Skills or motivations? Pathways to adolescent digital literacy

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9 March 2026

Abstract

Adolescents rely heavily on online news sources, but many struggle to evaluate the reliability of content they encounter. Integrating research from education and political psychology, we develop a theory to explain how skills and motivations interact to shape digital literacy among adolescents. We test the theory with a preregistered experiment on a national sample of Spanish teenagers. The experiment separately randomizes exposure to a low intensity skills treatment (fake news discernment tips) and an individually-targeted motivational prime (matched to teens' pre-existing concerns about misinformation using a large language model). Descriptively, two-thirds of teens overestimate their ability to discern fake news — a tendency that exists across demographic groups, political identities, and academic performance. Experimental results demonstrate that skills training improves fake news discernment *only* when paired with a motivational prime. By contrast, skills training and motivational primes are ineffective or counterproductive when delivered alone. Our results demonstrate the importance of both skills and motivation for improving digital literacy and provide insights into how future age-targeted digital literacy interventions should be developed.

Word count: 8574

*We thank Vin Arceneaux, Siyun Jiang, Guillermo Toral, and participants at the 2025 MPSA Annual Meeting and 2024 Madrid Empirical Social Sciences Workshop for helpful input. Alfonso Pérez provided excellent research assistance. Data collection was funded by a Social Research Grant from Fundación La Caixa (Spain), number LCF/PR/SR24/57010024. Any remaining errors and omissions are our own.
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Introduction

Online misinformation represents one of the most widely recognized challenges facing democratic societies today. Survey evidence suggests that 82 percent of Europeans agree that false or misleading news is a problem for democracy (European Commission 2025); similarly, in the United States 87 percent of people agree that fake news is a significant problem for the country (Poushter et al. 2025).[1] While misinformation is dangerous for democratic societies in general, adolescents are especially at risk because they increasingly consume news from online sources rather than legacy sources with more rigorous standards (Twenge, Martin, and Spitzberg 2019). For instance, in the United States, 70 percent of teenagers report getting their information from social media rather than traditional media, such as newspapers, radio, or television (Dautrich 2018). In Spain — the setting of our study — roughly two-thirds of teenagers report spending two or more hours per day on social media platforms; 38 percent report they are online more than four hours a day or "permanently" (Save the Children España 2024). This increasing reliance on online news sources renders adolescents more vulnerable to fake news and other forms of low quality information (Allcott and Gentzkow 2017).

Existing research makes clear that many young people fail to critically evaluate online content they encounter. One study found that 96 percent of U.S. teens failed to investigate the source of purportedly factual — but actually unreliable — information they encountered about climate science (Breakstone et al. 2021). A 2024 survey revealed that 76 percent of young people in the European Union (and 88 percent in Spain) believed they had been exposed to fake news or misinformation in the previous week. However, in the same survey, only 18 percent of young Europeans were very confident in their ability to identify misinformation (Starostin 2025). This lack of digital literacy may have profound consequences, distorting beliefs and attitudes during a politically formative period with potentially lasting consequences into adulthood (Campbell et al. 1960; Sears and Valentino 1997).

[1]The 87 percent figure includes respondents who indicated that "made-up news and information" is a very or moderately big problem in their country.

Best practices to improve digital literacy among teenagers are unclear, despite policymakers considering these skills a priority. For instance, "information and digital literacy" is the first component included in the European Commission's Digital Competence Framework, which "provides a detailed description of all the skills needed to be competent in digital environments and describes them in terms of knowledge, skills, and attitudes, and provides levels within each competence." (EU Commission 2018). However, this abstract prioritization of digital literacy has not translated into concrete gains among students: only around 60% of European teenagers say that school has helped them with digital skills, and Spanish students are slightly below average (Fraillon 2023). The practice of digital literacy at schools and beyond is not yet adequately developed, and its implementation is uneven.

One reason for the limited success of digital literacy initiatives is that existing research offers limited guidance about the form those initiatives should take. Some experimental studies find that digital literacy trainings significantly improve adolescents' ability to distinguish between true and fake news (Amar et al. 2025; Orosz et al. 2024); however, other studies have documented null or even backfire effects (Badrinathan 2021; Ghazi et al. 2025; Nygren and Efimova 2025; Tamboer et al. 2024). From the perspective of the educator of policymaker, it is unclear what lessons to take from these mixed findings. To help explain these divergent findings, we emphasize the role of *motivation*, which research suggests is an important predictor of learning and which we expect to play a particularly important role among young people when evaluating online content about politics. Young people are comparatively low in political experience, interest, and knowledge (Jennings and Niemi 1981; Delli Carpini and Keeter 1996; Galston 2001). We believe existing research on misinformation skills acquisition has overlooked the importance of motivation for learning, and thus failed to develop and study motivation interventions that complement skills training. This is the key gap we try to address in this article.

We expect that most adolescents have low intrinsic motivation to internalize digital literacy skills (even when provided in age-appropriate, accessible formats) and to apply them when consuming political content. Building on research from educational and political psychology, we

argue that skills-enhancing interventions will be significantly more effective when paired with motivational primes that increase the perceived importance of digital literacy and, in turn, stimulate adolescents to devote attention and effort to learning and applying skills they are taught. As we argue below, motivational primes that accentuate extrinsic benefits (e.g., protecting oneself or one's peers from the dangers of misinformation) should be especially effective at stimulating attention and effort.

We test our theory with fake news discernment experiments conducted on a nationally representative sample of teenagers (age 14–18) in Spain. The experiments randomize exposure to a widely used skills-based treatment (an infographic containing digital literacy tips) and an individually targeted motivational prime. Our primes focus on extrinsic benefits that prior research has found are effective at stimulating costly action in other domains: generalized risk, in-group risk, and in-group responsibility. For respondents randomized to receive a motivational prime, we use a large language model (ChatGPT–4.0) to present them with the motivational prime that most closely relates to their pre-existing concerns about misinformation (measured in an open-ended survey question). All respondents are then presented with a randomized subset of true and fake news posts and asked to evaluate the reliability of each. This design allows us to estimate the effect of digital literacy training on fake news discernment and, most importantly, the extent to which that effect varies among adolescents with varying levels of motivation.

To provide context for our study, we begin by presenting descriptive evidence on digital literacy and related attitudes among teens, focusing on both objective measures (fake news discernment) and subjective measures (perceived discernment ability, epistemic efficacy). We show that baseline levels of fake news discernment among teens are low: on average, true stories are rated just 25 percent more reliable than fake stories. Moreover, two-thirds of teens overestimate their discernment ability relative to their peers. Both trends are consistent across teens with different socioeconomic, political, and academic backgrounds. Overall, the descriptive results suggest that digital literacy is a widespread challenge among teens, and that digital literacy is likely orthogonal to traditional measures of academic performance and political engagement.

Consistent with our theory, experimental results demonstrate that motivation plays an important role in shaping the effectiveness of skills-enhancing interventions. When motivation is not stimulated, our skills-based training fails to significantly improve discernment. However, among respondents who receive a motivational prime, we observe a significant improvement in discernment — an effect that is driven by reducing false skepticism of true stories (as opposed to increasing skepticism of false stories). We find suggestive evidence that these results are largest among the lowest academically performing students (a proxy for motivation) — precisely those that are often hardest to reach by educators. However, while motivational primes increase the effectiveness of skills-based trainings, we do not find that they increase demand for additional digital literacy resources (a proxy for likelihood of opting into such resources in the real world).

Overall, our results suggest that relatively modest, scalable interventions (e.g., tips) can improve fake news discernment — but only if accompanied by motivational interventions that stimulate adolescents to invest attention and effort. Importantly, however, these treatments are ineffective (in the case of our low-intensity skills training) or counterproductive (in the case of motivational primes) when delivered alone. These results offer important lessons for policymakers, educators, and misinformation researchers. We discuss these implications in the conclusion, as well as outlining limitations to our results and lingering questions for future research.

Pathways to adolescent digital literacy

Foundational research in political behavior demonstrates that citizens acquire political skills as they age (Campbell et al. 1960; Delli Carpini and Keeter 1996; Nie, Junn, and Stehlik-Barry 1996; Stoker and Bass 2011). Indeed, both civic knowledge (about the role and functioning of institutions) and political knowledge (about the ideology and positions of major parties) are low among teenagers compared to non-teenage adults (Chan and Clayton 2006; Hart and Atkins 2011; Johann and Mayer 2017). The positive relationship between age and both forms of knowledge has been attributed to numerous mechanisms, including formal education (Kahne and Sporte

2008; Schulz et al. 2023), political interest (Verba, Schlozman, and Brady 1995; Jennings and Markus 1984; Delli Carpini and Keeter 1996), experience interacting with government (Jennings and Markus 1984), and habit formation (Jennings and Markus 1984; Prior 2005; Plutzer 2002).

In addition to underperforming older cohorts in terms of political knowledge, research demonstrates that adolescents often struggle with various aspects of digital literacy (Guess and Munger 2022). Studies have found that teens often fail to scrutinize online content (Breakstone et al. 2021), resulting in poor fake news discernment and a tendency to share low quality content. Given these challenges, significant effort has been devoted to developing age appropriate interventions to improve digital literacy among adolescents. Educators, journalists, and others have developed a range of interventions aimed at children (Berg et al. 2025) and adolescents, and many jurisdictions now include digital literacy in their curriculum.

These age-targeted interventions have taken many forms, including in-school lessons (Amar et al. 2025; Badrinathan 2021), online exercises (Orosz et al. 2024), games (Barzilai et al. 2023; De La Hera et al. 2024), mobile applications (Hartwig et al. 2024), and interactive chatbots (Alonso-Molina, Sabitzer, and Dostál 2024), among others. While effectiveness varies across interventions, literature reviews and meta-analyses suggest that these skills-enhancing interventions generally improve digital literacy (Huang, Jia, and Yu 2024; Guess et al. 2024). Certain types of interventions, in particular those that emphasize lateral reading and source verification, seem especially effective (Guess et al. 2024). Based on existing evidence, we predict that:

H1: Exposure to digital literacy tips will improve fake news discernment.

While some skills-enhancing interventions have been shown to improve digital literacy, the broader literatures on political knowledge and educational psychology suggest that skills alone are not sufficient. Even when skills are provided, recipients must make a deliberate choice to devote attention and cognitive effort into learning and applying skills they are taught. Going back to Downs (1957, ch. 13), scholars have emphasized the costs of acquiring political skills. These costs include opportunity costs and, especially important in the context of digital literacy, the cognitive effort required to carefully evaluate the credibility of political information. Understandably, in

many real world political settings, citizens are reluctant to incur these costs. Somin (2013, ch. 3) argues that citizens are rationally ignorant: the perceived distance of politics from one's own life and the availability of information shortcuts lead many voters to remain uninformed. Indeed, levels of political knowledge in the population have remained stable (and relatively low) even as levels of formal education have increased over time and political information has become more readily available (Somin 2013). When more political information becomes available (e.g., through new technology), knowledge gains accrue to those individuals who are interested in politics and therefore motivated to consume it (Prior 2005). Scholars have observed similar patterns when it comes to digital literacy resources (e.g., fact-checking sites), which are freely available online but seldom visited by all but the most politically engaged citizens (Guess, Nyhan, and Reifler 2020; Graham and Porter 2024). These findings suggest that there is a *motivational* component to political knowledge (see Delli Carpini and Keeter 1996, 184–187). Applying this logic to the challenge of digital literacy, we argue that providing skills training (e.g., tips) is not enough. People must be motivated to devote attention to the interventions, internalize their lessons, and apply newly learned skills in concrete situations.

We expect motivation to play an especially important role among adolescents, who have comparatively low interest in politics (Prior 2018), lack experience thinking through political issues (Prior 2010), and consume a barrage of online content of varying quality (Twenge, Martin, and Spitzberg 2019). While skills-enhancing treatments should provide some benefits in contexts where recipients are not highly motivated (as is the case in the typical experimental study), we argue that adolescents who are highly motivated should see the largest gains. This argument is consistent with educational research, which has found that perseverance of effort is associated with higher achievement in conventional subjects (Credé, Tynan, and Harms 2017; Muenks et al. 2017).[2] It is unclear, however, whether the positive effects of perseverance of effort also apply to tasks that have a primarily out-of-school application, such as discernment of misinformation.

[2]These findings are based on analysis of one component of the "grit" construct (Duckworth et al. 2007), with the other component being consistency of interests over time.

