Children's Differentiation of Fake News from Real News is Facilitated by Cognitive Reflection

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Abstract

Adults' ability to detect online misinformation is improved by cognitive reflection and targeted instruction. Is the same true for children? We explored this question by asking elementary-school-aged children (n = 135) to judge the veracity of news stories, some real and some fake, and comparing their performance to scores on the Cognitive Reflection Test, Developmental version (CRT-D). Participants were also administered a tutorial encouraging them to scrutinize the plausibility of a story's content or the credibility of its source. Children's differentiation of fake news from real news was correlated with their CRT-D scores but did not improve with instruction. A comparison group of adults (n = 117) demonstrated similar findings with the exception that source-based instruction improved their news differentiation. These findings suggest that the ability to detect online misinformation is aided by cognitive reflection from the start but could be improved with knowledge of news sources.

Keywords: cognitive development, cognitive reflection, evidential reasoning, news evaluation, media literacy

Introduction

Before the internet, the news landscape looked very different. News was disseminated by teams of professional reporters, editors, and fact checkers who systematically vetted the stories they published. Although professional journalists were not immune to mistakes or bias, they employed a set of standards that ensured that the news they reported was generally accurate. This assumption is no longer valid in the age of digital media. Anyone can post anything on the internet, and false posts can be shared as easily as true ones. Indeed, studies of information spread on social media have found that fake news, designed to deceive or mislead, spreads faster and farther than real news (Vosoughi et al., 2018).

The prevalence of false or misleading information on the internet forces internet users to grapple with the challenge of detecting it. This challenge is epistemically complex; it requires coordinating factual knowledge of events that have (or have not) happened, conceptual knowledge of events that are likely (or unlikely) to happen, and social knowledge of reliable (and unreliable) informants. Such epistemic demands can be burdensome for any internet user (van der Linden, 2023), but they are perhaps most burdensome for the internet's youngest users: elementary-school-aged children.

Most elementary schoolers in the US have regular access to the internet and routinely use the internet for both entertainment and education (Rideout & Robb, 2020). But children of this age have a limited understanding of what the internet is and how it works. Many think that information found on the internet is generally accurate (Girouard-Hallam et al., 2023) and that the credibility of a website can be gleaned from its appearance (Metzger et al., 2015). When searching for information online, they are largely indifferent to whether a website contains exaggerations or inaccuracies (Einav et al., 2020), often because they fail to register these errors. A national survey of elementary schoolers in the UK found that only 3% were able to identify which of six news stories were false (National Literacy Trust, 2018).

Older children's understanding of the internet is not much better. Many middle schoolers fail to recognize that some websites are hoaxes, such as websites on male pregnancy (Metzger et al., 2015) or the Pacific Northwest Tree Octopus (Loos et al., 2018), and most middle schoolers have trouble explaining why sponsored content from a bank might not provide objective financial advice or why statistics cited in the comments section of a news site should not be included in a research paper (McGrew et al., 2018). Most middle schoolers also have trouble discriminating news stories from other content posted online such as opinion pieces and sponsored advertisements (McGrew et al., 2018). Even high schoolers tend to evaluate the credibility of a source based solely on what the source has posted about itself (Wineburg et al., 2022).

In the present study, we explore children's susceptibility to online misinformation in the context of a controlled paradigm used to study adults' susceptibility: a fake news detection task, pioneered by Pennycook and Rand (2019). Participants in this task are shown a variety of news stories, some real and some fake, and asked to judge the veracity of each. Successful performance on this task varies with several factors, including partisan identity (Roozenbeek et al., 2022), social media habits (Ceylan et al., 2023), and aging (Brashier & Schacter, 2020). Two additional factors, potentially relevant to children, are reflection and instruction. Adults who exhibit higher levels of cognitive reflection, or the ability to identify and override erroneous intuitions, are better at discriminating fake news from real news (Batailler et al., 2022; Pehlivanoglu et al. 2021; Pennycook & Rand, 2019), as are adults instructed to focus on the accuracy of the stories they are reading (Martel et al., 2024; Panizza et al., 2023; Pennycook & Rand, 2022).

