmation bias (Ku et al., 2019).

Analytical thinking is therefore fundamental to understanding news messages. Critical skills, such as understanding the viewpoints and objectives of a news message, evaluating the strength and quality of the evidence presented, distinguishing between facts and opinions, and identifying biases present in the information, are essential for forming a critical and informed opinion (Fleming, 2014; MaksI et al., 2015; Marten, 2010; Mihailidis, 2014).

In this context, the present investigation seeks to answer the following question: "To what extent does the degree of analytical thinking among 15 to 19-year-old high school students influence their consumption of news media, knowledge of fact-checkers, following fact-checkers, and perceived credibility of fact-checkers, and how do these influence their ability to identify fake news on social media?"

To address this question, the specific objectives include: (a) Evaluating whether the degree of analytical thinking determines the ability to identify fake news on social media; (b) Assessing whether the degree of analytical thinking can be influenced by knowledge of fact-checkers, following fact-checkers, and perceived credibility of fact-checkers; and (c) Analyzing whether news media consumption, knowledge of fact-checkers, following fact-checkers, and perceived credibility of fact-checkers can determine their ability to identify fake news on social media.

2 Background

According to McIntyre, the post-truth era is often depicted as an ideological supremacy where people are constantly influenced to believe in something despite the lack of consistent evidence to support it. The threat to an individual's personal beliefs through contact with undesirable facts culminates in the conscious or unconscious repudiation of a fact, leading to the development of motivation to "assert something that is more important to us than reason itself" (2018, p. 13).

As individuals navigate and actively participate in information-saturated networks, questions arise about people's ability to discern between what is false and what is authentic (Figueira & Oliveira, 2017). Thus, those who consume fake news and information on social media are more likely to believe and replicate this information, contributing to its dissemination on these platforms (Merchant & Asch, 2018). Interestingly, the consumption of television news is associated with a lower perception of exposure to fake news (Wasserman & Madrid-Morales, 2019). This phenomenon suggests that individuals who obtain information through television sources may perceive a lower risk of believing misleading information compared to those who primarily rely on information from social media platforms.

In recent years, media literacy has emerged as a vital framework for understanding how individuals engage with media, particularly in the context of fake news. As highlighted by scholars such as Vraga and Tully (2015), media literacy education has been shown to empower individuals by fostering critical thinking skills necessary to navigate complex media landscapes. Moreover, Martens and Hobbs (2015) argue that the active engagement with media through media literacy practices leads to a more informed public, capable of not just identifying misinformation but also understanding the broader social and political contexts that allow misinformation to spread. Furthermore, research by Wineburg and McGrew (2019) suggests that young people, despite being digital natives, often struggle with evaluating the credibility of online information. Their studies show that students often confuse advertising with news, have difficulty recognizing bias, and are generally ill-equipped to handle the nuances of online misinformation. This aligns with the findings of Pennycook et al. (2020), who argue that susceptibility to fake news is often not driven by ideological bias but by a lack of analytical thinking skills. They assert that people who engage more deeply with media, and who possess strong critical thinking skills, are less likely to believe or spread fake news.

We believe that higher levels of news media consumption tend to result in a greater ability to identify fake news (**H1**), as individuals will have greater contact and knowledge of the factual landscape of reality, and thus be better prepared to evaluate the veracity of false information that is incompatible with this landscape.

Amazeen (2015) further highlights that fact-checkers are fundamental in rectifying misconceptions, emphasizing that their focus should be on verifiable facts and establishing a clear distinction between facts and opinions. A study conducted by Gottfried et al. (2013) revealed that individuals who visit fact-checking websites demonstrate a greater ability to respond to factual questions.

Mestre (2021), in a study on the relevance of fact-checking, already highlighted the growing awareness of misinformation and the importance of fact-checkers in combating this phenomenon. However, the study's results indicate that although most participants are aware of these verification tools, they do not frequently visit their sites. This context leads us to believe that higher levels of following fact-checkers tend to result in a greater ability to detect fake news (**H2**). Additionally, based on existing literature, we speculate that higher levels of knowledge about fact-checkers tend to result in a greater ability to identify fake news (**H3**), as there may be greater recognition of the global problem, the role these fact-checkers play, and the need to critically evaluate consumed information.

Studies documenting the impact of source credibility perceptions on communication effectiveness reveal that high-credibility sources tend to outperform low-credibility sources in altering beliefs, attitudes, and behaviours (Albarracín & Vargas, 2010; Hovland & Weiss, 1951; Pornpitakpan, 2004; Stiff & Mongeau, 2016). This also applies to news and news correction, as corrections made by a reliable source are a useful strategy to reduce belief in false information. Although trust was not measured in their study, Jennings and Stroud (2023) two-step motivated reasoning model on how misinformation corrections are processed supports that trust in the source is a key factor in how recipients adjust their beliefs as a result of a corrective message (Liu et al., 2023).

Thus, we speculate that higher levels of perceived credibility in fact-checkers tend to result in a greater ability to identify fake news (**H4**), as trust in the source allows for greater flexibility and openness in individuals to deconstruct potentially already adopted or developing false beliefs (cognitive correction), as well as trust in and knowledge of verification procedures that detect falsehoods (learning).

The risks of accepting information based on convenience, emotional appeal, popularity, or other heuristics rather than evidence or facts are exacerbated by digital news platforms and, in the case of adolescents, aggravated by mimetic bias effects, especially in social environments. Two factors exacerbate this context. On one hand, the immediacy of social media

in news dissemination increases its influence, allowing the public to participate in information dissemination (Pew Research Center, 2011), and making them feel more involved in the news landscape (Sveningsson, 2015). On the other hand, social media promotes heuristic processing through “news snacking”, which involves consuming news occasionally and sporadically without dedicating enough time to understanding and evaluating the content. This heuristic consumption often occurs through reading headlines, keywords, images, or other highlights (Meijer & Kormelink, 2015), which are often deliberately controversial, emotional, and uninformative, resulting in a superficial impression of the news content without a deep understanding that allows for forming critical perspectives.

Given the presented context, we believe that higher levels of news media consumption tend to produce higher levels of analytical thinking (**H5**), as they allow for a more efficient deconstruction of received information, since individuals have a broader range of information that enables them to identify concepts, people, situations, and events mentioned.

Additionally, Wineburg and McGrew (2016) showed that despite recognizing the importance of staying informed, many adolescents who consume news do not feel inclined to question the credibility of sources or do not know how to perform this critical analysis. In this domain, education and awareness of following fact-checkers and subsequent learning can help develop essential skills and behaviours for information verification. Indeed, Nygren et al. (2021) investigated whether a professional fact-checking tool could be used in curricular activities to make students more competent in determining the credibility of digital news and inspire them to use digital tools to enhance their transliteracy and technocognition. They concluded that even a two-hour intervention had a statistically significant impact on adolescents’ abilities to determine the credibility of fake images and videos. They also found that the intervention inspired students to use digital tools to evaluate information credibility without making them more sceptical of credible news. Therefore, we believe that higher levels of knowledge about fact-checkers can produce higher levels of analytical thinking (**H6**), and higher levels of following fact-checkers tend to produce higher levels of analytical thinking (**H7**), as adolescents are exposed to false information verification and the verification procedures adopted by fact-checkers, potentially learning information verification strategies.

In the broader context of media literacy testing, it is important to recognize that numerous instruments have been developed to assess media or news literacy, many of which include analytical thinking as a key dimension. For instance, the News Media Literacy Scale (Ashley et al., 2013) emphasizes the role of critical thinking and source evaluation in distinguishing credible news from misinformation. Similarly, the Media Literacy Implementation (MLI) Index (Hobbs et al., 2022; Martens & Hobbs, 2015) and the Digital Media Literacy (Zhang & Zhu, 2016) assess individuals’ abilities to critically evaluate media content, with a particular focus on identifying bias and assessing the credibility of sources. These instruments all measure components of media literacy that align with analytical thinking, particularly in the evaluation of complex media messages and the detection of misinformation.

Furthermore, the Civic Online Reasoning Assessment developed by McGrew (2020); McGrew et al. (2018) specifically targets the ability to effectively search for and evaluate social and political information online, a crucial skill in today’s misinformation-laden digital environment. The COR is designed to assess individuals’ ability to critically evaluate digital content, much like our study’s focus on the capacity of adolescents to discern between fake and real news on social media platforms. The Fake News Susceptibility Test (Pennycook & Rand, 2019), while more narrowly focused on misinformation detection, highlights that the ability to suppress intuitive judgments in favour of reflective analysis – exactly what is measured by Frederick’s Cognitive Reflection Test (CRT) – is critical in the detection of fake news.