From the point of view of the policymaker or educator, researchers have not had much success in designing interventions that systematically change students' mindsets and effort, as a recent meta-analysis has found (Sisk et al. 2018). There is some evidence, however, that intensive curricular interventions have been successful in increasing effort, particularly among the most disadvantaged and academically at risk or demotivated students. These in-classroom interventions have focused on explaining to students causal chains from neuroplasticity to effort to performance through case study instruction and the cultivation of deliberate practices of effort (Alan, Boneva, and Ertac 2019; Santos et al. 2022). Interventions of this kind are intensive in terms of teacher and class time (e.g. more than 24 class hours in Alan, Boneva, and Ertac 2019) and not targeted at a particular dimension of effort. This suggests a need to identify more realistic targeted alternatives of lower intensity tailored to improving digital literacy. Our goal is to find a a lower intensity intervention in terms of class and teacher time. We also seek to be low-touch so as not to crowd out other in-class curriculum or rely on shifting teacher practices, which might require an overhaul of professional development.

One lower intensity, highly scalable approach to motivating adolescents involves highlighting the concrete risks of misinformation and corresponding benefits of becoming more digitally literate. One could imagine several (extrinsic) motivational appeals along these lines, focusing on, for example, the broad social and political consequences of misinformation or the private costs to the individual such as confusion or opinion distortion. Research suggests that extrinsic motivations can be harnessed to stimulate behavioral change across a wide range of domains from energy conservation to voter turnout (Bolsen, Druckman, and Cook 2014; Druckman and Green 2013; Sinclair 2012; Cialdini and Goldstein 2004; Gross et al. 1974). Extrinsic motivational appeals may be especially effective among adolescents, compared to other groups, for the reasons discussed earlier. We do not offer predictions about the content of the most effective motivational appeals and have no reason to believe that they are homogeneous for different teenagers. However, this research leads us to expect that there will be *some* motivational appeals that (if received and accepted) will induce adolescents to invest greater attention and cognitive effort into learning

digital literacy skills. As a result, skills-enhancing interventions (e.g., trainings) should be more effective when accompanied by a prime that highlights salient extrinsic motivations. Our key hypothesis is therefore that:

> H2: Exposure to a motivational prime will increase the effectiveness of digital literacy tips.

If motivational appeals can be harnessed to increase the effectiveness of skills-training, a related question is whether they also increase demand for digital literacy resources. As discussed, most existing research focuses on digital literacy interventions that are delivered in captive settings, such as in schools (Badrinathan 2021) or in survey experiments (Guess and Coppock 2020). Outside of these captive settings, people must voluntarily opt-in to these resources. Existing evidence suggests that few people consume these resources in the real world (Guess, Nyhan, and Reifler 2020), and that stimulating demand in realistic contexts is difficult. Some approaches, however, have been shown to improve attitudes towards fact checkers and increase voluntary consumption of fact-checking content. Graham and Porter (2024) evaluate several approaches and show that three successfully increase demand: appeals to civic duty, social pressure, and micropayments. Encouragingly, these effects were observed among respondents with low pre-treatment willingness to consume fact checks.

Consistent with the theory presented above, we expect that motivational appeals will increase attention and concern about misinformation, which should in turn increase demand for digital literacy resources. We therefore predict that:

> H3: Exposure to a motivational prime will increase voluntary uptake of digital literacy resources.

Descriptive results: actual and perceived misinformation-tackling skills

Before testing our theory, it is useful to understand existing levels of digital literacy and related attitudes in the context where our experiment takes place (among 14–18 year olds in Spain). To do so, we analyze non-experimental questions from the survey we will present below.[3] In these descriptive analyses, we consider a series of outcome variables, which we categorize into objective or subjective measures (left and right panels of Table 1, respectively). Objective measures include fake news discernment, political knowledge, and belief accuracy. Subjective measures include self confidence in fake news discernment ability and epistemic political efficacy (EPE; Pingree 2011), which captures confidence in one's ability to tell true from false claims in politics. We examine the individual-level predictors of these dependent variables. Because outcome variables are measured on different scales, we normalize them to 0–1 for ease of interpretation. (We display the mean and standard deviation of each outcome variable, measured on its original scale, in the top row of Table 1.) Non-categorical predictors are also normalized.

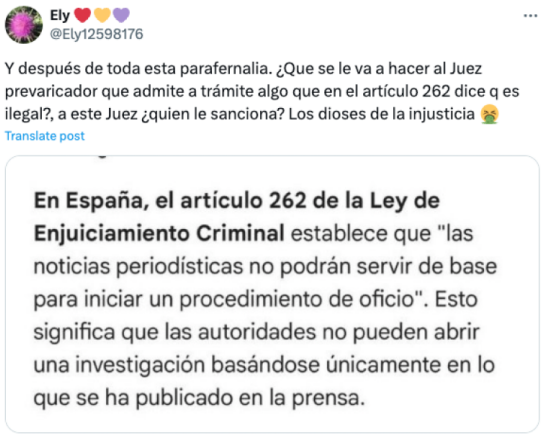
Our primary outcome variable — both here and in the experimental analyses below — is fake news discernment. Our survey asked respondents to evaluate the accuracy of nine news stories or social media posts — six false and three true — that were circulating online at the time of data collection (March 2025). Some news stories were attributed to major national outlets, others were unattributed, and some were screenshots from social media posts. Our goal was to mimick the diversity of the information environment teenagers may encounter (Twenge, Martin, and Spitzberg 2019).[4] Figure 1 provides an example of one true and one false story included in

[3] Of the questions analyzed in this section, all except fake news discernment were measured in the pre-experimental sections of the survey. For our analysis of discernment, in these descriptive analyses we limit the sample to control respondents because they represent a clean (no skills training) baseline.

[4] Although a systematic analysis of treatment effects by different attributes of news is beyond the scope of this paper, we provide in the Appendix all results by each of the news pieces.

Figure 1: Example news items used to evaluate discernment

(a) Example true item



(b) Example false item

the survey (all stories are displayed in Online Appendix B). While no nine stories can represent the entire universe of online content, we chose stories that varied in terms of topical focus, format, source, and tone (for a similar approach, see Guess et al. 2020). These stories or posts covered a wide range of issues spanning politics, science, education, and current events. Respondents were shown the stories in random order and asked to evaluate the reliability of each on a 4-point unipolar scale from "not at all reliable" to "totally reliable," with no limits on the time the subjects could dedicate to checking or the resources available to them. Following Guay et al. (2023), we operationalize discernment as the difference between a respondent's average rating of true and false stories, respectively. The resulting variable ranges from -3 to 3 with higher values corresponding to better discernment. For our descriptive analysis of discernment, we restrict the same to control respondents who did not receive the fake news tips treatment described below.

Political knowledge is measured as the number of correct answers to five questions about contemporary and current national politics in Spain. Belief accuracy is measured with a battery of ten questions on nonpolitical current affairs (e.g. "ham is the biggest export product in Spain"), subtracting the number of incorrectly assessed false beliefs from the number of correctly assessed

true beliefs (normalized by the number of true and false beliefs).

Subjective political skills include self confidence in discernment ability and epistemic political efficacy. Self confidence in discernment is measured using one question (taken from Lyons et al. 2021): "How do you think you compare to other Spaniards your age in your overall ability to recognize fake news? Answer using the scale below, where 1 means you're in the worst place (worse than 99% of people) and 100 means you're in the best place (better than 99% of people)." Finally, following Pingree (2011), epistemic efficacy is measured as average level of agreement (from 1–5) to the following three statements: "I am confident that I can discover the truth about political issues"; "If I wanted to, I could find out the facts behind most political disputes"; "Behind most political disputes there are objective facts, and if you try hard enough you can find them."

We examine the individual-level predictors of these actual and perceived political skills. We include predictors for gender, interest in politics, ideology, partisanship, and social media usage (our pre-registered predictors); in light of some of the experimental results presented below, we also included core measures of academic engagement, including interest in school, grit, and grade point average (GPA). The results results are shown in Table 1.

Table 1: Predicting actual and perceived political skills (normalized OLS models)

	Objective measures			*Subjective measures*	
	(1) Fake news discernment	(2) Political knowledge	(3) Belief accuracy	(4) Self confidence in discernment	(5) Epistemic efficacy
Mean	0.98	2.78	0.49	7.23	3.21
	(0.68)	(1.19)	(0.68)	(2.33)	(0.81)
Female	-0.04^{***}	-0.01^{*}	-0.02	-0.02	-0.02^{**}
	(0.01)	(0.004)	(0.01)	(0.01)	(0.01)
Not very interested in pol.	-0.03	0.02^{***}	0.06^{***}	0.05^{***}	0.01
	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)
Pretty interested in pol.	0.002	0.03^{***}	0.10^{***}	0.09^{***}	0.03^{*}
	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)
Very interested in pol.	-0.02	0.05^{***}	0.13^{***}	0.17^{***}	0.05^{***}
	(0.03)	(0.01)	(0.02)	(0.02)	(0.02)
Social media news user	-0.03	-0.09^{***}	-0.17^{***}	-0.07^{***}	0.10^{***}
	(0.03)	(0.01)	(0.02)	(0.02)	(0.02)
Grit	-0.02	0.05	0.03	0.13^{***}	0.05^{*}
	(0.05)	(0.03)	(0.01)	(0.03)	(0.03)
Interest in school	0.04	0.05^{*}	0.02	0.10^{***}	-0.02
	(0.04)	(0.02)	(0.01)	(0.02)	(0.02)
GPA	-0.03	0.05^{**}	0.04^{***}	0.04^{*}	-0.02
	(0.02)	(0.02)	(0.01)	(0.02)	(0.01)
Left-wing	0.02	0.01	-0.01	-0.05^{***}	0.02^{*}
	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)
Right-wing	0.01	-0.003	-0.01	0.02	0.02^{*}
	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)
Sumar (far left) voter	0.01	0.02^{*}	0.02	-0.01	0.03
	(0.04)	(0.01)	(0.02)	(0.02)	(0.02)
PSOE (center-left) voter	0.03	-0.001	0.04^{**}	0.05^{***}	0.02^{*}
	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)
PP (center-right) voter	0.02	-0.01	0.04^{*}	0.01	-0.003
	(0.02)	(0.01)	(0.02)	(0.02)	(0.01)
Vox (far right) voter	-0.01	-0.01	0.05^{***}	-0.004	0.01
	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)
Constant	0.60^{***}	0.60^{***}	0.54^{***}	0.72^{***}	0.47^{***}
	(0.09)	(0.02)	(0.04)	(0.04)	(0.04)
Preregistered controls	✓	✓	✓	✓	✓
Sample	Controls (no tips)	All	All	All	All
N	798	2827	2783	2891	2807

Note: Top panel shows means and standard deviations (in parentheses) for each outcome variable on its original scale as described in the text. Middle panel shows OLS coefficients with standard errors in parentheses, with all outcomes normalized to 0–1. Column 1 includes only control (no tips treatment) respondents; Columns 2–5 include all respondents, including incompletes who answered pre-experimental questions but did not reach the discernment tasks. Preregistered controls (omitted) include age and educational status. Significance levels: $^{***}p < .001$, $^{**}p < .01$, $^{*}p < .05$.

Beginning with fake news discernment (column 1), we see that mean discernment is quite low, with true stories rated as only 0.98 points more reliable than false stories on average — less than 25 percent of the four-point response scale. The distribution of the fake news discernment outcome variable is visualized in Figure 2. The figure displays the distribution of fake news discernment scores (left panel) and respondents' average rating of true and false stories (right panel), among those respondents in the control condition. Discernment scores are normally distributed around a mean of 1.02 ($sd = 0.66$), indicating that respondents rate true stories as about 1 point (or 25%) more accurate than false stories on average. Respondents give true stories an average rating of 2.93 (0.60) on the 4-point scale, corresponding to a rating of "very accurate." By contrast, they rate false stories 1.92 (0.41), corresponding to "not very accurate" (difference: $p < .001$). As shown in the right panel of Figure 2, ratings of false stories are normally distributed; by contrast, ratings of true stories are more non-normal, with many "false negatives," or ratings of true stories as unreliable. In the analyses that follow, we will focus on whether changes in discernment are driven by changes in the perceived accuracy of true stories, of false stories, or both (Guay et al. 2023).