Here, we investigate how well children are able to differentiate fake news from real news and whether this ability is influenced by reflection and instruction. Children

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have less knowledge to apply to the challenge of detecting fake news, either content knowledge or source knowledge, but this deficit does not necessarily render them more credulous. Ample research indicates that children are naturally skeptical of dubious information (Woolley & Ghossainy, 2013) and dubious informants (Mills, 2013), and the current study explores whether, and how, that skepticism manifests itself in the context of online misinformation and in relation to children's emerging reflectiveness about their own cognition. Cognitively reflective children have been shown to prioritize analysis over intuition across a variety of reasoning tasks (Shtulman & Young, 2023), and such skills may aid children in differentiating plausible news stories from implausible ones as well as credible news sources from noncredible ones.

Our study is the first to explore elementary school-aged children's differentiation of fake news from real news. We designed trainings appropriate for this age group (described below) as well as assessment materials. For the latter, we identified news stories that circulated on the internet whose truth would be challenging to discern but whose content was neither too complex nor too mature for use with children. Whereas adult studies of fake news detection have typically used political stories (following Pennycook & Rand, 2019), we used stories that covered child-friendly topics such as food, weather, animals, vehicles, and social customs.

To assess the overall discriminability of our fake stories from our real stories, we tested adults alongside children. We expected, in light of previous studies, that adults' discriminations would correlate with individual differences in cognitive reflection and would improve with instruction, but it was an open question how well children would discriminate real news from fake news and whether that discrimination would track the same variables.

Method

Participants

The participants were 135 children between the ages of 4 and 12 (*M* age = 8.1, *SD* = 2.3), and 117 adults. Child participants were recruited from public parks in the Los Angeles area and tested onsite using iPads. We targeted children old enough to complete our measures of cognitive reflection but not so old as to have entered middle school. Adult participants were recruited from psychology courses and compensated with course credit. They were not asked to provide any demographic information. Adults completed all tasks in the form of an online survey.

Procedure

The first task that all participants completed was the Cognitive Reflection Test, Developmental version or CRT-D (Young & Shtulman, 2020). The CRT-D consists of nine brainteasers appropriate for children as young as four. A sample question is "What do cows drink?", which elicits the intuitive response of "milk." This response can be identified as wrong with reflection on the fact that cows produce milk but do not drink it; they drink water. Children's scores on the CRT-D predict several measures of rational thought, such as privileging evidence over anecdotes, selecting favorable outcomes by probability rather than frequency, and drawing inferences from counterintuitive premises. They also predict domain-specific cognitive abilities, such as scientific reasoning, mathematical reasoning, and science learning (see Shtulman & Young, 2023, for a review).

Adults also completed the CRT-D. Even though adults perform substantially better on the CRT-D than children, they still exhibit robust variability, and this variability correlates with other measures of cognitive reflection, including the original CRT and expanded versions of the CRT (Gong et al., 2021). Adult CRT-D scores also correlate with adult performance on tests of rational thought and normative thinking dispositions (Gong et al., 2021).

The nine items of the CRT-D were presented in random order, and participants were scored on the number of items answered correctly. Consistent with prior research (Young & Shtulman, 2020), children answered an average of 3.0 items correctly (*SD* = 2.2), and scores were strongly correlated with age in months ($r = .61$, $p < .001$). Adults answered an average of 7.7 items correctly (*SD* = 1.4), and most (62%) answered fewer than nine correctly.

Following the CRT-D, participants evaluated the truth of 24 news stories, 12 real and 12 fake. Children's evaluations were elicited with two questions. First, they were asked whether the story was true or false. Second, they were asked whether the story was "definitely" true/false or "probably" true/false. Together, these questions comprised a four-point rating scale, ranging from "definitely false" (scored 0) to "probably false" (1) to "probably true" (2) to "definitely true" (3). Adults rated each story using the same scale, with all options presented at once.

The 24 news stories were broken into two blocks of 12 presented before and after a brief training on how to evaluate the veracity of a news story. Each block contained six real stories and six fake stories, and the blocks were counterbalanced across participants so that the block that served as pretest for half the participants served as posttest for the other half. The stories within each block were presented in a random order.

Materials

All news stories were culled from Snopes.com, a fact-checking website. Snopes investigates questionable stories that circulate on the internet and determines whether those stories are true or false. We searched Snopes's list of true stories for suitable exemplars of real news and its list of false stories for suitable exemplars of fake news. The stories' appearance on Snopes.com ensured that all stories were implausible enough to raise suspicion but not so implausible as to be dismissed out of hand. Most stories that appear on Snopes.com are political and thus unsuitable for children. We limited our selection to stories that children would be able to evaluate on the basis of general knowledge about familiar

topics, such as stories about unusual animals, unusual technology, or unusual events.