While existing media literacy instruments incorporate elements of analytical thinking, our study specifically isolates this cognitive dimension to better understand its role in fake news detection. Unlike broad media literacy tools that assess multiple competencies, such as understanding

media construction or recognizing bias (e.g., Martens and Hobbs, 2015), our focus is explicitly on how adolescents' ability to override intuitive but incorrect responses – measured through the CRT – contributes to their capacity to identify misinformation.

This specificity is crucial because fake news often appeals to individuals' intuitive judgments and emotional responses, rather than their rational analysis (Pennycook et al., 2020), since highly analytical thinkers are more capable of distinguishing between fake and real news and are less likely to accept fake news as being true. By focusing on the analytical thinking component, our study sheds light on the cognitive processes that enable adolescents to critically deconstruct misinformation, a critical skill that broader media literacy assessments may overlook in favour of general media competencies. Thus, we posit that higher levels of analytical thinking, as assessed by the CRT, are directly related to a greater ability to detect fake news because this cognitive skill allows individuals to engage in the reflective thinking necessary to challenge misleading or false information (**H8**).

Individuals differ in their choice of analytical-rational or intuitive-experiential thinking styles, although these two information-processing systems can function both in parallel and interactively (Epstein et al., 1996). According to academics, responses to messages are influenced by individual differences in predominant thinking patterns. For example, analytical thinkers may find rational messages more appealing than emotional ones (Epstein, 1994; Epstein & Pacini, 1999). According to this concept, fact-checking messages, which typically include logic and factual evidence, may be more appealing to analytical-rational thinkers than to intuitive-experiential thinkers (Liu et al., 2023).

This may lead certain individuals to find fact-checkers and their statements more credible than others. Furthermore, Allen et al. (2021) and Martel et al. (2021) found that individuals with a greater propensity for analytical thinking were more likely to agree with correction signals. Thus, it is expected that higher levels of analytical thinking tend to result in higher perceived credibility in fact-checkers (**H9**), as individuals recognize value and competence in factual diagnoses and authority in fact-checkers.

3 Methodology

We adopted a quantitative and cross-sectional methodology, using a questionnaire administered in person, to adolescents who use social media and who are thus exposed to the phenomenon of misinformation. Participants were surveyed regarding six dimensions: Analytical Thinking (AT), News Media Consumption (NMC), Knowledge of Fact-Checkers (KFC), Following Fact-Checkers (FFC), Perceived Credibility of Fact-Checkers (PCFC), and Ability to Detect Fake News (ADFN) as detailed in Table 1.

Dimension	Variables	Scale	Source
Analytical Thinking (AT)*	(AT-Q1) A bat and a ball cost \$1.10 in total. The bat costs \$1.00 more than the ball. How much does the ball cost? ____ cents	Intuitive answer: 10 Correct answer: 5	Frederick (2005)
	(AT-Q2) If it takes 5 machines 5 minutes to make 5 widgets, how long would it take 100 machines to make 100 widgets? ____ minutes	Intuitive answer: 100 Correct answer: 5	
	(AT-Q3) In a lake, there is a patch of lily pads. Every day, the patch doubles in size. If it takes 48 days for the patch to cover the entire lake, how long would it take for the patch to cover half of the lake? ____ days	Intuitive answer: 27 Correct answer: 47	

News Media Consumption (NMC)	How often do you receive news from the following sources: Television Radio Printed newspapers/magazines Websites of newspapers/magazines Mobile applications for newspapers/magazines Social media (pages of newspapers/magazines) Other news pages or groups on social media	5-point scale: <i>Never, Rarely, Sometimes, Frequently, Always</i>	Wasserman and Madrid-Morales (2019)
Knowledge of Fact-Checkers (KFC)	Regarding the following fact-checkers, indicate which ones you know: Polígrafo (SIC) Prova dos Factos (Publico) Fact Check (Observador)	5-point scale: <i>Totally unaware, Know very little, Know moderately, Know very well, Know completely</i>	Self-developed
Following Fact-Checkers (FFC)	Regarding the following fact-checkers, indicate which ones you follow: Polígrafo (SIC) Prova dos Factos (Publico) Fact Check (Observador)	5-point scale: <i>Never, Rarely, Sometimes, Frequently, Always</i>	Self-developed
Perceived Credibility of Fact-Checkers (PCFC)	Please indicate how much you trust the following fact-checkers: Polígrafo (SIC) Prova dos Factos (Publico) Fact Check (Observador)	-2, -1, 0, 1, 2 For the following dimensions: Incompetent/Competent; Doubtful/Trustworthy; Dishonest/Honest; Biased/Neutral; Opaque/Transparent; Ill-intentioned/Well-intentioned	Adapted from Curry and Stroud (2021); Rieh and Danielson (2007)
Ability to Detect Fake News (ADFN)**	Portugal stands out at the top of the highest tax burden in the European Union.	Fake	Self-developed
	Portugal has the lowest min. wage in Europe.	Fake	
	Does this photograph show Monday's solar eclipse, visible in almost all of America?	Fake	
	Countries like Japan, Cuba, and Norway are "banning Islam."	Fake	
	Citizen Cards are issued to foreigners who do not even speak Portuguese in two days.	Fake	
	From severe drought to almost full Alqueva Dam in 11 months proves "climate fraud."	Fake	
	Turning on the car's air conditioning after exposure to the sun can release excessive amounts of benzene.	Fake	
	Chega/Azores wants to allow "rat hunting" with firearms and even on private property (with an air gun).	Not Fake	
	Is it true that 13% of residents in Portugal live in "overcrowded houses"?	Not Fake	
	Putting hot food in the refrigerator can increase electricity consumption.	Not Fake	
	Compal has reduced the amount of product sold in juice packages but has not lowered prices.	Not Fake	
	Supermarkets in Luxembourg with food supply shortages.	Not Fake	
	Primary School in Portimão served fried fish with larvae to students.	Not Fake	
	More than half of Portuguese workers earned only up to 800 euros in salary in 2023.	Not Fake	

*The first variable we presented in euros. Following Frederick's (2005) method, participants may score 0, 1, 2 or 3, according to the number of correct responses given.

** Participants were given a test consisting of seven fake news stories and seven real ones, presented at random and taken from the fact-checking website O Polígrafo.

Table 1: Research dimensions and variables

Source: own processing, 2025

We used three existing measures and developed three others. Frederick's (2005) Cognitive Reflection Test was used as a measure for Analytical Thinking, which was translated to Portuguese. The CRT is specifically designed to assess the ability to suppress an intuitive but incorrect response in favour of a reflective and correct one. This is directly relevant to evaluating the analytical thinking skills of the participants, which is a primary focus of this study. Moreover, Frederick's (2005) CRT is particularly suited for assessing analytical thinking in media literacy contexts. By measuring participants' ability to override intuitive but incorrect responses, the CRT is closely aligned with the analytical processes required for discerning misinformation.

Frederick's (2005) CRT is widely regarded as one of the most effective tools for measuring the ability to engage in reflective, analytical thinking over impulsive, intuitive responses. The test consists of three deceptively simple mathematical problems that prompt participants to generate an immediate, intuitive answer, which is typically incorrect. To arrive at the correct solution, participants must suppress their initial impulse and engage in reflective thinking. This makes the CRT particularly effective in assessing the cognitive processes involved in problem-solving and decision-making, especially in contexts where intuitive judgments can lead to errors.

Several other cognitive reflection measures have been developed in recent years, including extended versions of the CRT, such as CRT-7 and CRT-10 (Primi et al., 2016). These versions incorporate additional items that increase the reliability of the measure and cover a broader range of cognitive abilities. However, while these extended tests offer greater robustness and reliability in certain contexts, their increased length and complexity can make them less suitable for younger populations or for studies where time constraints are a concern.

In contrast, the original CRT (2005) offers a more compact and accessible measure of cognitive reflection. It has been shown to effectively capture the key components of reflective thinking with just three questions. This simplicity is particularly advantageous when working with adolescent populations, as is the case in this study. Adolescents, especially those within the 15 to 19 age range, often have limited attention spans and can struggle with more complex or prolonged tasks, particularly in a school setting where distractions are common. The brevity of the CRT makes it an ideal tool for this demographic, allowing researchers to assess cognitive reflection without overburdening participants.

