Fact-checking Instruction Strengthens the Association between Attitudes and Use of Lateral Reading Strategies in College Students

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Abstract

In today's politically polarized environment, college students need strategies to discern trustworthy information. Educational interventions have had modest success in teaching students to fact-check online information using lateral reading, i.e., leaving the original content to investigate information sources and claims. College students ($N = 157$, $M = 20.2$ years ($SD = 4.0$), 61.8% F) completed a semester-long online curriculum teaching fact-checking via lateral reading. Students made gains in their lateral reading attitudes (i.e., preference for fact-checking using lateral reading strategies) and use of lateral reading. Preference predicted use at posttest, but not at pretest. At posttest, preference also partially mediated the effect of reading comprehension on use. The majority of students mentioned cognitive and/or contextual factors when explaining how the Internet contributes to political polarization, though their awareness of such factors did not increase post-intervention.

Keywords: lateral reading; fact-checking; strategy use; educational intervention; Internet; polarization; algorithm

Introduction

United States' politics is heavily partisan and polarized (Deane & Gramlich, 2020). Ahead of the 2020 presidential election, 77% of Trump supporters surveyed by the Pew Research Center reported differing from Biden voters in their political priorities and core values (Pew Research Center, 2020b). Most Biden supporters (80%) felt similarly about Trump voters. van Baar and FeldmanHall (2021) proposed that processing of political information is influenced by interactions between contextual and cognitive factors, leading to polarized attitudes. Contextual factors pertain to individuals' information and social environments, including social media and dynamics in offline and online social groups. Cognitive factors include individuals' traits, needs, and beliefs.

This study sought to help college students think critically about some of the factors that contribute to polarized information processing. We focused on students' fact-checking of online information, especially on social media. We chose this approach because younger adults are more likely to use social media for their political news, compared to all adults (Pew Research Center, 2020a). College students also show limited understanding of how algorithms curate social media (Brodsky et al., 2020).

K–12 and college students are often taught to use checklist-based strategies for fact-checking, which involve closely examining online content for cues about its veracity (so-called "vertical reading"; Wineburg & McGrew, 2019). However, these strategies are time-consuming and poorly suited to today's online environment (Wineburg et al., 2020). Instead, professional fact-checkers "read laterally," meaning they leave the original content (i.e., by opening up new tabs) to research its source (i.e., organizations and people) and verify claims (Wineburg & McGrew, 2019).

Recent efforts to teach lateral reading indicate that students start with minimal use of such strategies, but make gains after direct instruction (e.g., Breakstone et al., 2021; Brodsky, Brooks, Scimeca, Galati et al., 2021; Brodsky, Brooks, Scimeca, Todorova et al., 2021, McGrew et al., 2019). Using a pre/posttest control-group design, Brodsky, Brooks, Scimeca, Todorova et al. (2021) found that college students who received a classroom-based fact-checking curriculum were more likely to read laterally and accurately assess the trustworthiness of online content at posttest than controls. However, on average, students who received the curriculum still only read laterally and accurately assessed one out of four posttest examples of online content. Similarly modest gains were found by Brodsky, Brooks, Scimeca, Galati et al. (2021) in their evaluation of an online, asynchronous curriculum teaching lateral reading strategies. In that study, lateral reading was taught using the SIFT acronym: Stop, Investigate the source, Find better coverage, and Trace content to the original context (Caulfield, 2019). Completion of instructional assignments and reading comprehension predicted use of lateral reading.

While gains in lateral reading seem modest, students may also have made gains in their attitudes towards lateral reading, i.e., their preference for using lateral reading strategies to fact-check online content. Behavioral change interventions suggest that increasing individuals' skill in performing a desired behavior is associated with changes in their attitudes towards that behavior (Steinmetz et al., 2016). Therefore, direct instruction and practice with

lateral reading may increase students' preference for fact-checking by reading laterally.

Fostering students' positive attitudes towards lateral reading strategies is important as these attitudes may in turn influence strategy use (Verplanken & Orbell, 2022). For example, according to the Theory of Planned Behavior, attitudes, as well as subjective norms and perceived behavioral control, influence intentions to engage in a behavior. This intention, along with actual control, in turn affects whether the behavior is performed (Ajzen, 2020). However, the extent to which individuals' attitudes and intentions predict their behaviors may vary based on their direct experience (e.g., practice) with the desired behavior (Glasman & Albaraccin, 2006; Sheeran et al., 2017).