The stories were presented as they would appear on social media: a headline, an image, a brief summary, and a URL source, as depicted in Figure 1. Most stories were presented as they had originally appeared on the internet, but some were slightly edited to fit the chosen format. Stories that lacked a summary were supplemented with text from the main body, and stories that lacked an image were supplemented with a generic image related to that topic. Stories were also selected from different sources to prevent the possibility that participants' evaluation of a story could have been influenced by their evaluation of other stories from the same source.

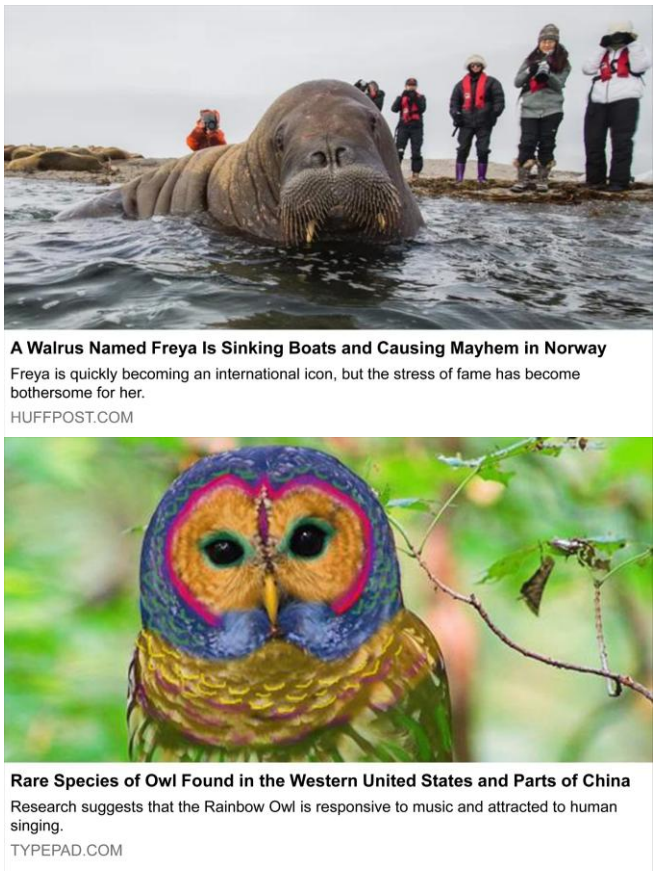

Figure 1: Example of a real news story (top) and a fake news story (bottom).

Sandwiched between two blocks of stories was a training. The training focused on either the plausibility of a story's content or the credibility of its source. The content training encouraged participants to ask themselves whether the story makes sense given what they know about the topic and whether it makes sense given what they know about the world in general. The source training encouraged participants to ask themselves whether the story comes from a professional news organization and, if they cannot tell, whether it is reported neutrally and objectively.

Each strategy was modeled with two examples of fake news: a story titled "California newborn becomes first baby to be named an emoji: Her name is [heart-eyes][heart-eyes][heart-eyes]" from prettycoolsite.com and a story titled "Man hospitalized after his apple airpods exploded in his ear" from huzlers.com. Trainings took approximately five minutes to complete. Children were led through the training by an experimenter; adults read through the training on their own. All assessment materials and training materials are available on the Open Science Framework (tinyurl.com/mv8x3fth); all data and analyses are also available at this site.

Results

Truth Ratings

Participants' mean truth ratings are displayed in Figure 2. Participants in both age groups reliably discriminated fake news from real news at both assessment periods, though adults discriminated fake news from real news more successfully than children, especially at posttest following the source training.

We used repeated-measures ANOVAs to analyze participants' truth ratings for effects of news type (fake vs. real), training type (content vs. source), and assessment period (pretest vs. posttest). Adults' ratings varied by all three factors: news type ($F(1, 115) = 797.36$, $p < .001$, $\eta^2_p = .87$), training type ($F(1, 115) = 6.23$, $p = .014$, $\eta^2_p = .05$), and assessment period ($F(1, 115) = 18.28$, $p < .001$, $\eta^2_p = .14$). These effects were qualified by two-way interactions between news type and training type ($F(1, 115) = 5.59$, $p = .020$, $\eta^2_p = .05$), news type and assessment period ($F(1, 115) = 8.90$, $p = .003$, $\eta^2_p = .07$), and training type and assessment period ($F(1, 115) = 21.20$, $p < .001$, $\eta^2_p = .16$), as well as a three-way interaction among all variables ($F(1, 115) = 23.29$, $p < .001$, $\eta^2_p = .17$). We explored these interactions with separate ANOVAs for each training type.