Another commonly used tool for measuring cognitive reflection is the Cognitive Reflection and Insight Task (CRIT) (Toplak et al., 2011, 2014), which blends the CRT with additional problems that require insight rather than mere reflection. While CRIT provides a more comprehensive assessment of cognitive flexibility, it requires higher cognitive load and longer completion times, which might not be suitable for adolescent populations who are still developing these higher-order thinking skills. This tool might be more appropriate for adult populations where cognitive capacity is fully matured and where a broader measure of reflective thinking is required.

When considering other alternatives like the Berlin Numeracy Test (BNT) (Cokely et al., 2012), which is focused more on numeracy and probabilistic reasoning, it becomes clear that these tools are better suited to measuring domain-specific cognitive abilities, rather than the general reflective thinking skills that the CRT targets. The CRT, on the other hand, isolates the reflective cognitive process across various types of reasoning, making it more flexible and universally applicable.

Wasserman and Madrid-Morales (2019) media consumption scale was also incorporated in the model, as it provides a comprehensive set of media interfaces. The scale was adapted from Curry and Stroud (2021) and Rieh and Danielson (2007), to include a multidimensional evaluation of trust, referring to competence, trustworthiness, honesty, neutrality, transparency, and intentionality. This comprehensive approach ensures a nuanced understanding of participants' trust in fact-checkers, beyond a simple binary measure. Knowledge and following of fact-checkers were evaluated with a five-point frequency scale. Finally, the ability to detect fake news was measured by a test aimed at verifying if the participants were able to determine if a set of news were fake or not. The set was retrieved from the website of the fact-checker Polígrafo (the most

popular in Portugal). The news were hand-picked by the researchers (purpose sampling), among the debunks posted in the six months prior to the implementation of the survey, containing a full image of the original post that they were captured from, similar to Pennycook and Rand (2019).

As a result of the literature previously presented and supported by the measures, we tested the following research hypothesis (Figure 1).

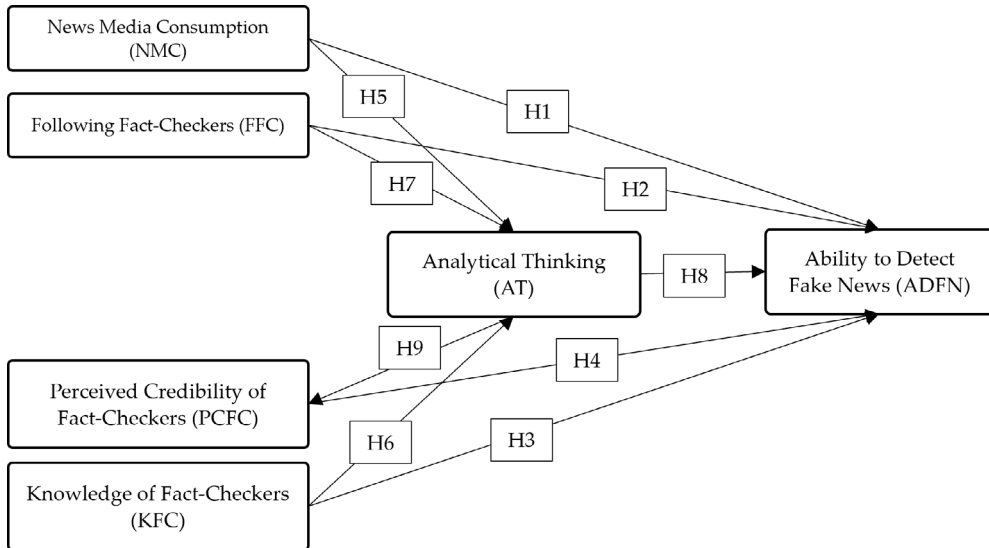


Figure 1: Research hypotheses

Source: own processing, 2025

In this study, we adopted a non-probabilistic convenience sample to ensure access to adolescent participants. The convenience sample of adolescents (minors) was selected in the Autonomous Region of Madeira, aged mainly between 15 and 19, attending grades 10 through 12 and enrolled at Jaime Moniz Secondary School in Funchal, which was willing to collaborate in the research. This constitutes a sample of adolescents attending the same school, thereby limiting the possibility of composing an exceptionally large sample. Accessing underage adolescents is a time-consuming procedure that requires additional data protection mechanisms and ethical requirements, as detailed in the next section. Nevertheless, we believe this sample is relevant as there are few studies specifically addressing young people in this age group, who are on the verge of adulthood, and characterized by imminent autonomy and independence. This crucial phase, marked by the proximity to voting rights and the growing need to make independent decisions, raises the question of how these young individuals will handle the challenges associated with making informed decisions in the face of frequently distorted or misleading information. Thus, the study employs a convenience sampling method due to the ethical and logistical constraints of accessing a sample of minors. While this approach limits generalizability, the sample provides valuable insights into theoretical dimensions for a specific demographic that remains under-researched.

3.1 Ethical and Data Protection Procedures in Participant Recruiting and Surveying

The ethical procedures for accessing participants and data protection were verified and authorized by the Regional Secretariat for Education, Science, and Technology of the Regional Government of Madeira, which oversees the implementation of research in all local schools,

in cooperation with the Regional Office for Digital Compliance, Data Protection, and Cybersecurity and with the Director of the aforementioned school. Written authorization was obtained for the data collection in the schools, according to the schedule devised by the school's Director. The adolescents obtained prior parental written consent to participate in the research, through a form that was stored in each student's archive. A calendar for the collection of data was designed together with the school's board and the teachers responsible for each class of students. The researchers did not collect any data that allowed the identification of the participants, such as name, school year, class, and numerical age.

No cookies were stored except for session cookies, which expired at the end of the session. No data and time of response, nor the IP address of the fixed or mobile device used, were collected. Additionally, no tokens that could individualize the responses were generated. The option to save responses for later completion required credentials to be defined by the user, and if adopted, these credentials were automatically deleted after the completion of the questionnaire. Data analysis was conducted through descriptive and inferential statistics to test the formulated research hypotheses (Barreiros dos Santos et al., 2019), using IBM SPSS 28.

4 Results

4.1 Demographics

The sample consisted of 162 respondents, the majority of whom were female (63.6%), followed by males (35.8%). A small proportion (0.6%) chose not to indicate their gender (Table 2). Concerning the age of the respondents, we can also see in Table 3 that the most representative slice corresponds to respondents aged between 17 and 18 (54.3%), followed by respondents aged between 15 and 16 (42.6%) and finally those aged 19 or over (3.1%).

	N	%
Gender	162	100.0
Female	103	63.6
Male	58	35.8
Prefer not to say	1	0.6
Age group	162	100.0
15-16	69	42.6
17-18	88	54.3
19 or over	5	3.1

Table 2: Sample demographics (N=162)

Source: own processing, 2025

The use of social media was assessed using a five-point frequency scale ranging from *Never* to *Always*, as shown in Figure 2 and Table 3. The results indicate high levels of social media usage, with Instagram (88.9%) being the most used platform, followed by TikTok (80.3%), WhatsApp (55%), Youtube (47.5%), Snapchat (35%), X (Twitter) (13.5%), second to last is Facebook (3.1%) and finally the least used social network is Reddit (2.4%).

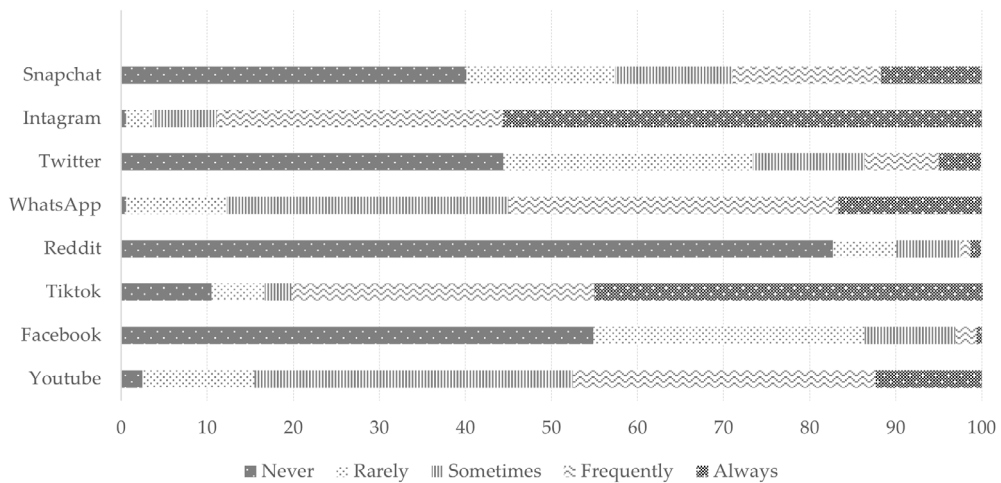


Figure 2: Social media usage

Source: own processing, 2025

Indicators	N	Min.	Max.	Mean	SD
YouTube	162	1	5	3.42	0.951
TikTok	162	1	5	3.98	1.297
Snapchat	162	1	5	2.43	1.453
Instagram	162	1	5	4.40	0.807
Facebook	162	1	5	1.62	0.819
X (Twitter)	162	1	5	2.01	1.172
WhatsApp	162	1	5	3.59	0.923
Reddit	162	1	5	1.31	0.766

Table 3: Social media usage (mean values, N=162)

Source: own processing, 2025

4.2 Validation of Theoretical Dimensions

The data collected was exported to IBM SPSS Statistics 28 for analysis, aiming to build a database to assess the dimensionality, consistency, reliability, and validity of the variables under study. Exploratory Factor Analysis (EFA) was used to refine the scales.