Turning to the predictors of fake news discernment (Table 1, column 1), we find only one significant predictor: sex. Women perform significantly worse than men on our discernment tasks.[5] The lack of other significant predictors suggests that fake news discernment is a widespread challenge among teens. However, several factors are strongly predictive of *confidence in* one's own discernment ability (column 4) and epistemic efficacy (column 5). In particular, higher levels of political interest and all three measures of academic performance (grit, interest in school, GPA) are consistently linked to self confidence in discernment and (to a lesser extent) epistemic efficacy. This suggests false confidence on the part of highly politically knowledgeable and academically high performing teens: they are more confident in their ability to recognize fake news and feel more epistemologically efficacious, but in reality perform no better than their peers. Interestingly,

[5]However, research suggests that observed gender gaps in political sophistication are sensitive to measurement approaches (Kraft 2024).

these same "high performers" do in fact perform better on conventional measures of political sophistication, namely knowledge (column 2) and belief accuracy (column 3). This pattern of results suggests that fake news discernment may pose a unique challenge for teens, including the most politically interested and academically high performing teens.

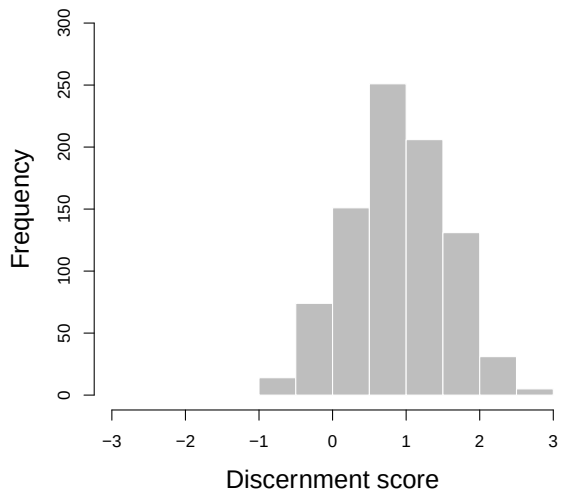
We also note that frequent consumers of news on social media are less politically knowledgeable and have less accurate beliefs; although they perform no worse than their peers in actual misinformation discernment, they are less confident in their own discernment ability. Paradoxically, they report higher levels of epistemic efficacy, perhaps suggesting that they feel informed about politics in general but nonconfident in the narrower ability to recognize fake news.

To further examine the problem of overconfidence, we plot actual and perceived fake news discernment ability in Figure 3.[6] The horizontal axis gives respondents' placement in the distribution of fake news discernment scores, and the vertical axis gives their estimated placement using the pre-treatment question from Lyons et al. (2021). The results are quite striking: approximately two-thirds of teens overestimate their relative performance in fake news discernment. This overconfidence is large in absolute terms (mean 15.6 percent, standard deviation 32.6 percent) and widespread across respondents with different characteristics. In Appendix Table A.2, we show that there are few significant predictors of overconfidence. We find some suggestive evidence that more politically interested teens are more overconfident. However, there is no evidence that overconfidence is associated with sex, social media news consumption, academic performance, or political attitudes. We take these results as further evidence that fake news discernment — and the overconfidence problem — is a widespread challenge among teens.

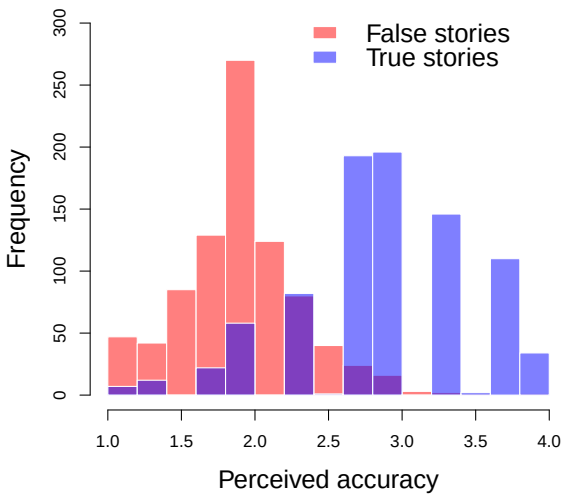
[6]This plot is limited to control respondents who did not receive the digital literacy tips treatment described below.

Figure 2: Distribution of fake news discernment outcomes

(a) Discernment score

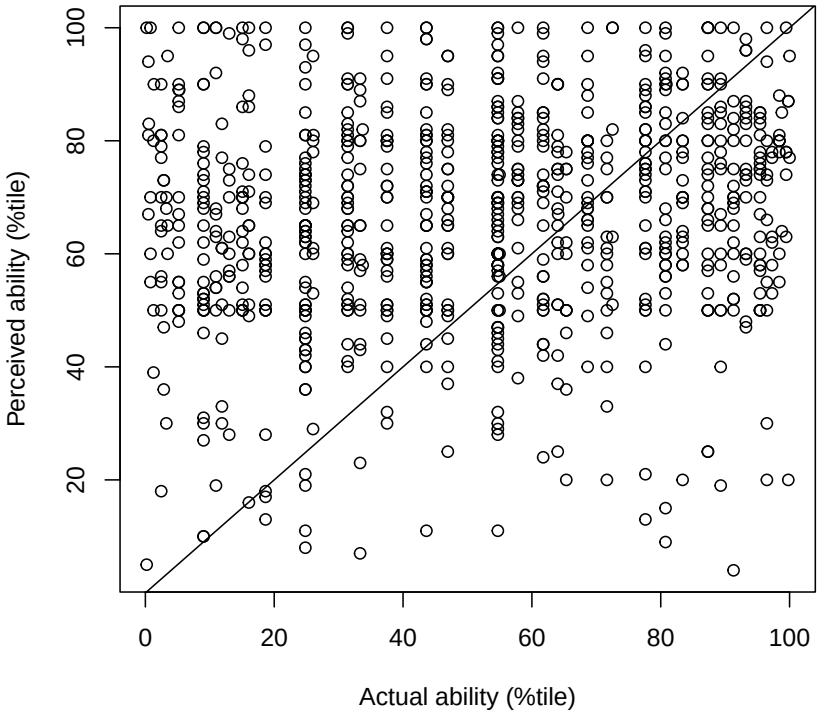


(b) Average accuracy ratings



Note: Sample includes control (no tips treatment) respondents only.

Figure 3: Actual vs. perceived fake news discernment ability



Note: Sample includes control (no tips treatment) respondents only. The x-axis is respondent's percentile in fake news discernment as measured in discernment tasks (described in text). The y-axis is respondent's perceived percentile as measured in the following survey question: "How do you think you compare with other Spaniards your age in your general ability to recognize 'fake news'? Please answer using the scale below, where 1 means you are at the bottom (worse than 99% of people) and 100 means you are at the top (better than 99% of people)." (Survey question taken from Lyons et al. 2021.)

Experimental design

The descriptive results suggest that fake news discernment is a widespread challenge among teens, including among the select few who are highly interested in politics and excel academically. We now turn to an experimental test of our theory about the determinants of digital literacy among adolescents. We conducted a preregistered survey experiment using a national sample of adolescents (age 14–18) in Spain ($N = 1803$).[7] Respondents were recruited from a commercial panel (Netquest) in the spring of 2025 and resembled the national age cohort in terms of gender and region (autonomous community).[8] The sample contains substantial variance on theoretically relevant variables (Druckman and Kam 2011), including educational status (academic, vocational tracks or not in education), academic performance, and interest in politics. Following our theory, the experimental design manipulates both skills (in the form of fake news discernment tips) and motivation to invest time and effort learning those skills (in the form of an individualized prime).

Figure 4 illustrates the survey design. Respondents began the survey by answering a set of standard background, demographic, and political questions. Respondents then answered an open-ended question about the potential risks of misinformation.[9] We use responses to this question in one of our randomized treatments, described below.

Randomization occurs in two stages. First, respondents are randomly assigned to receive a motivational prime or not. For those assigned to receive a prime, we use the large language model ChatGPT–4.0 to analyze their response to the open-ended question and estimate three similarity scores. These scores capture the extent to which their open-ended response discusses the social costs of misinformation, private costs of misinformation, or the role of adolescents in spreading and consuming misinformation, respectively.[10] We present treated respondents with the prime

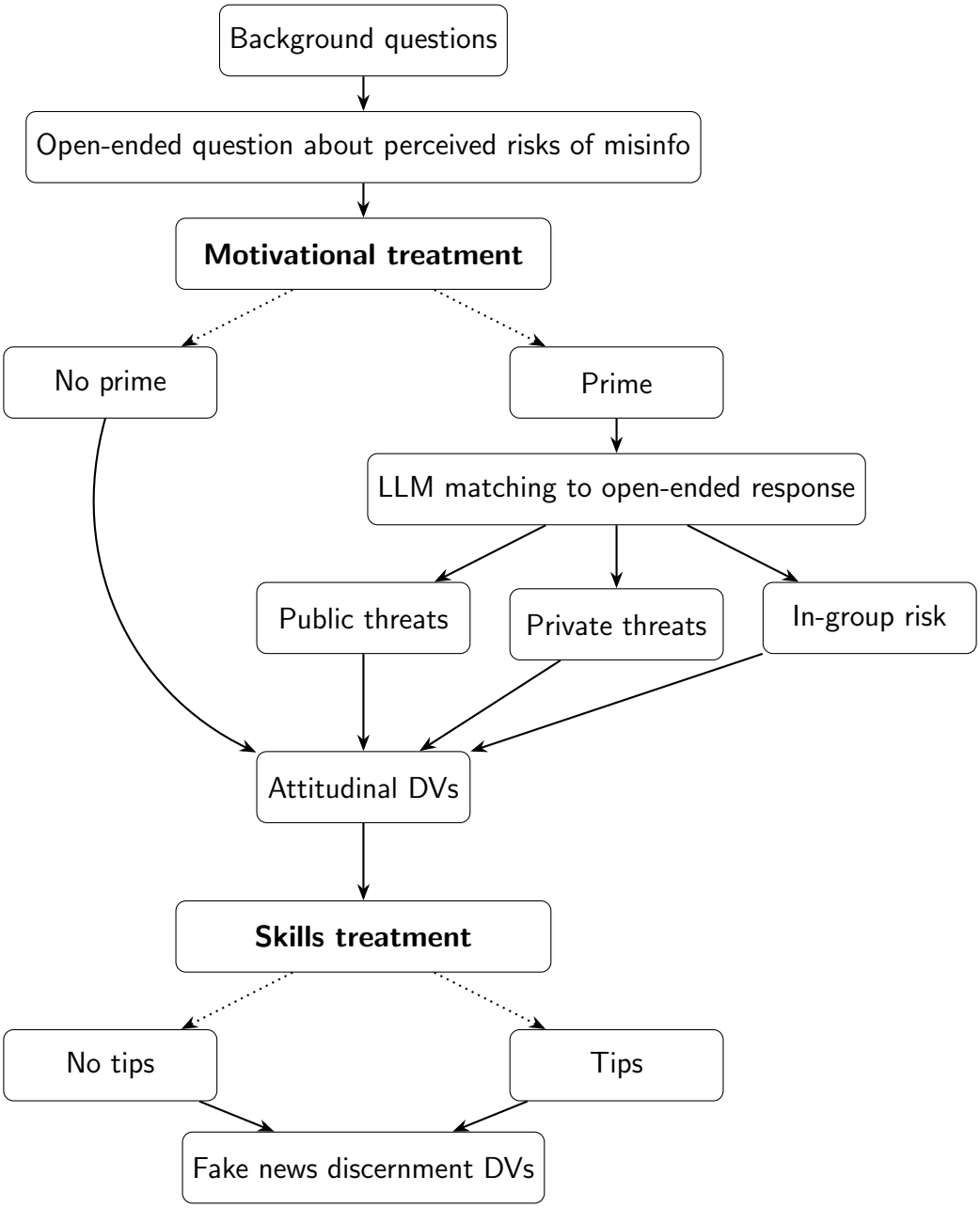
[7] This N includes respondents who reached the experimental portion of the survey ("Motivational treatment" in Figure 4). An anonymized version of the preregistration is provided in the supporting materials.

[8] Sample characteristics are in Appendix Table A.1.

[9] The question wording was, "There is a lot of talk these days about misinformation, or 'fake news.' What do you think are the main risks or dangers posed by fake news? (Answer in at least 100 characters)."