Adults who received the content training exhibited main effects of news type ($F(1, 55) = 331.58$, $p < .001$, $\eta^2_p = .86$) and assessment period ($F(1, 55) = 35.68$, $p < .001$, $\eta^2_p = .39$) but no interaction between them. They rated real news as more true than fake news at both pretest and posttest yet rated both types of news as less true at posttest. In other words, content training increased adults' skepticism toward all news without improving their differentiation of fake news from real news.

A different pattern emerged for adults who received the source training. They exhibited a main effect of news type ($F(1, 60) = 475.23$, $p < .001$, $\eta^2_p = .89$), as they judged real news as more true than fake news, but no main effect of assessment period ($F(1, 60) = 0.06$, $p = .807$, $\eta^2_p = .001$). However, assessment period interacted with news type ($F(1, 60) = 24.86$, $p < .001$, $\eta^2_p = .29$) because adults' differentiation of fake news real fake news increased from pretest to posttest. They judged real news as more true at posttest and fake news as less true at posttest—the desired outcome of a media literacy intervention.

Similar to adults, children exhibited main effects of news type ($F(1, 133) = 81.60$, $p < .001$, $\eta^2_p = .38$) and assessment period ($F(1, 133) = 19.74$, $p < .001$, $\eta^2_p = .13$), but unlike

adults, they exhibited no main effect of training type ($F(1, 133) = 1.72$, $p = .19$, $\eta^2_p = .01$) and no interactions with training type. Children judged real news as more true than fake news, but they judged both types of news as less true at posttest. News type did not interact with assessment period ($F(1, 133) = 1.11$, $p = .29$, $\eta^2_p = .01$), indicating that children's differentiation of fake news from real news remained consistent even as they judged both types of news as less true at posttest. Children's increased skepticism from pretest to posttest was observed for both the content training (main effect of assessment period: $F(1, 82) = 23.92$, $p < .001$, $\eta^2_p = .23$) and the source training (main effect of assessment period: $F(1, 51) = 3.79$, $p = .057$, $\eta^2_p = .07$), though the latter effect was marginal.

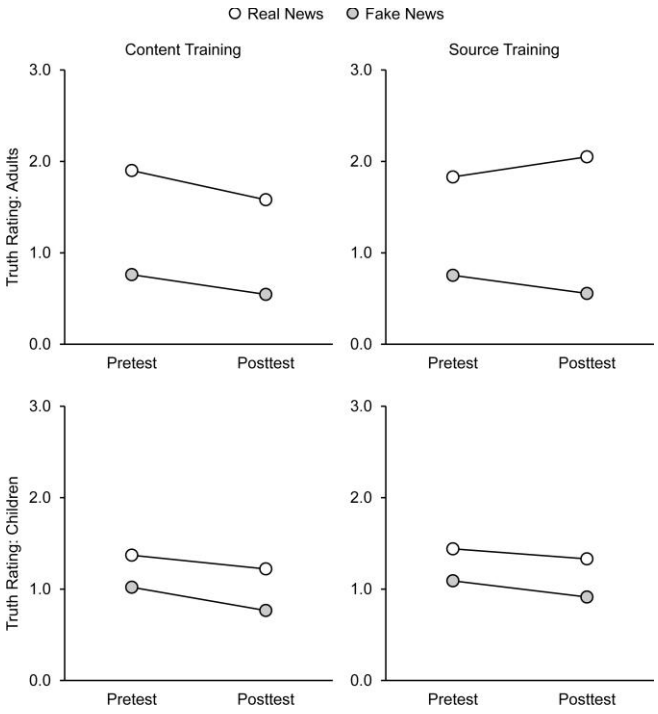

Figure 2: Mean truth ratings for real and fake news before and after training; all $SE < .1$.

Predictors of News Differentiation

Collectively, participants in each age group differentiated fake news from real news, but did this ability vary with cognitive reflection? We addressed this question by computing a news differentiation score for each participant at each assessment period, subtracting a participant's average truth rating for fake stories from their average truth rating for real stories. The highest score achievable on this measure was 3.0 if every real story was rated "definitely true" and every fake story "definitely false." On average, adults achieved a differentiation score of 1.1 at pretest ($SD = 0.5$) and 1.3 at posttest ($SD = 0.6$); children achieved a differentiation score of 0.4 at pretest ($SD = 0.7$) and 0.4 at posttest ($SD = 0.6$).