According to Damásio (2012), Exploratory Factor Analysis (EFA) is a set of techniques designed to identify the underlying structure of the data matrix, determining the number and nature of items that best represent the dimensions. EFA allows for the adjustment of the initial set of items in the dimensions, eliminating those with weak statistical relationships (extraction values are less than 0.50).

a) Analytical Thinking (AT)

For the Analytical Thinking (AT) dimension, the KMO test yields a value of 0.664, indicating reasonable sample suitability for factor analysis. Additionally, Bartlett's test of sphericity showed a p-value of less than 0.001 ($<.001$), suggesting significant correlations between the variables, which confirms the appropriateness of conducting factor Analysis (Table 4). Using the Kaiser (1960) criterion, factors with eigenvalues greater than 1 were selected, indicating which factors allow the extraction of at least one original variable. Factor analysis indicates that three factors (or components) are sufficient to explain 100% of the variance in the data. The first factor is

the most significant, explaining 65.187% of the total variance in the data, suggesting it is highly representative of the original data. The high factor loadings (0.823, 0.751, 0.845) indicate a strong association of the variables with factor 1. This suggests that factor 1 (Table 4) is a robust representation of individuals' capacity for cognitive reflection.

	Component 1
AT1 Q1 A bat and a ball cost €1.10 in total. The bat costs €1.00 more than the ball. How much does the ball cost? Score	.823
AT1 Q2 If it takes 5 minutes for 5 machines to produce 5 watches, how long would it take 100 machines to make 100 watches? Score	.751
AT1 Q3 In a lake, there is a patch of water lilies. Every day, the patch doubles its size. If it takes 48 days for the patch to cover the whole lake, how long does it take for the patch to cover half the lake? Score	.845

Principal component analysis. KMO=.664; $p < .001$

Table 4: *Analytical thinking (AT) component matrix*

Source: own processing, 2025

Table 5 summarizes the results for the Analytical Thinking dimension, highlighting young people's performance in this skill.

	Total		Male		Female	
Final unique score	N	%	N	%	N	%
0	108	67.1	30	27.8	77	71.3
1	26	16.1	11	42.3	15	57.7
2	15	8.7	7	50.0	7	50.0
3	13	8.1	9	69.2	4	30.8
Correct answers per question	N	%	N	%	N	%
AT-Q1	27	16.7	15	55.6	12	44.4
AT-Q2	39	24.1	22	56.4	17	43.6
AT-Q3	29	17.9	17	58.6	12	41.4

Note: Responses of "Prefer not to say" were excluded from the Sex variable.

Table 5: *Analytical thinking (AT) evaluation unique scores (N=162)*

Source: own processing, 2025

As it consisted of three questions, each participant could obtain a final score of between zero and three, depending on the number of correct answers recorded. In our sample (Table 5) more than half of the young people (67.1%) obtained a score of 0 (zero) and 16.1% answered only one of the questions correctly. Only 16.8% answered two questions correctly (8.7%) or all three questions correctly (8.1%). The first and third questions posed the greatest difficulties, in descending order. Notably, overall low performance is particularly pronounced among young women, who comprised 71.3% of the respondents who scored 0 (zero) on the test and only 30.8% of the young people who scored the maximum of 3 points. This gender disparity is statistically significant and aligns with findings by Frederick (2005), indicating that men generally perform better than women in math tests. Women's performance is also between 11% and 17% lower than men's across all questions.

We conducted a detailed analysis to identify the most common type of error leading to incorrect answers (Table 6). This analysis is crucial because the analytical thinking test is designed to induce, immediately and unreflectively, an intuitive response that is wrong, and which is

impulsively recorded without reflection. Consequently, the test measures the analytical ability to revise this initial intuitive impression (Frederick, 2005). Each test question has a predicted intuitive response, as described in the methodology section. Below we outline the types of errors observed: intuitive error (which refers to the wrong predicted answer), other errors (other answers that do not coincide with the intuitive error), and don't know (for cases in which the participant specifically indicated not being able to answer, not even using the intuitive error).

Overall, there is a notable inclination towards deficient analytical reasoning, favouring experiential systems, which, as defined by Liu et al. (2023), are based on automatic affective experience and rapid processing and on heuristic/intuitive systems, to the detriment of analytical/reflective ones, as defined by Kahneman (2013) and Stanovich et al. (2000).

Type of error	Total		Male		Female	
	N	%	N	%	N	%
AT-Q1						
Intuitive error	124	76.6	41	33.1	82	66.1
Another error	2	1.2	0	0.0	2	100
Don't know the answer	9	5.6	2	22.2	7	77.8
AT-Q2						
Intuitive error	89	54.9	29	32.6	59	66.3
Another error	25	15.4	4	16.0	21	84.0
Don't know the answer	9	5.6	3	33.3	6	66.7
AT-Q3						
Intuitive error	95	58.6	32	33.7	63	66.3
Another error	18	11.1	6	33.3	12	66.7
Don't know the answer	20	12.3	3	15.0	16	80.0

Note: Responses of "Prefer not to say" were excluded from the Sex variable.

Table 6: Analytical thinking (AT) types of errors (N=162)

Source: own processing, 2025

For all the questions in the test, the most common type of error observed is the predicted intuitive error, confirming that most of the errors made are due to a lack of reflection on the answer that is impulsively recorded, particularly in the first question. Although not statistically significant, women tend to exhibit a higher propensity for intuitive errors. Additionally, they are more likely to indicate "don't know" answers. Frederick (2005) similarly noted that women's errors tend to be of the intuitive type, whereas men tend to make a broader range of errors. Interestingly, contrary to Frederick's findings, in our sample, adolescent males also frequently make intuitive errors.

b) News Media Consumption (NMC)

Concerning News Media Consumption (NMC), we conducted a factor analysis, presented similarly to the previous variable. A KMO value of 0.753 indicates that the sample is well-suited for factor analysis (values above 0.7 are generally considered adequate for carrying out factor analysis). Regarding Bartlett's Test of Sphericity, the p-value of less than 0.001 ($<.001$) indicates significant correlations between the variables, making factor analysis appropriate (Table 7). The first factor was the most significant, explaining 46.163% of the total variance in the data, suggesting it is highly representative of the original data. The high factor loadings (0.666, 0.560, 0.746, 0.684, 0.725) show strong associations of the variables with factor 1 (Table 7). This suggests that factor 1 is a robust representation of individuals' frequency of News Media Consumption.

How often do you watch news on the following media?	Component 1
Television	.666
Newspapers or printed magazines	.560
Newspaper or magazine websites (e.g. www.publico.pt)	.746
Newspaper or magazine mobile apps (e.g. Público's mobile app)	.684
Newspaper or magazine pages on social media (e.g. Público's Instagram page, Facebook, etc.)	.725

Principal component analysis. KMO=.753; $p < .001$

Table 7: News media consumption (NMC) component matrix

Source: own processing, 2025

In Figure 3, we characterize the dimension.