Students' reading comprehension may also influence their ability to learn and implement lateral reading strategies (Brodsky, Brooks, Scimeca, Galati et al., 2021). Many students come to college with inadequate reading skills (NAEP, 2019). In keeping with the Multiple-Document Task-based Relevance Assessment and Content Extraction model (MD-TRACE), students with poor comprehension may struggle to form a "task model" for lateral reading, i.e., a mental representation of the task based on written instructions and feedback (Rouet & Britt, 2011). Even if struggling readers recognize that they should read laterally, they may then find it difficult to assemble and synthesize information from their lateral searches. However, the MD-TRACE model was developed to describe the process of reading multiple analog documents. Hence, it is unclear if this model appropriately characterizes the demands of processing information when reading online (Bråten et al., 2020; Wineburg et al., 2022).

Research Objectives

The current study examined the effects of direct instruction on students' attitudes toward lateral reading as a preferred strategy for evaluating online information. We also examined whether preference predicted lateral reading use and whether it mediated the effect of reading comprehension on use. We chose to use a pre/posttest design because, in our prior work using a control-group design, we had already established that changes in lateral reading were attributable to direct instruction via a fact-checking curriculum (Brodsky, Brooks, Scimeca, Todorova et al., 2021). Therefore, in the current study, it seemed unnecessary and unethical to withhold the curriculum from students enrolled for credit in a course.

Since 2018, our institution has participated in the Digital Polarization Initiative to teach college students strategies for fact-checking information in today's polarized online information environment (AASCU, 2018). The current study was conducted in a Spring 2021 general education civics course. At the start of the semester, national attention was focused on the controversial storming of the U.S. Capitol Building on January 6, 2021. Therefore, we also examined students' explanations of how features of the Internet contribute to political polarization.

Method

Participants

Learning outcomes assessment data were collected from students ($N = 157$, $M = 20.2$ years ($SD = 4.0$, $Range = 16$–43), 61.8% female) enrolled in eight online sections of a general education civics course taught at an open-admission public university (IRB classification: Exempt). Only students who completed both the pretest and posttest were included. About half (46.5%) were first-generation students (i.e., neither parent attended college); 41.4% were non-native English speakers. Students self-reported race/ethnicity using non-mutually exclusive categories: 35.0% White, 22.9% Hispanic/Latinx, 15.3% Asian/Asian American, 14.0% Black/African American, 9.6% Middle Eastern/North African, 5.7% Other, 1.9% Unknown; 2.6% did not disclose. Students' self-reported political identities (30.6% Democrat, 28.0% Unsure, 14.7% Independent, 4.5% Republican, and 7.0% Other; 15.3% did not disclose) suggested a slight liberal bias in the sample.

Online SIFT Curriculum

Students completed five online assignments over a 15-week semester: pretest (Week 1), three instructional assignments (Weeks 3, 7, 11) and posttest (Week 13). Instructional assignments used videos to teach students SIFT lateral reading strategies (Stop, Investigate the source, Find better coverage, and Trace content to the original context; Caulfield, 2019). Students then applied these strategies to fact-check content related to polarizing topics: how social media companies navigate issues related to free speech (including responses to the storming of the U.S. Capitol Building on January 6, 2021); citizenship status questions on the 2020 U.S. Census and immigration policy; and economic impact of the COVID-19 pandemic and vaccines. Students learned how to use Wikipedia to investigate sources, search Google News to find better coverage, and Google reverse image search to trace photographs and images back to their original context. After each instructional activity, students received feedback showing how to use SIFT strategies to fact-check the content; see Fig. 1 [left panel]. On average, students completed two to three assignments ($M = 2.48$, $SD = 0.84$).

Online Pretest and Posttest

Pre/posttest probed students' attitudes toward / preference for lateral reading strategies (multiple-choice problems), their use of lateral reading strategies (open-response problems), and their grasp of how the Internet contributes to political polarization.

Open-response lateral reading problems. Two sets of open-response problems assessed use of lateral reading strategies. Each comprised five examples of online content: an image, a social media post, a medical information website, and two news articles, including one related to the COVID-19 pandemic; see Fig. 1 [right panel].