Correlations between news differentiation scores and CRT-D scores are presented in Table 1. At pretest, CRT-D scores correlated with news differentiation scores for participants in both age groups and in both training conditions. At posttest, these correlations remained significant only for children. The loss of predictive power for adults suggests that training nullified differences in adults' preexisting strategies for evaluating the news, either for better (in the case of source training, where overall accuracy increased) or for worse (in the case of content training, where overall accuracy decreased).

Table 1: Correlations between CRT-D scores and news differentiation scores. $*p < .05$, $**p < .01$, $***p < .001$

Age group	Training	Pretest	Posttest
Adults	Content	.30*	.09
	Source	.30*	.21
Children	Content	.30**	.34**
	Source	.30*	.57***

As noted earlier, children's CRT-D scores were strongly correlated with their age ($r = .61$, $p < .001$), raising the possibility that age rather than reflection drove children's ability to differentiate fake news from real news. Indeed, age was strongly correlated with children's differentiation scores at both pretest ($r = .34$, $p < .001$) and posttest ($r = .49$, $p < .001$). Partial correlations, controlling for age, revealed that the association between cognitive reflection and news differentiation remained significant at pretest ($r = .19$, $p = .024$) but not at posttest ($r = .08$, $p = .374$). Training thus appears to have nullified preexisting differences between highly reflective children and less reflective ones, similar to how training affected adults.

Closer inspection of the relation between age, cognitive reflection, and news differentiation revealed that age and cognitive reflection improved children's accuracy at judging fake news as false but not their accuracy at judging real news as true. Across the two assessment periods, age correlated with accuracy for real news ($r = .34$, $p < .001$) but not fake news ($r = .03$, $p = .738$), and cognitive reflection scores correlated with accuracy for real news ($r = .35$, $p < .001$) but not fake news ($r = .01$, $p = .945$). These correlations indicate that older children and cognitively reflective children were more adept at identifying signs of illegitimacy in a news story but were no more adept at identifying legitimate journalism.

Discussion

When children access the internet, they will encounter both real information and misinformation. Can they differentiate the two? Our findings suggest yes, at least to a moderate degree. The children in our study judged fake news as false more often than they judged real news as false, even though both types of news were surprising enough to merit fact-checking by an established fact checker (Snopes.com). Older children differentiated fake news from real news more reliably than younger children, and children who scored high on a test of cognitive reflection differentiated the two types

of news more reliably than those who scored low, even when controlling for age (prior to training).

Children were less successful than adults at differentiating fake news from real news, but the key difference between these groups lay in their judgments for real news, not fake news. Prior to training, fake stories were judged false 67% of the time by children and 83% of the time by adults (a difference of 16%), whereas real stories were judged true 35% of the time by children and 74% of the time by adults (a difference of 39%). Children and adults generally agreed that the fake stories were false but disagreed about whether the real stories were true.

This finding is surprising given the commonsense belief that children should be more susceptible to misinformation than adults. It is less surprising, however, when considering that the real stories used as stimuli were culled from the same fact-checking website as the fake stories, to ensure that all stories presented a comparable challenge. It is also less surprising in light of the consistent finding that children err on the side of skepticism rather than credulity when evaluating the possibility of expectation-defying events (see Shtulman, 2023, for a review).

That said, children's skepticism of all news raises the question of whether concerns about children's susceptibility to fake news are unfounded. Is it a problem that children err on the side of rejecting real news rather than accepting fake news? We would argue that it is because media literacy requires not just the detection of fake news but the differentiation of fake news from real news or, in the terminology of Pennycook and Rand (2019), "media truth discernment." Many of the children in our sample failed to show any such discernment, especially the youngest children. At pretest, 57% of four- to five-year-olds earned a differentiation score of zero or below, as did 50% of six- to seven-year-olds, 30% of eight- to nine-year-olds, and 14% of ten- to twelve-year-olds.