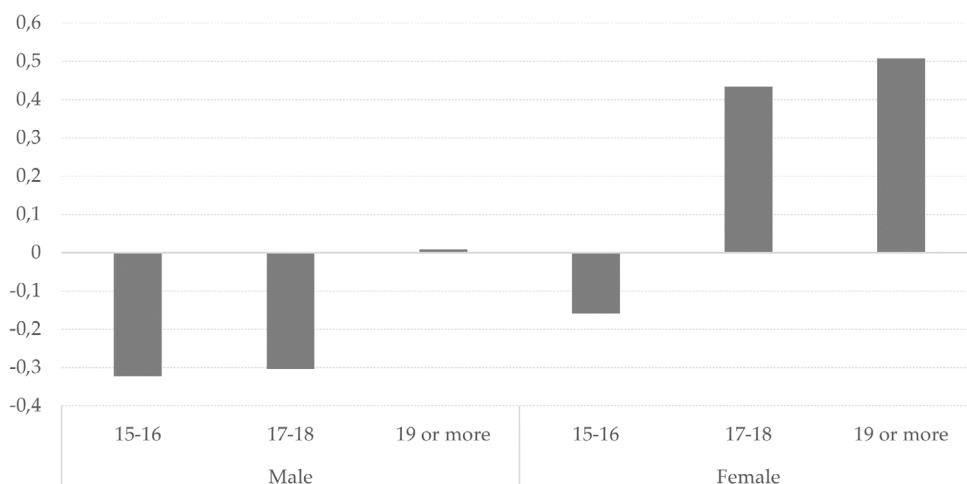


Figure 3: Media consumption (standardized values)

Source: own processing, 2025

The average News Media Consumption is 2.5, indicating low to moderate consumption (between *Rarely* and *Sometimes*). Figure 3 illustrates differences in News Media Consumption between male and female teenagers, although not statistically significant. Female teenagers tend to consume more than the average, especially among those aged 17 and older. In contrast, male adolescents generally show below-average consumption, particularly noticeable among those aged 15 to 18.

c) Knowledge of Fact-Checkers (KFC)

As far as the Knowledge of Fact Checkers (KFC) dimension is concerned, the value obtained in the KMO test is 0.646, indicating a moderate degree of suitability for factor analysis. Regarding Bartlett's test of sphericity, the p-value was found to be less than 0.001 ($< .001$), suggesting significant correlations between the variables and confirming the appropriateness of factor analysis for the dataset (Table 8). The first factor is the most significant, explaining 61.860% of the total variance and suggesting it strongly represents the original data. High factor loadings (0.714, 0.823, 0.818) indicate these variables are strongly associated with factor 1. This suggests that factor 1 is a robust representation of individuals' knowledge of fact-checkers.

Regarding fact-checkers, please list the ones you know:	Component 1
Polígrafo (SIC)	.714
Fact Check (Observador)	.823
Prova dos factos (Publico)	.818

Principal component analysis. KMO=.646; $p < .001$

Table 8: Knowledge of fact-checkers (KFC) component matrix

Source: own processing, 2025

In Figure 4, we characterize the dimension.

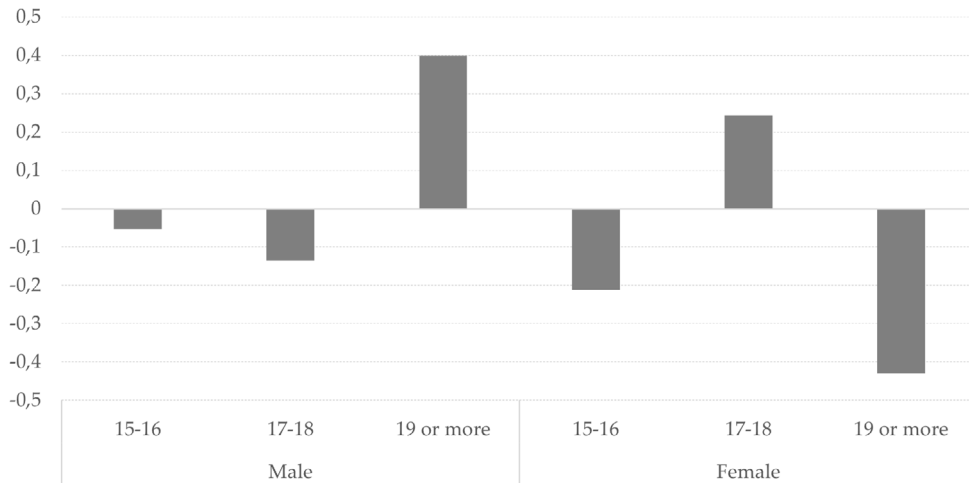


Figure 4: Knowledge of fact-checkers (standardized values)

Source: own processing, 2025

The average score on Knowledge of Fact-Checkers is 1.89, indicating a low level of knowledge (between *Never* and *Rarely*). Figure 4 illustrates differences in knowledge of fact-checkers between male and female teenagers, though these differences lack statistical significance. Male teenagers exhibit knowledge levels above the average score, particularly from the age of 19, while their knowledge is below from ages 15 to 18. In contrast, female teenagers demonstrate above-average knowledge, especially from ages 17 to 18, and below-average knowledge from ages 15 to 16 and from 19 onwards.

d) Following Fact-Checkers (FFC)

About the Following Fact-Checkers (FFC) dimension, the KMO test yields a value of 0.677, indicating that the sample is reasonably suitable for factor analysis. Bartlett's test of sphericity showed a significant result, with a p-value of less than 0.001 ($< .001$), indicating significant correlations between the variables and confirming the appropriateness of factor analysis (Table 9). The first factor is the most significant, explaining 65.984% of the total variance, suggesting it strongly represents the original data (Table 9). The high factor loadings (0.779, 0.844, 0.812) indicate a strong association of the variables with factor 1. This suggests that factor 1 is a robust representation of individuals' Following Fact-Checkers.

Regarding the fact-checkers, please indicate which ones you follow:	Component 1
Polígrafo (SIC)	.779
Fact Check (Observador)	.844
Prova dos factos (Publico)	.812

Principal component analysis. KMO=.677; $p < .001$

Table 9: Following fact-checkers (KFC) component matrix

Source: own processing, 2025

In Figure 5, we characterize the dimension.

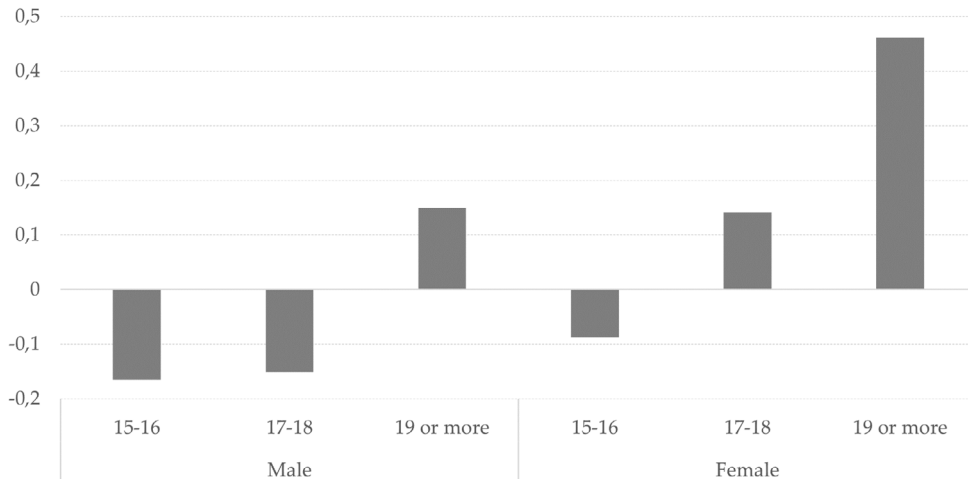


Figure 5: Following fact-checkers (standardized values)

Source: own processing, 2025

The average value for Following Fact-Checkers is 1.55, indicating a low level of knowledge (between *Never* and *Rarely*). Figure 5 illustrates discrepancies in Following Fact-Checkers between female and male adolescents, although these differences lack statistical significance. Female teenagers exhibit above-average levels of following, noticeable from the age of 17. In contrast, male teenagers demonstrate below-average following notably between the ages of 15 and 18.

e) Perceived Credibility of Fact-Checkers (PCFC)

A factor analysis was conducted similar to previous variables. The KMO test yielded a value of 0.811, confirming the optimal suitability of the sample for factor analysis. Bartlett's test of sphericity resulted in a p-value of less than 0.001 ($< .001$), indicating significant correlations between the variables and justifying the use of factorial analysis (Table 10). The first factor is the most significant, explaining 72.190% of the total variance, suggesting it strongly represents the original data. High factor loadings (0.815, 0.858, 0.811, 0.864, 0.789, 0.821, 0.880, 0.953, 0.713, 0.871, 0.943) indicate that the variables are strongly associated with factor 1. This suggests that factor 1 provides a robust representation of the Perceived Credibility of Fact-Checkers.