Sample activity with feedback (in red) in which students practiced investigating sources using Wikipedia	Open-response lateral reading problem from set A
As you probably know, the social media platform Twitter suspended former president Donald Trump's account on January 8th. You can read about their reasoning in this blog post: https://blog.twitter.com/en_us/topics/company/2020/suspension.html Let's investigate the trustworthiness of some of the claims that circulated following this suspension. For example, let's say you come across the following tweet from the Media Research Center: https://twitter.com/theMRC/status/1348808917422379009 **MediaResearchCenter** @theMRC · Jan 11 "Big Tech has declared war on **free speech** and is now an existential threat to democracy." More than 30 conservative leaders have signed on to a statement calling for Big Tech to be broken up. You also come across the following tweet from Media Matters for America: https://twitter.com/mmfa/status/1347705757064699910 **Media Matters** @mmfa · Jan 8 Angelo Carusone: **Twitter** banning Trump now is "a lot like senior administration officials resigning with only days left" mediamatters.org /twitter/angelo... "These actions are long past due and appropriate. But, Twitter (and other platforms) doing this now is a lot like senior administration officials resigning with only days left—too little too late. Trump has repeatedly broken Twitter rules. **If only Twitter** **Stop!** First, get some context about these tweets by **opening a new browser tab** and **investigating the source** of each tweet. To do this, search The Media Research Center on Wikipedia, and then search Media Matters for America on Wikipedia. Based on what you read about each source, to what extent would you trust these sources for information about Twitter's decision to permanently suspend the account of former president Donald Trump? **Tip:** You can search for a topic or source in Wikipedia by adding the keyword "wiki" to the end of your Google search. When we searched the Media Research Center and Media Matters for America on Wikipedia, we saw that they are both media watchdog groups with very different political leanings: https://en.wikipedia.org/wiki/Media_Research_Center https://en.wikipedia.org/wiki/Media_Matters_for_America So, by using Wikipedia to investigate each of these sources, we were able to quickly determine that both sources have an agenda and would not be a trustworthy source of information.	There is a lot of information available online about the COVID-19 pandemic (i.e., the coronavirus outbreak), like this story: https://www.thegatewaypundit.com/2020/10/new-data-reveals-coronavirus-4th-worst-us-pandemic-last-100-years-destroyed-economy/ Home About Privacy ProTrumpNews Store MORE **GATEWAY PUNDIT** **New WHO Data Reveals Coronavirus Less Lethal than Last Three Major US Pandemics – And they Destroyed the Economy for This** By Jim Hoft Published October 4, 2020 at 7:30am 380 Comments f Share on Facebook (6.3k) Tweet Share Email To what extent do you feel provoked by this story (meaning that it causes you to feel annoyed, angry, or have another strong reaction)? Not at all provoked A little provoked Somewhat provoked Mostly provoked Very provoked What is your level of trust in this story? Very High High Moderate Low Very Low Unsure How did you decide your level of trust?

Figure 1: Screenshots of sample instructional activity [left panel] and open-response lateral reading problem [right panel].

Table 1: Keywords and sample responses for coding of responses about the Internet's contribution to political polarization.

Factors	Keywords	Sample Responses
Reinforcing cognitive biases	want to see, want to hear, want to believe, mind, extrem, block, confirm, justify, own side, ignore	"articles people read are just what they want to hear"
Spreading false information	exaggerat, fabricat, twist, misinform, fals, fake, spread, shar, viral, propagand, lies, mislead	"fake news posted from both parties might trigger arguments between people"
Filtering information	search, collect, history, track, filter, target, bubble, recommend, personality, preference, feeds, contradict, algo	"social medias filter out the stuff that an individual would not be interested in"
Occurring via media	media, facebook, twitter, insta, tik, snap, youtube, news, cnn, fox, platform, forum, influencer, post, comment, meme, screen	"news stories, articles and social media are constantly pushing 2 different ideas"

Problem sets (A and B) were counterbalanced at the instructor level for use in the pretest vs. posttest. Aside from the COVID-19 news problems, other problems were taken from previous studies (Brodsky, Brooks, Scimeca, Galati et al., 2021; Brodsky, Brooks, Scimeca, Todorova et al., 2021). On each problem, students rated the content's provocativeness (1 = *not at all provoked* to 5 = *very provoked*) and their level of trust in content (1 = *very low* to 5 = *very high* or –9 = *unsure*). They were then prompted to answer the question "How did you decide your level of trust?" using an open-response textbox.