[10] For the first similarity score (public costs), the prompt used was: "Does this text address the consequences

Figure 4: Experimental design



Note: Dotted lines indicate random assignment.

of misinformation on macro-level social and political outcomes, such as democracy, elections, governance, and public health? Calculate a score from 0 to 100 that captures the extent to which the text addresses these macro-level social and political consequences of misinformation (where 0 = not at all and 100 = a lot). Make

corresponding to their highest similarity score. The goal here is to present each treated respondent with a motivational prime that will resonate with them most based on their pre-existing concerns about misinformation.

We designed each of the three motivational primes based on the literature discussed above, which has found that extrinsic motivational appeals can spur costly behavioral change. All three primes were formatted as a short news story or blurb that summarized a fictional study from Oxford University (a salient, prestigious, but non-Spanish university). The public threats prime cued the dangers of misinformation for democracy; the private threats prime discussed dangers specific to teenagers; and the in-group blame prime discussed the role of teenagers in spreading a disproportionate share of online misinformation. The full text of all primes is provided in Appendix B. Pilot analysis on a national sample of Spaniards showed that all three primes increased the perceived dangers of misinformation.

All respondents — whether they received a motivational prime or not — then answered a series of attitudinal questions, which included agreement with various statements that misinformation is dangerous and demand for additional digital literacy resources. The demand question asked, "This concludes this part of the survey. At the end of the survey, would you like to receive more information about any of the following? (Click in as many as you wish)" (with options being tips to identify fake news, a list of non-partisan fact-checking sites in Spain, free online digital literacy course). We use the agreement questions as manipulation checks to verify the success of the motivational primes. We use the demand outcomes to test H3.

Second, we randomized exposure to an infographic providing tips on fake news discernment. Following Guess et al. (2020), we rely on a series of tips originally designed by Facebook (2025). We created a shortened and translated version of Facebook's original tips, which we thought more suitable to Spanish teenagers while continuing to be low cost as well. The infographic provides a series of short tips for spotting fake news, including being skeptical of all caps headlines, checking

sure to provide only one numerical value between 0 and 100. Do not include any additional text or words." The other two prompts took the same format.

sources, inspecting dates, and checking claims against other reports. The infographic is displayed in Appendix Figure A.1. Past research has found that this and similar tips-based treatments improve fake news discernment. Respondents could spend as much or as little time as they wanted on this screen.

In the final stage of the survey, respondents complete fake news detection tasks, which we use to test H1 and H2. As discussed above, respondents were presented with a mix of true and false stories (see Figure 1) and asked to rate the reliability of each. We calculate overall fake news discernment as the difference in average accuracy ratings of true and false stories.

To summarize, our design randomized motivations (via an individualized prime) and skills (via a series of digital literacy tips). We examine how these treatments affect fake news discernment (to test H1 and H2) and demand for additional digital literacy resources (H3).

Experimental results

We test our hypotheses with a series of preregistered OLS models. For all experimental analyses, we estimate treatment effects on overall discernment as well as belief in true and false stories (Guay et al. 2023). We present aggregate results in the main text and separate claim-specific models in Appendix A.

H1 predicted that the skills treatment will improve fake news discernment. We test this hypothesis by regressing our discernment outcomes on a dummy variable for the tips treatment among all respondents (i.e., including those who received a motivational prime and those who did not). Table 2 shows the results. Contrary to past research and our prediction, we fail to find evidence that the tips treatment improved overall discernment (column 1), increased belief in true claims (column 2), or decreased belief in false claims (column 3). In the Appendix, we show that these null effects are consistent across the different true and false stories included in our discernment tasks (see Appendix Tables A.7 and A.8).[11] From these results, we conclude that skills training alone is ineffective at improving digital literacy among adolescents. H1 is not

[11] Results are largely consistent across the different true claims, although individually underpowered. In the case of

Table 2: Effect of skills-based treatment on fake news discernment (H1)

	Dependent variable:		
	(1) Overall discernment	(2) Belief in true claims	(3) Belief in false claims
Tips treatment	0.05	0.06	0.002
	(0.03)	(0.03)	(0.02)
Constant	0.98***	2.90***	1.92***
	(0.02)	(0.02)	(0.01)
N	1506	1506	1508

Note: Cell entries are OLS coefficients with clustered standard errors in parentheses. Significance levels: $^{***}p < .001$, $^{**}p < .01$, $^{*}p < .05$.

supported.

Although the skills treatment alone fails to improve discernment, H2 posits that effectiveness depends on whether adolescents are sufficiently motivated. Specifically, we predicted that the effect of skills training on discernment would be larger for respondents who receive an individualized motivational prime. We test this hypothesis with models that interact the tips and motivational prime treatments. We display the regression results in Table 3; effects are presented visually in Figure 5.

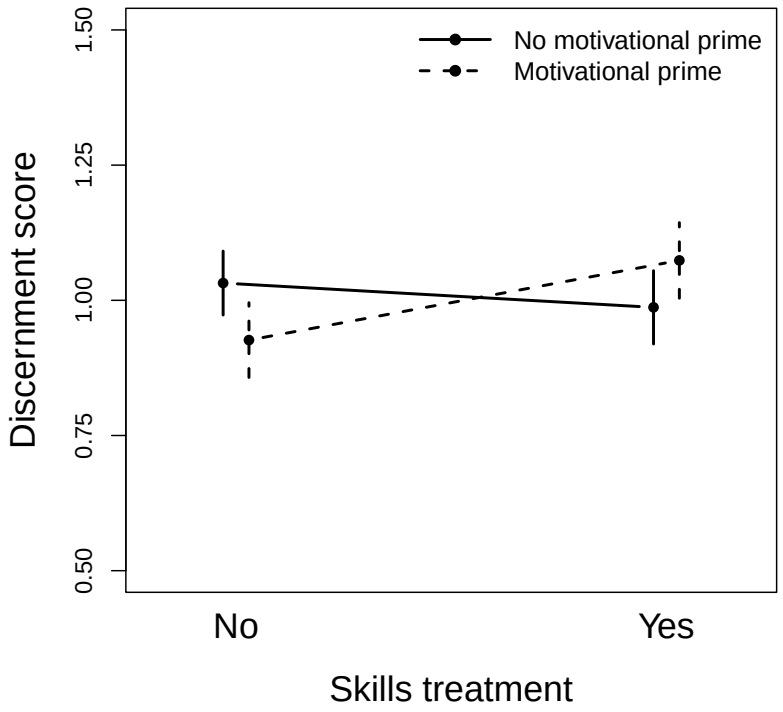
Figure 5 displays mean discernment scores (with 95 percent confidence intervals) for different experimental conditions. Among respondents who did not receive a motivational prime (solid black lines), we find that skills training fails to increase discernment. By contrast, we see significant effects among respondents who received a motivational prime (dotted black lines). Among these motivated respondents, skills training leads to significant gains in discernment $(p < .001)$. This effect is sizeable, with an interaction effect on the discernment score of .19 points (column 1), or an increase of about a fifth of the average levels of discernment. An interesting and unex-

false claims, a story related to the political amnesty of Catalan politicians — a highly polarizing issue — seems to be to have the strongest negative effects. However, our overall results are not dependent on that claim.

pected finding is that motivational primes presented alone (i.e., without skills training) decrease discernment ($p < .05$). However, when motivated respondents are provided will skills training, this negative effect is eliminated and we see significant gains in discernment.

Disaggregating these overall effects, Table 3 examines the effect of our treatments on overall discernment (column 1) as well as belief in true and false claims (columns 2 and 3, respectively). Looking at columns 1 and 2, it becomes clear that the aggregate effects in Figure 5 are driven by changes in the perceived accuracy of true claims. When motivational primes are presented alone, respondents demonstrate a pattern of false skepticism, reducing their belief in true claims, which then results in decreases in overall discernment. When both tips and motivational primes are provided, we see discernment improve relative to the motivation only baseline — an effect that is again driven by changes in the perceived accuracy of true claims. (In Appendix Figure A.2 (panel A), we present differences in the distributions of discernment by treatment group, and in panels B and C for accuracy of true stories, and false stories, respectively.) However, it is worth noting that respondents who received both skills training and a motivational prime still do not outperform pure control respondents who received neither treatment. This is at least partially because our skills training fails to decrease the perceived accuracy of false news — a point to which we return in the concluding discussion.

Figure 5: Effect of skills-enhancing treatment on fake news discernment



Note: Dots show mean discernment score by condition. Error bars contain 95% confidence intervals.

Table 3: Claim-specific interactive effects of skills-based and motivational treatments on fake news discernment (H2)

	Dependent variable:		
	(1) Overall discernment	(2) Belief in true claims	(3) Belief in false claims
Tips treatment	−0.04	−0.01	0.02
	(0.05)	(0.04)	(0.03)
Motivational prime	−0.11*	−0.09*	0.01
	(0.04)	(0.04)	(0.03)
Tips × motivation	0.19**	0.14*	−0.04
	(0.07)	(0.06)	(0.04)
Constant	1.03***	2.94***	1.92***
	(0.03)	(0.03)	(0.02)
N	1506	1506	1508

Note: Cell entries are OLS coefficients with clustered standard errors in parentheses. Significance levels: $^{***}p < .001$, $^{**}p < .01$, $^{*}p < .05$.

Finally, we examine H3, which posited that motivational primes will increase demand for digital literacy resources. The results are presented in Table 4. Contrary to our prediction, the overall effect of the motivational primes on demand for resources is negative and statistically significant (relative to baseline demand of just under one resource per respondent). To better understand this unexpected finding, we examine the separate effects of each individual motivational prime on demand in the bottom panel of Table 4. Here we see that the overall negative effect is driven by the in-group risk prime, which focused on the role of teenagers in spreading and consuming misinformation. Exposure to this prime decreases demand for each of the three resources (although only significantly in the case of demand for a free course, $p < .05$), resulting in a significant overall reduction in demand. (We present the effects on demand visually in Figure A.2 (panel D), which displays the distribution of the total demand outcome by experimental condition.)

Table 4: Effect of motivational prime on demand for digital literacy resources (H3)

	Dependent variable:			
	(1) Total demand	(2) Demand: DL tips	(3) Demand: list of FCs	(4) Demand: free course
Any motivational prime (pooled effect)	-0.13^{***} (0.04)	-0.05^{*} (0.02)	-0.04^{*} (0.02)	-0.04^{*} (0.02)
Public risk prime	-0.02 (0.05)	0.001 (0.03)	0.01 (0.02)	-0.02 (0.02)
Private risk prime	0.03 (0.06)	0.07 (0.04)	-0.04 (0.03)	0.01 (0.03)
In-group risk prime	-0.15^{*} (0.07)	-0.02 (0.05)	-0.05 (0.04)	-0.08^{*} (0.03)
Constant	0.90^{***} (0.03)	0.51^{***} (0.02)	0.21^{***} (0.01)	0.17^{***} (0.01)
N	1697	1697	1697	1697

Note: Total demand is the number of resources demanded (maximum value is 3). Cell entries are OLS coefficients with clustered standard errors in parentheses. Significance levels: $^{***}p < .001$, $^{**}p < .01$, $^{*}p < .05$.

Exploratory extensions

In light of our experimental results, we conducted a series of exploratory extensions. Specifically, we examine heterogeneity by student performance and the motivational prime respondents received. We present the exploratory results in Appendix A and provide an overview here in the main text.

Heterogeneity by student performance

The descriptive analyses presented above reveal that adolescents who perform highly academically (as measured by interest in school, grit, and GPA) are more confident in their discernment ability and feel more epistemically efficacious. In reality, however, these individuals perform no

better on fake news discernment than their less academically inclined peers (shown in Table 1). Prior experimental studies suggest that skills training may be particularly effective among low academically performing students. Other findings in the education literature suggest that school performance is correlated with performance in new, unrelated skills outside the classroom (Van Iddekinge et al. 2024). One may therefore wonder if the effects we found above differ substantially across academically stronger and weaker adolescents.

We evaluate this possibility by testing for heterogeneous effects based on respondents' interest in school, grit, GPA, and political knowledge. We look for heterogeneous effects by rerunning our models for H1, H2, and H3 across subgroups; the results are presented in Tables A.3-A.5. We fail to find evidence that the effect of skills training alone varies across more or less academically inclined or politically interested adolescents. Although all these measures interact positively with the effects of the tips treatment, all effects are small and insignificant.