In your opinion, the fact-checker...	Component 1
... Fact Check (Observador) is... [Incompetent Competent]	.815
... Fact Check (Observador) is... [Doubtful Reliable]	.858
... Fact Check (Observador) is... [Biased Neutral]	.811
... Fact Check (Observador) is... [Obscure Transparent]	.864
... Prova dos Factos (Publico) is... [Incompetent Competent]	.789
In your opinion, the fact-checker Fact Check (Observador) is... [Ill-intentioned/ Well-intentioned]	.821
... Prova dos factos (Publico) is... [Doubtful Reliable]	.880
... Prova dos Factos (Publico) is... [Dishonest Honest]	.953
... Prova dos Factos (Publico) is... [Biased Neutral]	.713
Prova dos Factos (Publico) is... [Obscure Transparent]	.871
... Prova dos Factos (Publico) is... [Ill-intentioned/ Well-intentioned]	.943

Principal component analysis. KMO=.811; $p < .001$

Table 10: Perceived credibility of fact-checkers (PCFC) component matrix

Source: own processing, 2025

In Figure 6, we characterize the dimension.

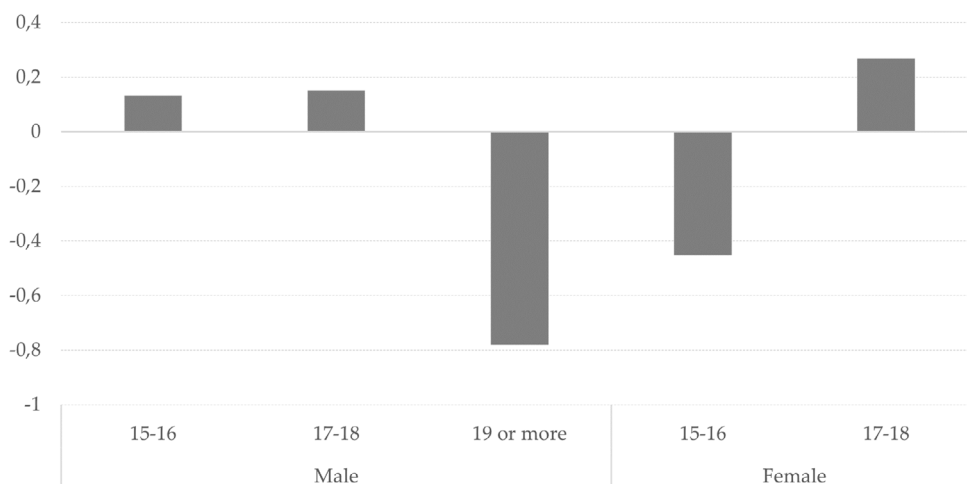


Figure 6: Average perceived credibility of fact-checkers (standardized values)

Source: own processing, 2025

The average value of Perceived Credibility of Fact-Checkers is 3.45, indicating a moderate to high level of knowledge (between *Sometimes* and *Often*). Figure 6 illustrates the variations in the perceived credibility of fact-checkers between female and male teenagers, although these differences are not statistically significant. Male teenagers report above-average perceived credibility, particularly between the ages of 15 and 18, but exhibit increased scepticism from the age of 19 onwards. In contrast, female teenagers report below-average perceived credibility between the ages of 15 and 16, and above-average credibility between the ages of 17 and 18.

f) Ability to Detect Fake News (ADFN)

Regarding the Ability to Detect Fake News (ADFN) dimension, the value obtained in the KMO test is 0.599, which means that the value is close to 0.6 and the sample is reasonably suitable for factor analysis. Bartlett's test of sphericity resulted in a p-value of less than 0.001 ($< .001$), indicating significant correlations between the variables and confirming the appropriateness of

factor analysis (Table 11). The first factor is the most important, explaining 52.156% of the total variance, suggesting that this factor is highly representative of the original data. High factor loadings (0.638, 0.747, 0.774) indicate that the variables are strongly associated with factor 1. This suggests that factor 1 provides a robust representation of individuals' ability to identify fake news.

In your opinion, the fact-checker...	Component 1
N04 Portugal has the lowest minimum wage in Europe. Score	.638
N11 Countries like Japan, Cuba and Norway are banning Islam. Score	.747
N12 Turning on the car's air conditioning after exposure to the sun can release excessive amounts of benzene. Score	.774

Principal component analysis. KMO=.599; $p < .001$

Table 11: *Ability to detect fake news (ADFN) component matrix*

Source: own processing, 2025

The participants were asked to assess 14 news items sourced from the Polygraph website to determine their ability to identify fake news. These items were presented randomly, and participants had to evaluate the perceived veracity of each item, choosing from four options: "fake", "probably fake", "probably true", and "true". The ability to detect fake news was scored as follows: 1 point for a completely correct answer, 0.5 points for a partially correct answer, and 0 points for an incorrect answer. Table 12 characterizes this dimension, considering all 14 news items and the 3 items identified as significant through factor analysis.

14 news set			3 news set		
Unique score	N	%	Unique score	N	%
1	2	1.2	0	30	18.5
1.5	1	0.6	0.5	50	30.9
2	6	3.7	1	38	23.5
2.5	13	8.0	1.5	16	9.9
3	14	8.6	2	16	9.9
3.5	17	10.5	2.50	7	4.3
4	31	19.1	3	5	3.1
4.5	22	13.6			
5	20	12.3			
5.5	14	8.6			
6	9	5.6			
6.5	3	1.9			
7	7	4.3			
7.5	2	1.2			
10.5	1	0.6			
Total	162	100	Total	162	

Table 12: *Ability to detect fake news (ADFN) unique scores*

Source: own processing, 2025

The overall ability to identify fake news is very low, with most of the scores concentrated between 3 and 5.5. Given that the maximum possible score for the test is 14 points, the highest score achieved in the sample was 10.5, which was obtained by only one participant. For the 3 news items considered after the Factor Analysis, the ability to identify fake news remained very low, with most scores between 0 and 1.

4.3 Testing of Hypotheses

A linear regression model was employed to investigate how the dependent variables (Y) relate to the independent variables (X). The stronger the correlation between the variables, the more accurate the model's predictive capacity. The results are presented in Table 13.

Hypothesis	R ²	p-value	Result
(H1) NMC → ADFN	0.004	0.424	Rejected
(H2) FFC → ADFN	0.012	0.164	Rejected
(H3) KFC → ADFN	0.003	0.498	Rejected
(H4) PCFC → ADFN	0.020	0.426	Rejected
(H5) NMC → AT	0.006	0.337	Rejected
(H6) KFC → AT	0.035	0.017	Rejected
(H7) FFC → AT	0.015	0.126	Rejected
(H8) AT → ADFN	0.035	0.017	Rejected
(H9) AT → PCFC	0.003	0.760	Rejected

Table 13: Linear regression results for the research hypotheses

Source: own processing, 2025

The R², or coefficient of determination, represents the proportion of the total variance of the dependent variable that is explained by the independent variable(s) in the model. In our case, R² is very low for all research hypotheses, and there is no statistical significance, indicating that the models do not explain the variance observed in the data, thus all research hypotheses are rejected.

These results also led us to conduct additional regression analysis to explore other possible relationships among variables, despite not foreseen as research hypotheses, by treating the independent variables as dependent. The results are presented in Table 14.

Hypothesis	Regression equation	R ² *	p-value	β
FFC + PCFC → NMC	$NMC = 0.271 + 0.090AT - 0.265KFC + 0.584FFC + 0.358PCFC + 0.090ADFN$	0.687	≤ 0.001 0.005	0.584 0.358
KFC + NMC → FFC	$FFC = -0.159 - 0.097AT + 0.592KFC - 0.148PCFC + 0.015ADFN + 0.808NMC$	0.716	≤ 0.001 ≤ 0.001	0.592 0.808
FFC → KFC	$KFC = 0.862 + 0.112AT + 0.157PCF + 0.041ADFN - 0.416NMC + 0.670FFC$	0.472	≤ 0.001	0.670
NMC → PCFC	$PCFC = -0.445 - 0.056AT - 0.035ADFN + 0.708NMC - 0.211FFC + 0.198KFC$	0.353	0.005	0.708

* Adjusted.

Table 14: Linear regression results for additional analysis

Source: own processing, 2025

Several relations among variables were found, although none of these include the dimensions of Analytical Thinking (AT) or Ability to Detect Fake News (ADFN), which reinforces either the low performance of adolescents in both tests or their ability to measure the theoretical construct they were designed for.