Students' responses to each problem were first scored based on if they did (1) or did not (0) indicate use a SIFT lateral reading strategy to determine their trust rating. The scores were determined automatically by searching each spell-checked text response for keywords associated with lateral reading. In our previous studies, we found the accuracy of automated scoring to be comparable to manual scoring (Brodsky, Brooks, Scimeca, Galati et al., 2021; Brodsky, Brooks, Scimeca, Todorova et al., 2021). Students' lateral reading use score was the total number of problems read laterally (*Range* = 0–5).

Multiple-choice lateral reading problems. Two sets of two multiple-choice problems (counterbalanced at the instructor level) assessed students' preference for fact-checking information using SIFT strategies. Students were asked to select their first- and second-choice strategies (out of four options) for determining if an article was a trustworthy source of information and for deciding the authenticity of a photo (see Results section for prompts and response options). The options for each problem consisted of two lateral reading and two vertical reading strategies. Students' lateral reading preference score was the total number of lateral reading strategies selected across problems (*Range* = 0–4).

Reading comprehension assessment. Students read a passage from the New York State Regents High School Examination in English Language Arts (NYSED, 2018) and answered 6 multiple-choice questions, *M* = 3.4 correct (*SD* = 1.7) (Cronbach's α = .63, scalability *H* = .35; see Sijtsma & van der Ark, 2017).

Open-response question about political polarization. Students responded to the following open-response prompt: "Republicans and Democrats can't seem to agree on anything. How might the features of the Internet contribute to the problem? Your response should be about 50 words." After identifying responses mentioning cognitive or contextual factors, remaining responses were coded for failure to mention the Internet, only mentioning the Internet's benefits, only mentioning Internet-based antagonism, or Other. Responses mentioning cognitive or contextual factors (*n* = 200 across pre/posttest) were then coded for mentions of the following factors: reinforcing cognitive biases, spreading false information, filtering information, and/or occurring via media. Each spell-checked text response was first searched for keywords associated with each factor (see Table 1 for keywords and sample responses). Coding was verified manually (*M* Scott's *pi* = .72, *SD* = .02, *Range* = .70–.74), with disagreements resolved in favor of the manual coding.

Results

Our main analyses examined predictors of students' preference for and use of lateral reading strategies at pretest and posttest. In studies where participants complete multiple trials (e.g., problems), it is common to use a logistic regression with a binomial distribution and logistic link function to model the proportion of successful trials out of the total trials completed (Dixon, 2008). Therefore, we used the *glm* function in the *lme4* package in *R* to predict the proportion of lateral reading strategies selected and the proportion of problems read laterally. Weights were set as total strategies selected and total problems attempted, respectively. All continuous predictors were standardized prior to being included in the models. Effect sizes are reported as odds ratios.

We checked models for multicollinearity and linearity of the association between continuous predictors and log-odds of the outcome (Field et al., 2012). We also examined standardized residuals for evidence of outliers and leverage for influential observations. To determine the effects of outliers and influential observations, we reran each model with those observations removed.

Table 2: Percentage of students who selected each strategy as their first or second choice on each multiple-choice problem at pretest and posttest (*N* pretest = 157, *N* posttest = 154).

	Pretest Choices		Posttest Choices	
Trustworthiness of a Source	1st	2nd (*N*=156)	1st	2nd (*N*=151)
Scrutinize the article (e.g., typos, URL, advertisements, references) closely	21.0%	28.2%	10.4%	17.9%
Look around the [Sputnik International / NewsPunch] website to learn about this news organization	15.9%	23.1%	3.2%	14.6%
Look up [Sputnik International / NewsPunch] on Wikipedia to learn more about it	7.0%	18.6%	45.5%	21.2%
Check the information with another source like a fact-checking site	56.1%	30.1%	40.9%	46.4%
Authenticity of a Photo	1st	2nd	1st	2nd (*N*=153)
Look carefully at the photo to see if it has been altered	6.4%	12.7%	4.5%	9.2%
Look up photos of [a border fence between Mexico and Guatemala / Ku Klux Klan members on a ferris wheel]	24.2%	28.7%	11.7%	23.5%
Reverse search for the image using Google	27.4%	29.3%	74.7%	12.4%
Check a news aggregator (e.g., Google News) to see if there are other reports of [a border fence between Mexico and Guatemala / Ku Klux Klan members on a ferris wheel]	42.0%	29.3%	9.1%	54.9%

Note: Bolded strategies are SIFT lateral reading strategies.