We do, however, find strong evidence that our key interactive effect — skills training and motivation — is driven by less gritty, less politically interested, and low GPA respondents (see Table A.4). This suggests that motivational appeals are especially important among less academically inclined and politically interested adolescents.[12] One interpretation is that high academic performers may have been somewhat "pre-treated" in terms of motivation: they have high baseline motivation to invest cognitive effort into analyzing political information, even *sans* motivational prime. These academic high performers are also likely high in need for cognition — a psychological disposition that captures individual differences in the tendency to engage in and enjoy deliberate thinking (Cacioppo and Petty 1982). This trait has been linked to academic motivation and cognitive capacity among adolescents (Kramer et al. 2021). By contrast, less academically inclined and politically interested adolescents are unlikely to invest effort into carefully evaluating political information unless motivated to do so. Receiving an individualized motivational prime provides this necessary push, which then leads them to apply their cognitive skills to interpret information.

[12]We show results separately by high- and low- levels of the potential moderators to facilitate interpretation, instead of interacting them with the treatments.

With respect to demand for digital literacy resources (H3), we find no evidence of heterogeneity based on political interest or academic performance (see Table A.5).

Heterogeneity by motivational prime

The theory we offered above focuses on how skills and motivations interact to shape digital literacy. However, we did not offer a comprehensive theory of which particular types of motivations are most effective in stimulating adolescents to apply their cognitive skills. Instead, in our experiment, we took a data-driven approach by designing three primes (informed by theory and previous work) and presenting treated respondents with the prime that most closely related to their own preexisting concerns about misinformation.

Here, we examine whether some of our motivational primes — which focused on public costs, private costs, and in-group risk — were more effective than others. Following our preregistration, we conduct manipulation checks to examine the extent to which our motivational primes increased agreement with a series of statements about the dangers of misinformation. We combine these statements into an overall index and analyze that variable. The results are presented in Appendix Table A.6. As an initial note, it is important to recognize that baseline concern about the treats posed misinformation is quite high. Among untreated (no motivational prime) respondents, the average level of agreement is 4.12 on a 5-point scale. Despite the potential for ceiling effects, results demonstrate that receiving a motivational prime significantly increased agreement that misinformation is dangerous ($p < .01$). Looking at the three primes separately, we see that the public threats and in-group risk primes significantly increased the perceived threat of misinformation ($p < .01$ for both). The in-group risk prime is particularly effective, increasing the perceived threat by 0.21 points over a high baseline of 4.21 ($p < .001$). However, the private threats prime, which focused on the personal costs of misinformation (e.g., consumer scams, fraud), failed to significantly increase agreement. In fact, this private threats prime failed to increase agreement with the most theoretically related statement in the index: that "misinformation is a threat to me personally." This suggests that respondents who received the

private threats prime were not treated as successfully as respondents who received the other two primes (public costs, in-group risk). As a result, the the effect of motivations is likely conservatively estimated in our data. Stronger or better targeted motivational treatments would make the interactive effect between skills and motivations even larger.[13]

We conducted a series of additional analyses to examine whether our experimental results involving motivations (H2 and H3) depend on which prime respondents received. We present the results in Appendix Tables A.11 and A.12. Starting with H2 and the interactive effect of skills and motivations on discernment, we find no evidence that the interaction depends on the specific prime respondents received. When it comes to the effect of motivations on demand for resources, we reach the same result. We observe null effects of motivations on demand across all three motivational primes.[14]

Discussion and conclusion

Evidence suggests that digital literacy is a major challenge among adolescents: although they spend more time online than other age cohorts, they often struggle to evaluate the reliability of content they encounter. This article offered a theory to explain the determinants of adolescent digital literacy and how it can be improved. We focused in particular on the role of *skills*, which have been the focus of existing research (Guess et al. 2020; Badrinathan 2021; De La Hera et al. 2024), and extrinsic *motivations*, which are known to affect information processing but have not yet been incorporated into the study of digital literacy. In short, we argue that skills-enhancing interventions (such as tips and courses) will improve digital literacy most when paired with motivational appeals that convince adolescents to invest effort into learning and applying those skills. We tested the theory with a randomized experiment that varied skills training and

[13] Despite the failure of the private threats prime, we retain these respondents in the analyses to avoid post-treatment bias (Montgomery, Nyhan, and Torres 2018).

[14] This also means that excluding these primes from the pooled treatment arm of all motivational primes does not change any of the effects of receiving a motivational prime we identified for H2 and H3.

exposure to an individualized motivational prime.

Our results suggest that modest, scalable interventions targeting skills and motivations can improve fake news discernment when offered in combination. This is a small intervention that can be easily incorporated into classroom practice (through prominent display in classrooms, or incorporation into textbooks or classroom devices). We take this as strongly suggestive evidence that more intense treatments — such as multi-session in-class trainings and more vivid motivational appeals — would lead to even larger improvements in discernment. To reiterate, our skills treatment entailed a one-shot, text-only list of fake news tips with no guarantee that exposed respondents paid attention to it or applied the lessons when completing our discernment tasks. The same goes for our motivation treatments, which were presented as text-only news paragraphs quoting authoritative studies. The median time spent on the whole survey in our sample is just over eight minutes. Those in the tips-only treatment group spent a median time of 43 extra seconds on the survey than those in the the pure control group. Nonetheless, we show that these respondents saw significant gains in discernment when they were also exposed to a motivational prime.

One notable finding is that the interactive effect of skills and motivation (H2) is driven by lowering the increased skepticism about true claims induced by the motivational prime alone (recall Table 3, column 2). Highlighting the risks of misinformation alone (without providing skills) caused respondents to become more skeptical of true claims, worsening overall discernment. Similar results have been documented among adults in the literature (see Carey et al. 2020 for an example and Guay et al. 2023 for discussion). When skills training is provided alongside motivation, this false skepticism is reduced, resulting in a significant improvement in discernment. By contrast, our treatments did not affect the perceived reliability of false claims. This is a troubling result given high baseline levels of belief in fake news: 31% of the respondents in the pure control group (no skills or motivation treatment) in our sample rate the false claims to be somewhat reliable (average score greater than 2). This level of belief in false claims is not reduced by the skills or motivation treatments, either alone or combined (Table 3). Future research

should consider new skills trainings specifically targeted to recognizing false or unreliable claims (the treatment used in our experiment aimed to do this, although ultimately unsuccessfully). Another intervention that future research might explore is topic-specific training that improves baseline knowledge about topics for which fake news are widespread (e.g., health).

We also find the interesting result that our two-pronged approach to improving discernment is most beneficial for the least academically engaged students (with lower than median GPA or grit levels, or low interest in schools, shown in Appendix Table A.4). This finding is consistent with other work focusing on educational interventions designed to boost learning in conventional academic subjects, such as reduction of class sizes (Nye, Hedges, and Konstantopoulos 2000) or high-dosage tutoring programs (Guryan et al. 2023). However, this is not the case for other interventions, such as tracking (Card and Giuliano 2016) or acceleration or grade-skipping (Steenbergen-Hu, Makel, and Olszewski-Kubilius 2016), which seem to benefit high-achieving students only. Importantly, our finding of heterogeneity by academic performance occurs despite the fact that the least academically engaged students are no different from the more academically engaged ones in terms of baseline levels of misinformation discernment (see Table 1). This suggests that fake news discernment is orthogonal to other academic skills, where those who do least well initially have the most to gain from interventions. Future research could examine interventions that explicitly boost awareness of this lack of relation between academic performance and misinformation discernment. This approach could potentially encourage high performing students to exert more effort in learning and applying the skills they are taught.

Lastly, contrary to our predictions, we find that motivational primes fail to increase demand for digital literacy resources (H3). The rarefied survey setting and standard (not customized) online-only resources on offer may partly explain these null effects. Another possibility is that the motivation and skills treatments may have interacted to shape demand in unexpected ways. Consistent with this explanation, we find some evidence that the effect of receiving a motivational prime on demand is heterogeneous (see Appendix Table A.12): among respondents who did not receive the skills treatment, receiving a prime is positively associated with demand for the most

popular resource offered (tips). This is also shown visually in panel D of Appendix Figure A.2. The null results in Table 4 are therefore driven exclusively by the subgroup who receive *both* the motivation and tips prime. One interpretation is that there may be some substitution between receiving the skills treatment and demand for any additional resources — that is, respondents who are motivated by our primes but already receive relevant resources may be disinclined to express a demand for additional resources. Given the very low intensity nature of the skills treatment, this suggests that stronger primes may be necessary to better highlight the value of additional resources in helping to improve discernment skills.

The analyses reported here have other limitations that could be addressed in future research. First, our approach to stimulating motivation was a light touch intervention that could be made stronger or more personalized. For instance, video clips or in-person lessons by trained teachers would likely highlight the stakes of misinformation more vividly, which could instill more motivation in respondents. Relatedly, the effectiveness of our LLM-based procedure for assigning treated respondents to motivational primes depends in part on the quality of respondents' open-ended survey responses. One might worry that some respondents answered this open-ended question with the help of artificial intelligence (Zhang, Xu, and Alvero 2025; Traylor 2025), which would imply that the quality of the match was not as strong as it could have been. This would make the motivational treatment weaker (i.e., less closely tied to respondents' pre-existing concerns about misinformation), which would push effect estimates towards zero. Second, our analyses examine the effect of skills and motivations on various aspects of digital literacy, all measured in-survey. However, digital literacy is a multifaceted construct, and different operationalizations could lead to different results (Guess and Munger 2022). When studying digital literacy among adolescents, it would be important to establish whether skills-based and motivational treatments affect behavior on social media, such as patterns of fake news consumption and sharing (a la Guess, Nyhan, and Reifler 2020). Finally, our data cover one age group in one country. Future work could consider the robustness of our findings in other age groups or in countries with different educational systems or patterns of media consumption among adolescents.

Despite these limitations, our results shed important light on the determinants of adolescent digital literacy. As educators and policymakers continue to design tools and formulate policies aimed at vulnerable populations, sufficient attention should be paid to both skills-enhancing and motivational pathways to digital literacy.

References

Alan, Sule, Teodora Boneva, and Seda Ertac. 2019. "Ever failed, try again, succeed better: Results from a randomized educational intervention on grit." *The Quarterly Journal of Economics* 134 (3): 1121–1162.

Allcott, Hunt, and Matthew Gentzkow. 2017. "Social media and fake news in the 2016 election." *Journal of Economic Perspectives* 31 (2).

Alonso-Molina, Juan, Bernhard Sabitzer, and Jakub Dostál. 2024. "Fact Checking Chatbot: A Misinformation Intervention for Instant Messaging Systems." arXiv preprint arXiv:2403.12913.
URL: *https://arxiv.org/abs/2403.12913v1*

Amar, Priyadarshi, Sumitra Badrinathan, Simon Chauchard, and Florian Sichart. 2025. "Countering Misinformation Early: Evidence from a Classroom-Based Field Experiment in India." *American Political Science Review*.

Badrinathan, Sumitra. 2021. "Educative interventions to combat misinformation: Evidence from a field experiment in India." *American Political Science Review* 115 (4): 1325–1341.

Barzilai, Sarit, Shiri Mor-Hagani, Fayez Abed, Danna Tal-Savir, Na'ama Goldik, Ina Talmon, and Ohad Davidow. 2023. "Misinformation Is Contagious: Middle school students learn how to evaluate and share information responsibly through a digital game." *Computers Education* 202.

Berg, Freja Sørine Adler, Thomas Enemark Lundtofte, Lene Heiselberg, and Lena Frischlich. 2025. "Children and digital misinformation: A scoping review." *Global Studies of Childhood*.

Bolsen, Toby, James N. Druckman, and Fay Lomax Cook. 2014. "Communication and Collective Actions: A Survey Experiment on Motivating Energy Conservation in the U.S." *Journal of Experimental Political Science* 1 (March): 24–38.

Breakstone, Joel, Mark Smith, Sam Wineburg, Amie Rapaport, Jill Carle, Marshall Garland, and Anna Saavedra. 2021. "Students' Civic Online Reasoning: A National Portrait." *Educational Researcher* 50 (8): 505–515.

Cacioppo, John T., and Richard E. Petty. 1982. "The Need for Cognition." *Journal of Personality and Social Psychology* 42 (1): 116–131.

Campbell, Angus, Philip E. Converse, Warren E. Miller, and Donald E. Stokes. 1960. *The American Voter*. New York: John Wiley & Sons.