We observe that Following Fact Checkers (FFC) and Perceived Credibility of Fact-Checkers (PCFC) variables have a positive ($\beta = 0.584$ and $\beta = 0.358$, respectively) and statistically significant ($p \leq .001$ and $p = .005$, respectively) effect on the dependent variable News Media Consumption (NMC). Knowledge of Fact Checkers (KFC) and News Media Consumption (NMC) also have a positive ($\beta = 0.592$ and $\beta = 0.808$, respectively) and statistically significant ($p \leq .001$ and $p \leq .001$, respectively) effect on the dependent variable Following Fact Checkers (FFC). Moreover, Following

Fact Checkers (FFC) has a positive ($\beta = 0.670$) and statistically significant ($p \leq .001$) effect on the dependent variable Knowledge of Fact Checkers (KFC). Finally, News Media Consumption (NMC) has a positive ($\beta=0.708$) and statistically significant ($p=0.005$) effect on the dependent variable Perceived Credibility of Fact-Checkers (PCFC).

5 Discussion

Despite the theoretical support established for the research hypotheses, we believe that the lack of confirmed relationships is not merely a consequence of sample size but rather a result of a pronounced floor effect in analytical thinking and fake news detection. As seen in Tables 5 and 15, the adolescents demonstrated very poor levels of Analytical Thinking (AT) and critically low performance in the detection of fake news (ADFN). This suggests that rather than reflecting a methodological limitation, the study may have captured an alarming cognitive trend: a generalized inability among adolescents to engage in reflective reasoning necessary for discerning misinformation.

A key statistical challenge arising from this issue is the lack of variance in AT and ADFN scores, which restricts our ability to observe meaningful correlations with other behavioural variables. When a large portion of the sample scores at the lowest end of a measurement scale, standard statistical models may fail to detect existing relationships simply because there is insufficient differentiation in the performance levels. In other words, rather than our hypotheses being incorrect, it is likely that the low cognitive engagement with analytical reasoning in the sample prevented measurable relationships from emerging.

While one possible solution would be to increase sample size and diversity, this alone may not resolve the issue. Similar cognitive, social, and informational challenges among adolescents have been widely documented in previous literature. This homogeneous and low-performing nature in key cognitive domains aligns with the notion that adolescents often rely on intuitive and heuristic-based processing rather than analytical reasoning when evaluating digital information (Kahneman, 2013; Pennycook & Rand, 2019). The fact that even small cognitive reflection interventions have been shown to improve fake news detection (Nygren et al., 2021) suggests that the issue is not necessarily an absence of effect, but rather the necessity of targeted cognitive interventions to create enough variation in reasoning skills before meaningful correlations can emerge. Rather than expanding the sample, future studies may need to incorporate interventions designed to enhance analytical thinking prior to testing behavioural correlations, allowing for a wider distribution of cognitive performance.

Given this panorama, our concerns go far beyond the statistical inability to confirm the proposed research hypotheses. Instead, the findings emphasise a broader societal issue: a critical lack of cognitive and informational skills among adolescents that may hinder their ability to navigate misinformation effectively. This raises the need for urgent interventions and corresponding impact assessments to determine the most effective strategies for fostering analytical reasoning and media literacy in this demographic.

We deepen the discussion of the proposed research hypotheses in the following sections.

5.1 NMC → ADFN

We reject H1 (Higher levels of News Media Consumption tend to lead to a greater Ability to Identify Fake News), which does not allow confirmation of the assumptions of Merchant and Asch (2018), that individuals who consume fake news and information on social networks are more likely to believe and propagate it, contributing to its dissemination on these platforms. Similarly, Wasserman and Madrid-Morales (2019), concluded that individuals who obtain information

through television sources rather than social networks perceive a lower risk of exposure to disinformation, since by having greater contact and knowledge of the factual panorama of informational reality, they will be better prepared to assess the veracity of false information. However, in the case of adolescents, even if they are aware of the factual reality, it may not align with their emotional schema, cognitive beliefs, or values postulated in their family environments. This discrepancy could lead them to reject factual information in favour of disinformation that aligns with personal or familial values or desired alternative realities, as suggested by previous studies (McIntyre, 2018; Nickerson, 1998).

Additionally, our analysis revealed that Following Fact-Checkers (FFC) and Perceived Credibility of Fact-Checkers (PCFC) have a positive effect on News Media Consumption. According to Kožuh and Čakš (2021) and Tully et al. (2020) even individuals with a high level of news literacy may not always apply their knowledge to distinguish between high and low-quality information. The ability to differentiate may depend on their intention to verify the news they consume. Users might seek out other sources and opinions, as well as utilize trusted fact-checking tools. Moreover, Kožuh and Čakš (2023) suggest that this behaviour, driven by prior knowledge on the topic, can enhance the consumption of quality news media, as users become more critical and selective about the information they engage with. We believe that individuals who frequently consume news and follow fact-checkers tend to become more alert and discerning about specific topics. Fact-checkers, who typically validate and debunk misinformation, can encourage individuals to enhance the quality of their information sources. Consequently, users are likely to seek more news on topics they find interesting. Furthermore, when fact-checkers are perceived as transparent and thorough in their processes, trust in them increases. This trust can boost news consumption, as individuals feel more confident in the accuracy of the information they receive.

5.2 FFC → ADFN

We reject H2 (Higher levels of Following Fact-Checkers tend to lead to a greater Ability to Identify Fake News), which does not allow the validation of findings such as those reported by Gottfried et al. (2013), who revealed that individuals who visited fact-checking websites demonstrated greater ability to answer factual questions. However, we believe it is crucial to consider that the ability to identify fake news is not limited to factual knowledge alone but involves other skills of critical thinking and evaluation of sources, recognition of bias and understanding of context. Therefore, if teenagers don't have these skills developed, it will be very difficult for them to be able to identify fake news even if they check the facts. Furthermore, the effectiveness of fact-checkers in changing beliefs and behaviour is closely linked to the trust they have in them, as highlighted by Yaqub et al. (2020).

Moreover, through further analysis, we found that Knowledge of Fact-Checkers has a positive effect on Following Fact-Checkers. Bhattacharjee (2022) points out that when individuals are aware of fact-checkers and use fact-checking tools, they are more likely to analyze the validity of the news they find. This behaviour often leads people to actively follow fact-checking sources, thereby enhancing media literacy. Thus, we believe that teenagers who are familiar with and engage with fact-checkers are more likely to follow them to verify facts, as revealed in our results.

5.3 KFC → ADFN

We reject H3 (Higher levels of Knowledge of Fact-Checkers tend to lead to a greater Ability to Identify Fake News or information), also not confirming Mestre (2021) identified growing awareness of disinformation and the importance of fact-checkers. However, we believe that

although many young people are aware of the existence of fact-checking media, they often do not visit their websites or profiles on social media. Coupled with low critical thinking skills, poor evaluation of sources, and a lack of understanding of context, these reduce their ability to identify fake news, as also pointed out by Mestre (2021).

5.4 PCFC → ADFN

We reject H4 (Higher levels of Perceived Credibility of Fact-Checkers tend to lead to a greater Ability to Identify Fake News), also not confirming Jennings and Stroud (2023), evidence that trust in the source is a key factor in the extent to which recipients adjust their beliefs as a result of a corrective message from a fact-checker they trust. Conversely, we believe that excessive trust in a fact-checking source can lead to complacency and uncritical acceptance of information, especially if that source is not infallible. As Herrero-Diz et al. (2020) pointed out, recipients may become less inclined to question and verify information on their own, which can compromise their ability to identify fake news effectively.

On the other hand, with the additional analysis, we realized that News Media Consumption (NMC) has a positive effect on the Perceived Credibility of Fact-Checkers (PCFC) among adolescents. Lee et al. (2023) found that consistency and credibility among different fact-checking organizations increase public trust in their analysis of information, especially among regular news consumers familiar with fact-checking methods. Therefore, we believe that when individuals consume more news, they become more familiar with journalistic quality standards and, consequently, more critical of the information they encounter. This continuous evaluation process enhances the perceived credibility of fact-checkers, as they are seen as an extension of this journalistic rigour. Encouraging regular and conscious news media consumption can strengthen public trust in fact-checkers, leading to a more informed society that is more resistant to disinformation.