Gains in Lateral Reading Preference

At pretest, students selected an average of 2.39 (*SD* = 0.84) out of four SIFT lateral reading strategies across the two multiple-choice problems assessing preferred strategies for evaluating online content. At posttest, this increased to 3.03 lateral reading strategies (*SD* = 0.79), with 55.2% of students selecting at least one more lateral reading strategy at posttest than at pretest; see Table 2 for student preferences (%) for selecting each strategy at pre/posttest. At pretest, most students indicated at least some preference for lateral reading by selecting the strategy of checking information with another source, like a fact-checking site or a news aggregator. At posttest, gains in preference were evident for use of Wikipedia to learn more about a source and for use of Google to conduct a reverse image search.

Prior to instruction, reading comprehension approached significance in predicting students' selections of lateral reading strategies on the multiple-choice lateral reading problems: *OR [95% CI]* = 1.17 [0.99, 1.38], *p* = .065. Completion of SIFT assignments and problem set were not significant predictors. With outliers and influential observations removed (3.2%), reading comprehension was a barely significant predictor: *OR [95% CI]* = 1.19 [1.00, 1.41], *p* = .045. All observations were retained in the model.

After receiving the fact-checking curriculum, reading comprehension significantly predicted preference, such that stronger readers had higher odds of selecting a lateral reading strategy as their preferred method of determining trustworthiness and authenticity of online content: *OR [95% CI]* = 1.37 [1.13, 1.68], *p* = .002. Students who completed more homework assignments also had higher odds of selecting lateral reading strategies: *OR [95% CI]* = 1.28 [1.06, 1.54], *p* = .009. Problem set was again not a significant predictor. Removing outliers and influential observations (2.6%) did not change the overall findings. All observations were retained in the model.

Gains in Lateral Reading Use

At pretest, students read laterally on 0.31 (*SD* = 0.63) out of five open-response lateral reading problems on average. At posttest, this increased to 1.34 (*SD* = 1.74) problems, with 43.3% of students reading laterally on at least one more problem at posttest than at pretest. Table 3 shows percentages of students reading laterally on each problem at pre/posttest.

Table 3: Percentage of students who read laterally on each problem at pretest and posttest (*N* = 157).

Problem	Pretest	Posttest
News article	4.5%	28.8% (*N* = 156)
COVID-19 news	6.4%	21.8% (*N* = 156)
Medical news	3.8%	28.7%
Image	8.9%	26.8%
Tweet	7.0%	28.7%

Note: Since administration of problem sets was counterbalanced, percentages are reported across sets.
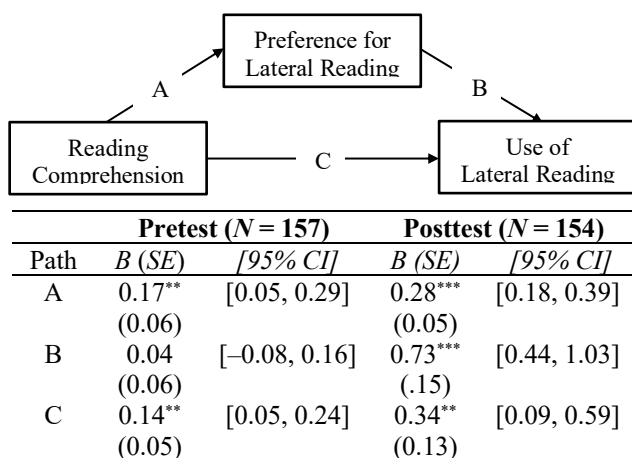
At pretest, reading comprehension predicted use of lateral reading, i.e., whether students indicated reading laterally on an open-response lateral reading problem: *OR [95% CI]* = 1.80 [1.30, 2.55], *p* = .001. Preference for lateral reading, completion of SIFT assignments, and problem set were not significant predictors. Removing outliers and influential observations (3.8%) did not change the overall findings. All observations were retained in the model.