Card, David, and Laura Giuliano. 2016. "Can tracking raise the test scores of high-ability minority students?" *American Economic Review* 106 (10): 2783–2816.

Carey, John M., Victoria Chi, D. J. Flynn, Brendan Nyhan, and Thomas Zeitzoff. 2020. "The effects of corrective information about disease epidemics and outbreaks: Evidence from Zika and yellow fever in Brazil." *Science Advances* 6 (5).

Chan, Tak Wing, and Matthew Clayton. 2006. "Should the voting age be lowered to sixteen? Normative and empirical considerations." *Political studies* 54 (3): 533–558.

Cialdini, Robert B., and Noah J. Goldstein. 2004. "Social Influence: Compliance and Conformity." *Annual Review of Psychology* 55: 591–621.

Credé, Marcus, Michael C Tynan, and Peter D Harms. 2017. "Much ado about grit: A meta-analytic synthesis of the grit literature." *Journal of Personality and social Psychology* 113 (3): 492.

Dautrich, Kenneth. 2018. "The Future of the First Amendment: 2018 Survey of High School Students and Teachers.".
URL: *https://knightfoundation.org/reports/the-future-of-the-first-amendment-2018/*

De La Hera, Teresa, Laura Cañete Sanz, Nuria Navarro Sierra, Jeroen Janz, Julia Kneer, Rene Glas, and Jasper van Vught. 2024. "Digital Literacy Games: A Systematic Literature Review." *Frontiers in Communication* 9: 1407532.

Delli Carpini, Michael X., and Scott Keeter. 1996. *What Americans Know about Politics and Why It Matters*. New Haven, CT: Yale University Press.

Downs, Anthony. 1957. *An Economic Theory of Democracy*. New York: Harper and Row.

Druckman, James N., and Cindy Kam. 2011. "Students as Experimental Participants: A Defense of the 'Narrow Data Base'." In *Cambridge Handbook of Experimental Political Science*, ed. James N. Druckman, Donald P. Green, James H. Kuklinski, and Arthur Lupia. New York: Cambridge University Press.

Druckman, James N., and Donald P. Green. 2013. "Mobilizing Group Membership: The Impact of Personalization and Social Pressure Emails." *SAGE Open* 3 (2).

Duckworth, Angela L, Christopher Peterson, Michael D Matthews, and Dennis R Kelly. 2007. "Grit: perseverance and passion for long-term goals." *Journal of personality and social psychology* 92 (6): 1087.

EU Commission. 2018. Digital Competence Framework for Citizens. Technical report Joint Research Centre.
URL: *https://joint-research-centre.ec.europa.eu/projects-and-activities/education-and-training/digital-transformation-education/digital-competence-framework-citizens-digcomp*$_{e}n$

European Commission. 2025. "Countering Information Manipulation.". Accessed 6 June 2025.
URL: *https://commission.europa.eu/topics/countering-information-manipulation*

Facebook. 2025. "Tips to spot fake news.". Accessed: 2025-03-19.
URL: *https://www.facebook.com/help/188118808357379*

Fraillon, Julian. 2023. *An International Perspective on Digital Literacy: Results from ICILS 2023*. IEA.

Galston, William A. 2001. "Political knowledge, political engagement, and civic education." *Annual review of political science* 4 (1): 217–234.

Ghazi, Maria, Marine Lemaire, Lorna Le Stanc, Marie Létang, Pascaline Citron, Emilie Decrombecque, Christophe Mousset, Mathieu Cassotti, and Grégoire Borst. 2025. "Fostering media truth discernment in adolescents by combining media and dual process interventions." *Computers in Human Behavior Reports* 100788.
URL: *https://www.sciencedirect.com/science/article/pii/S2451958825002039*

Graham, Matthew H., and Ethan V. Porter. 2024. "Increasing Demand for Fact-Checking." *Political Communication* (2): 325–348.

Gross, Allan E., Marvin J. Schmidt, John P. Keating, and Michael J. Saks. 1974. "Persuasion, Surveillance, and Voting Behavior." *Journal of Experimental Social Psychology* 10: 451–460.

Guay, Brian, Adam J. Berinsky, Gordon Pennycook, and David Rand. 2023. "How to think about whether misinformation interventions work." *Nat Hum Behav* (7): 1231–1233.

Guess, Andrew, and Alexander Coppock. 2020. "Does Counter-Attitudinal Information Cause Backlash? Results from Three Large Survey Experiments." *British Journal of Political Science* 50 (4): 1497–1515.

Guess, Andrew, Brendan Nyhan, and Jason Reifler. 2020. "Exposure to untrustworthy websites in the 2016 US election." *Nature Human Behaviour* 4 (5).

Guess, Andrew M., and Kevin Munger. 2022. "Digital literacy and online political behavior." *Political Science Research and Methods* 10 (3): 573–590.

Guess, Andrew M., Michael Lerner, Benjamin Lyons, Jacob M. Montgomery, Brendan Nyhan, Jason Reifler, and Neelanjan Sircar. 2020. "A digital media literacy intervention increases discernment between mainstream and false news in the United States and India." *Proceedings of the National Academy of Sciences* 117 (27): 15536–15545.

Guess, Andy, Shannon McGregor, Gordon Pennycook, and David Rand. 2024. "Unbundling Digital Media Literacy Tips: Results from Two Experiments." Accessed 7-10-2025.
URL: *https://osf.io/preprints/psyarxiv/u34fp*$_v1$

Guryan, Jonathan, Jens Ludwig, Monica P Bhatt, Philip J Cook, Jonathan MV Davis, Kenneth Dodge, George Farkas, Roland G Fryer Jr, Susan Mayer, Harold Pollack et al. 2023. "Not too late: Improving academic outcomes among adolescents." *American Economic Review* 113 (3): 738–765.

Hart, Daniel, and Robert Atkins. 2011. "American sixteen-and seventeen-year-olds are ready to vote." *The Annals of the American Academy of Political and Social Science* 633 (1): 201–222.

Hartwig, Katrin, Tom Biselli, Franziska Schneider, and Christian Reuter. 2024. "From Adolescents' Eyes: Assessing an Indicator-Based Intervention to Combat Misinformation on TikTok." In *Proceedings of the 2024 ACM CHI Conference on Human Factors in Computing Systems*. In *Proceedings of the 2024 ACM CHI Conference on Human Factors in Computing Systems*.

Huang, Guanghui, Wei Jia, and Weiyu Yu. 2024. "Media Literacy Interventions Improve Resilience to Misinformation: A Meta-Analytic Investigation of Overall Effect and Moderating Factors.".

Jennings, M. Kent, and Gregory B. Markus. 1984. "Partisan Orientations over the Long Haul: Results from the Three-Wave Political Socialization Panel Study." *American Political Science Review* 78 (4): 1000–1018.

Jennings, M. Kent, and Richard G. Niemi. 1981. *Generations and Politics: A Panel Study of Young Adults and Their Parents*. Princeton, NJ: Princeton University Press.

Johann, David, and Sabrina Jasmin Mayer. 2017. "Reif für die Wahl? Stand und Struktur des politischen Wissens in Österreich: Ein Vergleich der 16-und 17-Jährigen mit anderen Altersgruppen." *Österreichische Zeitschrift für Politikwissenschaft* 46 (2): 1–16.

Kahne, Joseph E, and Susan E Sporte. 2008. "Developing citizens: The impact of civic learning opportunities on students' commitment to civic participation." *American educational research journal* 45 (3): 738–766.

Kraft, Patrick W. 2024. "Women Also Know Stuff: Challenging the Gender Gap in Political Sophistication." *American Political Science Review* 118 (2): 903–921.

Kramer, Anne-Wil, Anna C. K. van Duijvenvoorde, Lydia Krabbendam, and Hilde M. Huizenga. 2021. "Individual differences in adolescents' willingness to invest cognitive effort: Relation to need for cognition, motivation and cognitive capacity." *Cognitive Development* 57: 100978.

Lyons, Benjamin A, Jacob M Montgomery, Andrew M Guess, Brendan Nyhan, and Jason Reifler. 2021. "Overconfidence in news judgments is associated with false news susceptibility." *Proceedings of the National Academy of Sciences* 118 (23): e2019527118.

Montgomery, Jacob M., Brendan Nyhan, and Michelle Torres. 2018. "How Conditioning on Posttreatment Variables Can Ruin Your Experiment and What to Do about It." *American Journal of Political Science* 62 (3): 760–775.

Muenks, Katherine, Allan Wigfield, Ji Seung Yang, and Colleen R O'Neal. 2017. "How true is grit? Assessing its relations to high school and college students' personality characteristics, self-regulation, engagement, and achievement." *Journal of Educational Psychology* 109 (5): 599.

Nie, Norman H., Jane Junn, and Kenneth Stehlik-Barry. 1996. *Education and Democratic Citizenship in America*. Chicago: University of Chicago Press.

Nye, Barbara A, Larry V Hedges, and Spyros Konstantopoulos. 2000. "Do the disadvantaged benefit more from small classes? Evidence from the Tennessee class size experiment." *American journal of education* 109 (1): 1–26.

Nygren, Thomas, and Evgenia Efimova. 2025. "Investigating the Long-Term Impact of Misinformation Interventions in Upper Secondary Education." *PLOS ONE* 20 (7): e0326928.

Orosz, Gábor, Laura Faragó, Benedek Paskuj, and Péter Krekó. 2024. "Strategies to Combat Misinformation: Enduring Effects of a 15-Minute Online Intervention on Critical-Thinking Adolescents." *Computers in Human Behavior* 159: 108338.

Pingree, Raymond J. 2011. "Effects of Unresolved Factual Disputes in the News on Epistemic Political Efficacy." *Journal of Communication* 61 (February): 22–47.

Plutzer, Eric. 2002. "Becoming a Habitual Voter: Inertia, Resources, and Growth in Young Adulthood." *American Political Science Review* 96 (1): 41–56.

Poushter, Jacob, Maria Smerkovich, Moira Fagan, and Andrew Prozorovsky. 2025. Widespread global public concern about made-up news. Technical report Pew Research Center.

Prior, Markus. 2005. "News vs. Entertainment: How Increasing Media Choice Widens Gaps in Political Knowledge and Turnout." *American Journal of Political Science* 49 (3): 577–592.

Prior, Markus. 2010. "You've Either Got It or You Don't? The Stability of Political Interest over the Life Cycle." *Journal of Politics* 72 (3): 747–766.

Prior, Markus. 2018. *Hooked: How Politics Captures People's Interest*. Cambridge University Press.

Santos, Indhira, Violeta Petroska-Beska, Pedro Carneiro, Lauren Eskreis-Winkler, Ana Maria Munoz Boudet, Ines Berniell, Christian Krekel, Omar Arias, and Angela Lee Duckworth. 2022. Can grit be taught? Lessons from a nationwide field experiment with middle-school students. Technical report IZA Discussion Papers.

Save the Children España. 2024. Derechos #Sinconexion: Un análisis sobre derechos de la infancia y la adolescencia y su protección en el entorno digital. Technical report Save the Children España.
URL: *https://www.savethechildren.es/sites/default/files/2024-07/Informe*$_{D}erechos_{S}inConexion.pdf$

Schulz, Wolfram, John Ainley, Julian Fraillon, Bruno Losito, Gabriella Agrusti, Damiani Valeria, and Tim Friedman. 2023. "Education for citizenship in times of global challenge. IEA International Civic and Citizenship Education Study 2022 international report.".

Sears, David O, and Nicholas A Valentino. 1997. "Politics matters: Political events as catalysts for preadult socialization." *American Political Science Review* 91 (1): 45–65.

Sinclair, Betsy. 2012. *The Social Citizen*. Chicago, IL: University of Chicago Press.

Sisk, Victoria F, Alexander P Burgoyne, Jingze Sun, Jennifer L Butler, and Brooke N Macnamara. 2018. "To what extent and under which circumstances are growth mind-sets important to academic achievement? Two meta-analyses." *Psychological science* 29 (4): 549–571.

Somin, Ilya. 2013. *Democracy and Political Ignorance: Why Smaller Government Is Smarter*. Stanford, CA: Stanford Law Books, Stanford University Press.

Starostin, Magdalena. 2025. Eurobarometer YOUTH SURVEY 2024. Technical report European Parliament. Accessed: 2025-05-05.