5.5 NMC, KFC, FFC → AT and AT → ADFN, PCFC

The rejection of H5 (Higher levels of News Media Consumption tend to produce higher levels of Analytical Thinking) diverges from the context of the assumptions of Pew Research Center (2011), Meijer and Kormelink (2015) and Sveningsson (2015), who argue that the dangers of trusting information based on convenience, emotional appeal, or popularity, rather than evidence, are amplified by digital news platforms. They highlight that teenagers are particularly vulnerable to mimetic bias in social environments. According to these authors, this risk is exacerbated by the rapid dissemination of news on social media, which increases its influence and public engagement in information dissemination. Additionally, the habit of “news snacking”, where individuals consume information superficially and sporadically, contributes to a lack of critical evaluation. Such consumption patterns often focus on sensational headlines, keywords, or highlights, which are typically polemical, emotional, and lacking in informative content. This superficial understanding of news content often fails to foster critical perspectives among consumers.

The rejection of H6 (Higher levels of Knowledge of Fact-Checkers tend to produce higher levels of Analytical Thinking) and H7 (Higher levels of Following Fact-Checkers tend to produce higher levels of Analytical Thinking) contradicts the position of Nygren et al. (2021), who suggested that a brief curricular intervention introducing students to professional fact-checking tools can significantly enhance their ability to assess the credibility of information. They found that such interventions did not increase scepticism towards reliable news but did lead to more frequent monitoring of fact-checkers. Adolescents exposed to the verification processes of false information by fact-checkers can also learn effective information verification strategies.

By rejecting H8 (Higher levels of Analytical Thinking tend to give rise to greater Ability to Identify Fake News), we do not confirm the argument of Pennycook and Rand (2019), which states that individuals with high analytical thinking skills are more able to distinguish between fake and real news. The authors also suggested that such individuals are less likely to accept fake news as real.

Finally, rejecting H9 (Higher levels of Analytical Thinking tend to lead to greater Perceived Credibility in Fact-Checkers) challenges the premise of Allen et al. (2021) and Martel et al. (2021), who found that individuals with a higher propensity for analytical thinking were more likely to trust corrective signals, recognizing the competence and credibility of fact-checkers in providing factual assessments. Additionally, the relationship between analytical thinking and perceived credibility might not be linear. Different aspects or types of analytical thinking (e.g., critical thinking vs. open-mindedness) might influence trust in fact-checkers differently. Some analytical thinkers might be more sceptical by nature, leading to lower perceived credibility of external sources, including fact-checkers (Pehlivanoglu et al., 2021). Moreover, analytical thinkers often expose themselves to a wider range of information sources. This exposure can lead to encountering conflicting information about the same topic, which might reduce their overall trust in any single source, including fact-checkers (Koch et al., 2023; Kwek et al., 2023).

We believe that the lack of association between Analytical Thinking and other variables stems from the low performance observed in our sample. Insufficient data on students with higher levels of Analytical Thinking prevented us from identifying patterns or trends among those individuals.

The additional analysis of the relationships between variables resulted in the following conceptual model of the relationships (Figure 7):

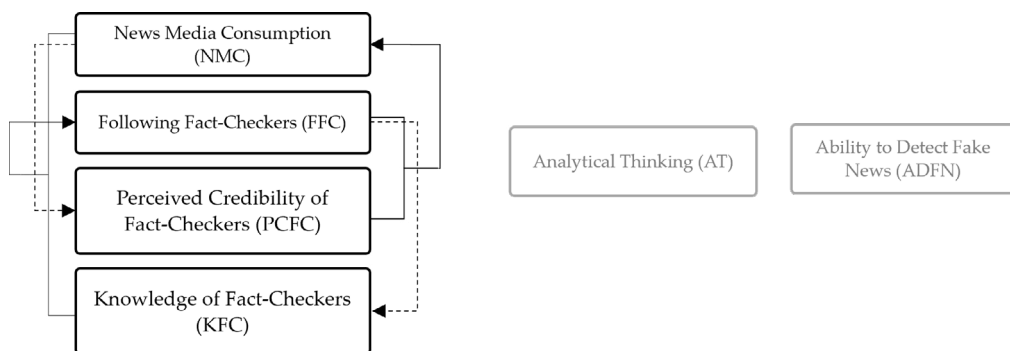


Figure 7: Conceptual model of the relationships found between the variables

Source: own processing, 2025

As it is possible to observe, there are relevant and significant relationships between the initial independent variables (AT and ADFN), but no relations between these and the core dependent variables. We cannot but highlight how these dependent variables consist of critical skills to navigate and survive the current post-truth era, and to stress how critically adolescents have underperformed in analytical thinking skills and fake news detection.

6 Conclusion

The results of this investigation provide crucial insights into the levels of Analytical Thinking (AT) and the Ability to Detect Fake News (ADFN) among adolescents, set against the backdrop of the growing phenomenon of misinformation. The study reveals a worrying trend of poor performance in both areas, highlighting the urgent need for targeted interventions. Over half of the participants scored zero in AT, with only 16.8% managing to answer two or all three

questions correctly, which underscores significant deficiencies in analytical reasoning – particularly among young women. Likewise, ADFN scores were consistently low, with most participants scoring between 2.5 and 5.5 out of a possible 14 points, and only one participant achieving a score of 10.5. Factor analysis further confirmed the critical gaps in both AT and ADFN, with a pronounced presence of a floor effect. The lack of variance in these cognitive dimensions likely obscured meaningful statistical relationships, rather than disproving the hypothesized connections between AT, fact-checking behaviours, and fake news detection. Rather than a methodological limitation, this finding underscores a broader cognitive deficit in adolescents' engagement with misinformation. The data suggests that many adolescents rely on heuristic and intuitive processing rather than reflective analytical reasoning when evaluating news, a trend that poses challenges for misinformation resilience.

Beyond the data, the study advances the field of media literacy in several ways. Firstly, the findings reinforce the argument that media literacy cannot be reduced to technological proficiency alone. While adolescents are often labelled as “digital natives”, this study shows that familiarity with digital platforms does not translate to the ability to critically engage with online content, particularly in detecting misinformation. This gap calls for a rethinking of media literacy education, where critical thinking and analytical reasoning are positioned as core competencies, rather than peripheral skills.

In the context of Portugal, the implications of this study are particularly significant. Despite global efforts to incorporate media literacy into education systems, Portugal lags in terms of structured programs that address the specific cognitive challenges posed by misinformation. This study suggests that current educational frameworks are insufficient in preparing adolescents to critically evaluate the veracity of information they encounter online. The low levels of AT and ADFN observed among Portuguese adolescents point to a broader national issue that must be addressed through policy changes. Policymakers should prioritize the integration of media literacy into the core curriculum, emphasizing not only the technical skills needed to navigate digital platforms but also the critical thinking abilities required to discern credible information from falsehoods.

From a practice perspective, the study underscores the importance of fact-checking education and the active promotion of critical media consumption behaviours. Educators and practitioners should focus on embedding these skills across different subjects, engaging students in activities that foster deep analytical thinking. Interventions must be contextually relevant and culturally sensitive, recognizing that misinformation often appeals to emotional and intuitive reasoning, which can overpower analytical thinking. In this sense, strategies that combine cognitive training with emotional and social literacy may be more effective in helping adolescents resist the allure of fake news.

Furthermore, the findings suggest that media literacy education must extend beyond the classroom and engage with broader social dynamics. Adolescents often consume news in fragmented, emotionally charged environments that do not lend themselves to reflective thinking. Therefore, educational interventions should not only focus on building cognitive resilience but also encourage the development of social practices that challenge misinformation within peer groups and families. Cross-national research has shown that media literacy programs that foster critical discussion and collective reflection can significantly improve the ability to detect misinformation (Papapicco et al., 2022). Similarly, the role of prosocial interventions, where students are empowered to become fact-checkers within their own social networks, could be a promising direction for future practice (Orosz et al., 2024).

Overall, this study contributes to the growing body of literature that underscores the importance of analytical thinking in media literacy. However, it also reveals critical gaps in adolescents' preparedness to navigate misinformation, particularly in the Portuguese context. The findings highlight the need for educational and policy reforms that place critical media literacy at the forefront of curricula, ensuring that future generations are equipped with the skills

to critically assess the information they encounter. Further research should explore cross-national comparisons and examine the effectiveness of different media literacy interventions in enhancing analytical thinking and misinformation detection, particularly among vulnerable youth populations.

This research is not without limitations. The use of this type of analytical thinking test can be discussed, as these are “riddles” that frequently appear on social media or are shared among adolescents, compromising the reliability of the responses, despite our results indicating otherwise. The adoption of a convenience sample prevents the generalization of the results. This is not a representative study of the national reality. Therefore, there is a need for research with a broader and more varied sample. Furthermore, we would need a slightly larger sample, but more importantly, a culturally more diverse one, to include, for example, different social strata and educational environments, which could lead to better results and a greater range of high-performance cases.

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