Lack of differentiation is potentially a problem because it implies that children's judgments are shallow, based on superficial impressions rather than reasoned considerations, and shallow judgments are more likely to be overridden by social pressure, such as how often a story has been liked, how often it has been shared, or whether it was shared by a trusted friend or authority. Children's lack of differentiation, relative to adults, may be why children appear particularly susceptible to misinformation in studies that have focused directly on children's understanding of websites and web content (e.g., Einav et al., 2020; Metzger et al., 2015). The youngest children in our study may not have fully understood the task, given their limited experience with social media or online news, and their differentiation of fake news from real news could potentially be improved with additional scaffolding or instruction. Still, the task was designed to emulate the everyday challenge of detecting misinformation in an online news feed, and children will encounter this challenge as soon as they become social media users themselves.

Consistent with the idea that children's skepticism reflects shallow judgments, children's ability to differentiate fake news from real news tracked their cognitive reflection scores, indicating that children who are inclined to privilege analysis over intuition are better at identifying the elements of a fake news story that signal its illegitimacy. This finding replicates the well-documented correspondence between cognitive reflection and fake news detection in adults (Pennycook & Rand, 2021)—a correspondence also documented in the current study using the CRT-D. Even though adults performed substantially better on the CRT-D than children, individual differences in CRT-D scores predicted individual differences in news differentiation in both age groups. Reflection may thus be a critical safeguard against misinformation across the lifespan.

In contrast to reflection, instruction did not aid children's differentiation of fake news from real news. Encouraging children to think more deeply about the plausibility of a story's content or the credibility of its source made children more skeptical of fake news but it also made them more skeptical of real news, yielding no overall improvement in the accuracy of their judgments. What kind of instruction, then, might boost children's discrimination of real and fake news?

Results from the adult participants suggest that source-based instruction may be more beneficial to pursue than content-based instruction. Adults encouraged to scrutinize source credibility demonstrated more accurate judgments at posttest, whereas adults encouraged to scrutinize content plausibility demonstrated less accurate judgments. The latter made gains in detecting fake news but those gains were offset by losses in real news detection—an outcome that has been observed for other content-based interventions as well (Modirrousta-Galian & Higham, 2023).

Content may not provide sufficient leverage for differentiating fake news from real news because the features that make fake news salient, such as evocativeness or controversiality, are the same features that make real events newsworthy. Source information, on the other hand, can provide critical insights into a story's origin, motivation, and production, and these factors are likely better indicators of accuracy than whether the story accords with prior knowledge. Arguably, even implausible stories should be believed if published by credible sources, i.e., sources that maintain rigorous standards for investigating and reporting their stories.

Presumably, the reason source training was effective for adults but not children is that children lack knowledge of how news is produced and by whom. Future research could attempt to bridge this gap with instruction about news production, though it is an open question whether children would benefit more from general information about journalistic standards or specific information about news outlets that maintain those standards. The latter may be more helpful when confronted with social-media-style posts that limit source information to a URL, but this approach would be contentious given the politics of today's media landscape (Gallup, 2018). Another approach is to highlight the unreliability of unreliable sources through guided exploration. This technique has been shown to increase

children's attentiveness to whether sources cite evidence (Orticio et al., 2024) and decrease their trust in sources that make blatantly false claims (Tong et al., 2025).

Whatever the approach, our results suggest that instruction may impact news evaluation above and beyond reflection, as the correspondence between CRT-D scores and news differentiation scores was reduced from pretest to posttest for both adults and children (at least when children's CRT-D scores were examined independent of age). Instruction has the potential to improve news evaluation in individuals who are not habitually reflective about whether a story can be trusted, but it could also derail news evaluation in individuals who are reflective if it focuses their reflection on considerations that do not reliably dissociate fake news from real news, as appeared to be the case for participants who received the content training. The specific features of a news story that facilitate accurate discrimination could be investigated in follow-up studies by asking participants to justify their judgments. Such justifications would shed light on why some children are able to make accurate judgments despite limited knowledge of news sources, as well as why some adults make less accurate judgments after receiving training on the plausibility of news content.

Conclusion

Children, like adults, are regularly on the internet and thus risk exposure to online misinformation. Our study indicates that children are not as skilled as adults at differentiating misinformation from real information but do have the capacity to do so, and this capacity is enhanced by a disposition to reflect on one's own cognition. Instructing children to scrutinize the plausibility of news content or the credibility of news sources increases their skepticism of online news but does not improve their discernment of news accuracy. Instructing adults to scrutinize the credibility of news sources does improve adults' discernment of news accuracy and may prove effective for children as well if accompanied by additional instruction on news production. Detecting misinformation is not the only skill that children need to protect themselves against digital manipulation, but it is a critical first step for engaging other tools in the toolkit that constitutes sound media literacy.

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