Steenbergen-Hu, Saiying, Matthew C Makel, and Paula Olszewski-Kubilius. 2016. "What one hundred years of research says about the effects of ability grouping and acceleration on K–12 students' academic achievement: Findings of two second-order meta-analyses." *Review of Educational Research* 86 (4): 849–899.

Stoker, Laura, and Jackman Bass. 2011. "Political Socialization: Ongoing Questions and New Directions." In *The Oxford Handbook of American Public Opinion and the Media*, ed. George C. Edwards III, Lawrence R. Jacobs, and Robert Y. Shapiro. Oxford, UK: Oxford University Press.

Tamboer, Sanne L., Anne Vlaanderen, Kirsten E. Bevelander, and Mariska Kleemans. 2024. "Do You Know What Fake News Is? An Exploration of and Intervention to Increase Youth's Fake News Literacy." *Youth & Society* 56 (4): 774–792.

Traylor, Frederic. 2025. "The threat of AI chatbot responses to crowdsourced open-ended survey questions." *Energy Research Social Science* 119: 103857.

Twenge, Jean M., Gabrielle N. Martin, and Brian H. Spitzberg. 2019. "Trends in U.S. Adolescents' Media Use, 1976–2016: The Rise of Digital Media, the Decline of TV, and the (Near) Demise of Print." *Psychology of Popular Media Culture* 8 (October): 329–345.

Van Iddekinge, Chad H, John D Arnold, Sara J Krivacek, Rachel E Frieder, and Philip L Roth. 2024. "Making the grade? A meta-analysis of academic performance as a predictor of work performance and turnover." *Journal of Applied Psychology*.

Verba, Sidney, Kay Lehman Schlozman, and Henry Brady. 1995. *Voice and Equality: Civic Voluntarism in American Politics*. Cambridge, MA: Harvard University Press.

Zhang, Simone, Janet Xu, and AJ Alvero. 2025. "Generative AI Meets Open-Ended Survey Responses: Research Participant Use of AI and Homogenization." *Sociological Methods & Research* 54 (3): 1197–1242.

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Online Appendix A: Tables and figures

Figure A.1: Digital literacy skills treatment (translated)

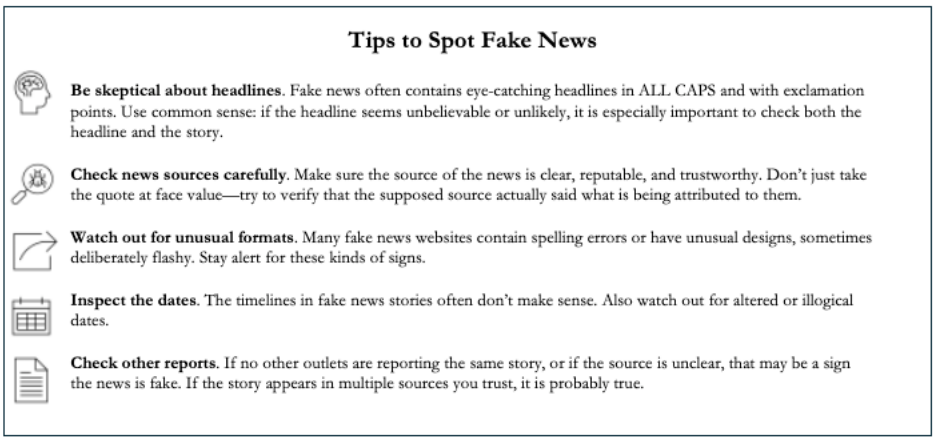
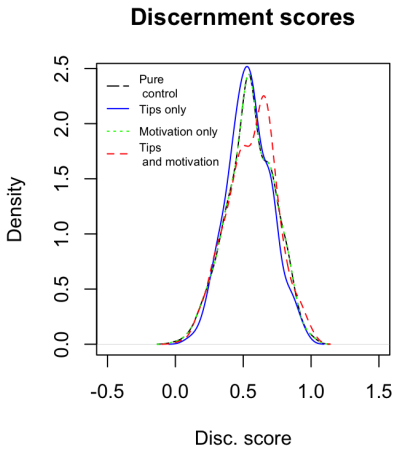
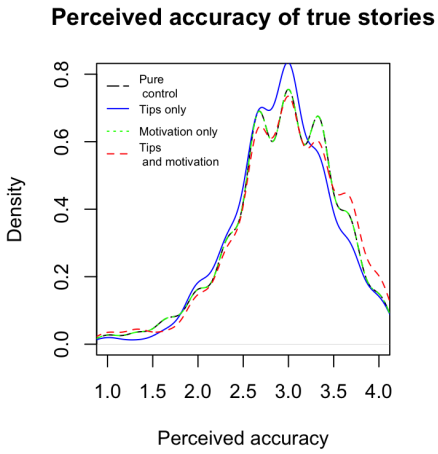


Figure A.2: Distribution of outcome variables by treatment group

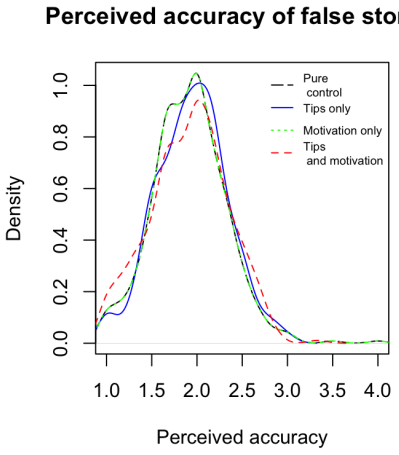
(a) Discernment score



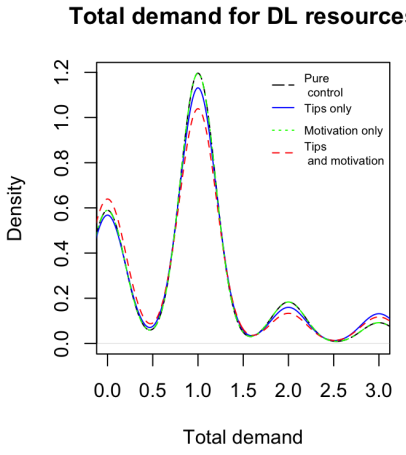
(b) Perceived accuracy of true news stories



(c) Perceived accuracy of false news stories



(d) Total demand for digital literacy resources



Note: Pure control is the treatment arm that receives neither tips nor motivation primes. In (D), total demand for digital literacy resources is the discrete count of the number of resources demanded out of three offered.

Table A.1: Sample characteristics

Commercial panel	Netquest
Field dates	10 March - 5 May 2025
Sample size	1803
Age	min - 14 mean - 17.6 max - 18
Sex	female - 58.8% male - 40.6%
Educational status	not enrolled - 2.6% mandatory secondary - 21.3% vocational - 26.9% bachillerato - 33.5% university - 15.7%
Political ideology (1–10)	mean - 5.18

Note: Sample size includes respondents who reached the experimental portion of the survey ("motivational treatment" in Figure 4).

Table A.2: OLS models predicting overconfidence in discernment ability

	(1) Is overconfident	(2) Percent overconfident
Female	0.001	0.92
	(0.04)	(2.53)
Not very interested in pol.	0.04	6.56*
	(0.05)	(3.23)
Pretty interested in pol.	0.05	6.29
	(0.05)	(3.76)
Very interested in pol.	0.11	12.23*
	(0.07)	(4.74)
Social media news use	−0.02	0.35
	(0.01)	(0.95)
Grit	0.05	3.81
	(0.03)	(1.95)
Interest in school	−0.01	−0.03
	(0.02)	(1.62)
GPA	0.06*	4.05
	(0.03)	(2.21)
Left-wing	−0.03	−3.05
	(0.05)	(3.15)
Right-wing	0.02	1.28
	(0.05)	(3.28)
Sumar (far left) supporter	−0.09	−4.60
	(0.09)	(6.32)
PSOE (center left) supporter	−0.07	−2.43
	(0.05)	(3.66)
PP (center right) supporter	−0.13	−6.41
	(0.06)	(4.50)
Vox (far right) supporter	−0.06	−2.11
	(0.05)	(3.61)
Constant	0.05	−25.96
	(0.45)	(31.18)
Preregistered controls	✓	✓
Sample	Controls (no tips)	Controls (no tips)
N	782	782

Note: Cell entries are OLS coefficients with clustered standard errors in parentheses. Preregistered controls include age and educational status. Significance levels: $^{***}p < .001$, $^{**}p < .01$, $^{*}p < .05$.

Table A.3: Effects of skills treatment on discernment by subgroup

	(1)	(2)	(3)	(4)	(5)
Tips treatment	0.05	0.03	0.18	0.19	−0.05
	(0.03)	(0.10)	(0.18)	(0.16)	(0.07)
Pol. knowledge		0.06**			
		(0.02)			
Tips × Pol. knowledge		0.01			
		(0.03)			
Grit			0.002		
			(0.04)		
Tips × Grit			−0.04		
			(0.06)		
Interest in pol.				0.04	
				(0.03)	
Tips × Interest in pol.				−0.04	
				(0.04)	
GPA					−0.03
					(0.04)
Tips × GPA					0.10
					(0.06)
Observations	1,506	1,478	1,505	1,505	1,506
R^2	0.001	0.01	0.002	0.003	0.003
Note:					*p<0.05; **p<0.01; ***p<0.001

Table A.4: Effects of skills and motivation treatment on discernment by subgroup

	High Grit	Low Grit	High Interest	Low Interest	High GPA	Low GPA
Tips treatment	0.002	-0.096	-0.001	-0.082	0.037	-0.108
	(0.065)	(0.074)	(0.072)	(0.067)	(0.071)	(0.067)
Motivational prime	-0.049	-0.166^{**}	0.019	-0.221^{***}	-0.111^{*}	-0.096
	(0.060)	(0.067)	(0.065)	(0.062)	(0.065)	(0.062)
Tips × Motivation	0.073	0.321^{***}	0.085	0.295^{***}	0.178^{*}	0.200^{**}
	(0.091)	(0.104)	(0.100)	(0.095)	(0.099)	(0.095)
Constant	0.986^{***}	1.081^{***}	0.983^{***}	1.073^{***}	1.003^{***}	1.052^{***}
	(0.040)	(0.046)	(0.045)	(0.041)	(0.045)	(0.041)
Observations	778	727	707	798	662	844
R^2	0.002	0.016	0.004	0.019	0.016	0.005

Note: Divides low- and high- levels of each moderator at their median sample value. *p<0.05; **p<0.01; ***p<0.001

Table A.5: Effect of motivational prime on total demand for resources, by subgroup

	(1)	(2)	(3)	(4)	(5)
Motivational prime	-0.128^{***}	-0.197	-0.248	-0.084	-0.178^{*}
	(0.036)	(0.109)	(0.191)	(0.170)	(0.075)
Know score		0.009			
		(0.024)			
Motivational prime × Know score		0.023			
		(0.033)			
Grit score			0.039		
			(0.042)		
Motivational prime × Grit score			0.038		
			(0.058)		
Interest in politics				0.078^{*}	
				(0.033)	
Motivational prime × Interest in politics				-0.012	
				(0.046)	
GPA score					-0.058
					(0.048)
Motivational prime × GPA score					0.053
					(0.068)
Constant	0.896^{***}	0.871^{***}	0.768^{***}	0.614^{***}	0.952^{***}
	(0.026)	(0.077)	(0.139)	(0.121)	(0.053)
Observations	1803	1762	1802	1802	1802
R^2	0.007	0.008	0.009	0.012	0.011

Notes: Standard errors in parentheses. $^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$.

Table A.6: Manipulation checks: effects of each motivational prime on perceived threats

	(1) Threat index	(2) Threat to me personally	(3) Threat to democracy	(4) Misinfo dangerous	(5) Misinfo serious problem
Motivational prime (any)	0.10**	0.08	0.09	0.12**	0.10*
	(0.03)	(0.05)	(0.05)	(0.04)	(0.04)
Constant	4.12***	3.70***	4.08***	4.49***	4.22***
	(0.02)	(0.03)	(0.03)	(0.03)	(0.03)
N	1652	1644	1647	1640	1648
Public threats prime	0.12**	0.12*	0.16**	0.11*	0.07
	(0.04)	(0.06)	(0.05)	(0.05)	(0.05)
Constant	4.12***	3.70***	4.08***	4.49***	4.22***
	(0.02)	(0.03)	(0.03)	(0.03)	(0.03)
Private threats prime	0.04	−0.04	0.02	0.11	0.08
	(0.05)	(0.07)	(0.07)	(0.06)	(0.06)
Constant	4.12***	3.70***	4.08***	4.49***	4.22***
	(0.02)	(0.03)	(0.03)	(0.03)	(0.03)
N	1118	1111	1113	1109	1115
In-group threats prime	0.21**	0.29**	0.02	0.26**	0.28**
	(0.07)	(0.10)	(0.10)	(0.09)	(0.09)
Constant	4.12***	3.70***	4.08***	4.49***	4.22***
	(0.02)	(0.03)	(0.03)	(0.03)	(0.03)
N	994	987	989	988	991

Note: Cell entries are OLS coefficients with clustered standard errors in parentheses. Each panel presents results from different regressions. Significance levels: $^{***}p < .001$, $^{**}p < .01$, $^{*}p < .05$.

Table A.7: Effect of skills-based training on belief in true claims

	(1) Pooled	(2) Agricultural protests	(3) Narco deaths	(4) Goat rescued
Tips treatment	0.06	0.04	0.10*	0.03
	(0.03)	(0.04)	(0.04)	(0.04)
Constant	2.90***	2.56***	3.09***	3.06***
	(0.02)	(0.03)	(0.03)	(0.03)
N	1506	1502	1499	1502

Note: Cell entries are OLS coefficients with standard errors in parentheses. Pooled model is the same as reported in Table 1. Significance levels: $^{***}p < .001$, $^{**}p < .01$, $^{*}p < .05$.

Table A.8: Effect of skills-based training on belief in false claims

	(1) Pooled	(2) Catalan amnesty	(3) Palestine protesters	(4) Climate lockdowns	(5) Vaccines/ autism	(6) Immigrant housing	(7) Official complaints
Tips treatment	0.002	−0.02	−0.09*	0.03	0.07	0.04	0.01
	(0.02)	(0.03)	(0.04)	(0.04)	(0.04)	(0.05)	(0.04)
Constant	1.92***	1.40***	1.64***	2.39***	1.82***	2.32***	1.93***
	(0.01)	(0.02)	(0.03)	(0.03)	(0.03)	(0.03)	(0.02)
N	1508	1500	1502	1501	1498	1503	1500

Note: Cell entries are OLS coefficients with standard errors in parentheses. Pooled model is the same as reported in Table 1. Significance levels: $^{***}p < .001$, $^{**}p < .01$, $^{*}p < .05$.

Table A.9: Effects of skills-based and motivational treatments on belief in true claims (H2)

	(1) Pooled (all T claims)	(2) Agricultural protests	(3) Narco deaths	(4) Goat rescue
Tips treatment	-0.01	-0.04	0.04	-0.03
	(0.04)	(0.06)	(0.06)	(0.06)
Motivational prime	-0.09^{*}	-0.05	-0.11^{*}	-0.09
	(0.04)	(0.06)	(0.05)	(0.06)
Tips $\times$ prime	0.14^{*}	0.16	0.13	0.12
	(0.06)	(0.09)	(0.08)	(0.09)
Constant	2.94^{***}	2.58^{***}	3.14^{***}	3.10^{***}
	(0.03)	(0.04)	(0.04)	(0.04)
N	1506	1502	1499	1502

Note: Cell entries are OLS coefficients with clustered standard errors in parentheses. Significance levels: $^{***}p < .001$, $^{**}p < .01$, $^{*}p < .05$.

Table A.10: Effects of skills-based and motivational treatments on belief in false claims (H2)

	(1) Pooled (all F claims)	(2) Catalan amnesty	(3) Palestine protesters	(4) Climate lockdowns	(5) Vaccines/ autism	(6) Immigrant housing	(7) Official complaints
Tips treatment	0.02	0.04	−0.10	0.07	0.08	0.03	0.06
	(0.03)	(0.04)	(0.06)	(0.06)	(0.06)	(0.07)	(0.05)
Motivational prime	0.01	0.10*	−0.05	0.07	−0.02	−0.03	0.04
	(0.03)	(0.04)	(0.05)	(0.06)	(0.05)	(0.06)	(0.05)
Tips × prime	−0.04	−0.13*	0.03	−0.09	−0.02	0.02	−0.11
	(0.04)	(0.06)	(0.08)	(0.08)	(0.08)	(0.09)	(0.07)
Constant	1.92***	1.36***	1.67***	2.36***	1.83***	2.33***	1.92***
	(0.02)	(0.03)	(0.04)	(0.04)	(0.04)	(0.04)	(0.03)
N	1508	1500	1502	1501	1498	1503	1500

Note: Cell entries are OLS coefficients with clustered standard errors in parentheses. Significance levels: $^{***}p < .001$, $^{**}p < .01$, $^{*}p < .05$.

Table A.11: Tips and motivation treatments on discernment scores

	(1) Any prime	(2) Public prime	(3) Private prime	(4) In group prime
Tips	-0.04	-0.04	-0.04	-0.04
	(0.05)	(0.05)	(0.05)	(0.05)
Motivation treatment	-0.11^{*}	-0.09	-0.14^{*}	-0.08
	(0.05)	(0.06)	(0.07)	(0.10)
Tips $\times$ Motivation	0.19^{**}	0.19^{*}	0.17	0.23
	(0.07)	(0.08)	(0.10)	(0.14)
Constant	1.03^{***}	1.03^{***}	1.03^{***}	1.03^{***}
	(0.03)	(0.03)	(0.03)	(0.03)
Observations	1,506	1,171	983	878
R^2	0.01	0.01	0.00	0.00

Notes: Clustered standard errors in parentheses. $^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$.

Table A.12: Effect of motivational prime on demand for digital literacy resources, among those with no exposure to skills treatment (H3)

	(1) Total demand	(2) Demand: DL tips	(3) Demand: list of FCs	(4) Demand: free course
Any motivational prime (pooled effects)	0.06	0.10^{**}	-0.03	-0.02
	(0.05)	(0.03)	(0.03)	(0.03)
Public risk prime	0.10	0.08	0.02	0.005
	(0.06)	(0.04)	(0.03)	(0.03)
Private risk prime	0.04	0.14^{**}	-0.07	-0.02
	(0.08)	(0.05)	(0.04)	(0.04)
In-group risk prime	-0.06	0.13	-0.10	-0.09
	(0.10)	(0.07)	(0.06)	(0.05)
Constant	0.90^{***}	0.51^{***}	0.21^{***}	0.17^{***}
	(0.03)	(0.02)	(0.01)	(0.01)
N	1697	1697	1697	1697

Note: Total demand is the number of resources demanded (maximum value is 3). Cell entries are OLS coefficients with clustered standard errors in parentheses. Significance levels: $^{***}p < .001$, $^{**}p < .01$, $^{*}p < .05$.

Online Appendix B: Discernment tasks

This appendix displays the news items used to measure fake news discernment. As described in the main text, respondents evaluated nine news items (three true and six false) in random order.

On the following pages, we will show you a series of posts that have recently appeared online. Naturally, some online content is more reliable than others. We are interested in knowing how reliable you find each piece of content.

— page break —

[Note: order of the following 9 posts is randomized with a page break after each]

La Guardia Civil bloquea a los tractores y les impide circular por la A-3

Los agricultores valencianos colapsan las carreteras para reivindicar sus derechos

Circulación por la A-3 este martes 6 de febrero.

How reliable is this post?

-Completely reliable
-Very reliable
-Not very reliable
-Not reliable at all

[True story - from https://www.lasprovincias.es/valencia-ciudad/guardia-civil-bloquea-tractores-impide-circular-20240206090305-nt.html?ref=https%3A%2F%2Fwww.lasprovincias.es%2Fvalencia-ciudad%2Fguardia-civil-bloquea-tractores-impide-circular-20240206090305-nt.html]

— page break —

EL MUNDO

Menú

CÁDIZ

Muere un narcotraficante durante una persecución de la Guardia Civil a una narcolancha en la desembocadura del Guadalquivir

Es el segundo fallecido en febrero, ya que el pasado día 7 una colisión en aguas de Tarifa entre una patrullera del de la Guardia Civil y una embarcación de recreo que transportaba fardos de hachís también se saldó con la muerte de uno de los tripulantes

La patrullera de la Guardia Civil Río Tiétar, en una imagen en otra actuación.

Otra persecución a una narcolancha en el Estrecho acaba con un traficante muerto y otro herido

Marlaska saca pecho en la cumbre europea contra el crimen organizado en Cádiz: Los narcos están "acorralados"

CHEMA RODRÍGUEZ | SEVILLA

18/02/2025 10:10

How reliable is this post?

-Completely reliable
-Very reliable
-Not very reliable
-Not reliable at all

[True story - from https://www.elmundo.es/andalucia/2025/02/18/67b44e7621efa087518b4598.html]

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EL PAÍS SUSCRÍBETE

SUCESOS INSÓLITOS >

Rescatada una cabra de la ventana de un quinto piso en Madrid: "Ya está, lista, la tenemos"

La Policía Municipal busca ahora al dueño del animal, ya que en el inmueble del distrito de Villaverde donde estaba "hace tiempo que no vive nadie" y ningún vecino sabe ni de quién es ni cómo llegó hasta allí

La cabra, que ha resultado ser un macho adulto de cabra enana, en el poyete de la ventana.
Vídeo: BOMBEROS MADRID

How reliable is this post?

-Completely reliable
-Very reliable
-Not very reliable
-Not reliable at all

[True story - from https://elpais.com/espana/madrid/2025-02-19/rescatada-una-cabra-de-la-ventana-de-un-quinto-piso-en-el-distrito-madrileno-de-villaverde.html]

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How reliable is this post?

-Completely reliable
-Very reliable
-Not very reliable
-Not reliable at all

[False claim - reported by Maldita (Spain) - https://maldita.es/malditobulo/20250922/comunicado-paises-europeos-amnistia-cortar-fondos-Espana/]

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How reliable is this post?

-Completely reliable
-Very reliable
-Not very reliable
-Not reliable at all

[False claim - reported by Deutsche Welle (Germany) - https://www.dw.com/en/fact-check-misleading-visuals-of-rafah-offensive-circulate-on-social-media/a-69217380]

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How reliable is this post?

-Completely reliable
-Very reliable
-Not very reliable
-Not reliable at all

[False claim - reported by Delfi (Lithuania) - https://www.delfi.lt/en/lie-detector/has-klaus-schwab-s-daughter-threatened-with-permanent-climate-restrictions-96211951]

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How reliable is this post?

-Completely reliable
-Very reliable
-Not very reliable
-Not reliable at all

[False claim - reported by Maldita (Spain) - https://maldita.es/malditobulo/20240503/bulo-mortalidad-vacuna-vrs-nirsevimab/]

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How reliable is this post?

-Completely reliable
-Very reliable
-Not very reliable
-Not reliable at all

[False claim - reported by El Diario (Spain) - https://www.eldiario.es/desalambre/cifras-contexto-confundirnos-comunidad-musulmana_1_1112563.html]

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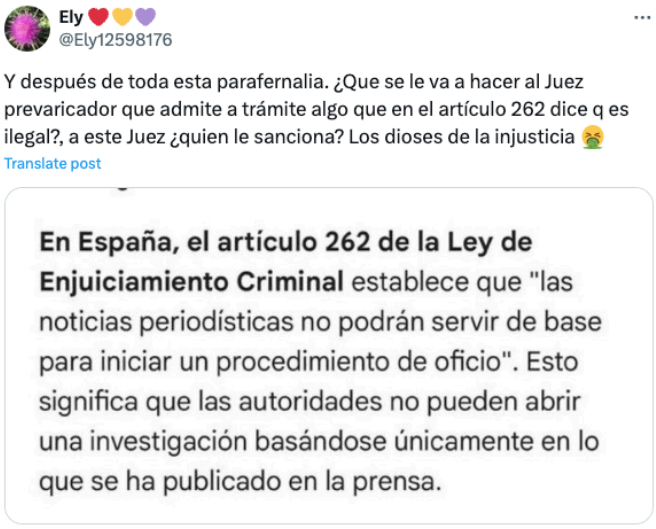

How reliable is this post?

-Completely reliable
-Very reliable
-Not very reliable
-Not reliable at all

[False claim - reported by Maldita (Spain) - https://maldita.es/malditobulo/20240426/ley-enjuiciamiento-criminal-publicaciones-periodisticas/]