At posttest, reading comprehension continued to be a significant predictor of lateral reading use: *OR [95% CI]* = 1.36 [1.12, 1.66], *p* = .002. In addition, students with greater preference for lateral reading had higher odds of reading laterally: *OR [95% CI]* = 1.72 [1.38, 2.15], *p* < .001. Completion of assignments was also associated with greater lateral reading use (*OR [95% CI]* = 2.09 [1.59, 2.84], *p* < .001), as was problem set (*OR [95% CI]* = 1.55 [1.07, 2.25],

p = .020). However, pretest performance was not a significant predictor of posttest performance. Removing outliers and influential observations (13.6%) did not change the overall findings. All observations were retained in the model.

Mediational Analyses

We next examined if the relation between reading comprehension and use of lateral reading was mediated by preference for lateral reading at pretest and/or posttest. For simplicity, the number of lateral reading strategies selected (i.e., preference) and the number of problems read laterally were both treated as continuous variables. See Figure 2 for the mediation model and path coefficients at pretest/posttest.

	Pretest (*N* = 157)		Posttest (*N* = 154)	
Path	*B* (*SE*)	*[95% CI]*	*B* (*SE*)	*[95% CI]*
A	0.17** (0.06)	[0.05, 0.29]	0.28*** (0.05)	[0.18, 0.39]
B	0.04 (0.06)	[–0.08, 0.16]	0.73*** (.15)	[0.44, 1.03]
C	0.14** (0.05)	[0.05, 0.24]	0.34** (0.13)	[0.09, 0.59]

*p < .05, **p< .01, ***p<.001

Note: Reading comprehension was standardized.

Figure 2: Mediation model and pre/posttest coefficients.

Direct effects of reading comprehension (Paths A and C) were significant at both time points. At pretest, the effect of reading comprehension on use of lateral reading was not mediated by preference for lateral reading strategies, *B* = 0.01 (bootstrap *SE* 0.01), percentile bootstrap 95% CI [–0.01, 0.03]. However, at posttest, preference partially mediated the effect of reading comprehension on use of lateral reading, *B* = 0.21 (bootstrap *SE* 0.06), percentile bootstrap 95% CI [0.09, 0.33].

Political Polarization

At pretest and posttest, most students mentioned cognitive and/or contextual factors when explaining how features of the Internet contribute to political polarization; Table 4 [top panel]. More students mentioned these factors at posttest than at pretest, but the change was not significant, McNemar's $\chi^2(1) = 0.77$, *p* = .382. When mentioning cognitive and/or contextual factors, students most often described polarization as occurring via media, e.g., social media and news coverage; Table 4 [bottom panel]. No pre/posttest differences were statistically significant.

Table 4: Pre/posttest percentages for coding of responses about the Internet's contribution to political polarization.

Content coding (Mutually exclusive)	Pretest (*N* = 157)	Posttest (*N* = 152)
No mention of the Internet	19.1%	13.2%
Only mention benefits of the Internet	3.2%	3.3%
Only mention fostering antagonism	14.0%	11.8%
Mention cognitive/contextual factors	61.8%	67.8%
Other	1.9%	3.9%
Cognitive/contextual factors (Not mutually exclusive)	**Pretest (*N* = 97)**	**Posttest (*N* = 103)**
Reinforcing cognitive biases	14.4%	16.5%
Spreading false information	56.7%	39.8%
Filtering information	5.2%	10.7%
Occurring via media	71.1%	67.0%

Discussion

This study examined effects of an online, asynchronous curriculum on preference for fact-checking using lateral reading strategies. Students showed greater preference for lateral reading at posttest than at pretest, which is encouraging given that performing a behavior is influenced at least in part by one's attitudes towards that behavior (Verplanken & Orbell, 2022). Students who completed more assignments were more likely to prefer lateral reading strategies at posttest, which is in keeping with prior research on attitude change (Steinmetz et al., 2016). Reading comprehension also predicted preference, which may reflect students' ability to understand instructions and feedback provided in the curriculum (Rouet & Britt, 2011).

We also found that preference predicted use of lateral reading at posttest, but not at pretest. This suggests that direct instruction and practice with using SIFT strategies may have helped align students' attitudes and intentions with their behaviors (Glasman & Albaraccin, 2006; Sheeran et al., 2017). While reading comprehension predicted use of lateral reading strategies at pretest and posttest, preference partially mediated this effect at posttest. As mentioned above, poor reading ability may have made it harder for students to form a more positive attitude towards lateral reading, which in turn made them less likely to read laterally (Rouet & Britt, 2011). Additionally, the direct effect of reading comprehension on use underscores the need for sufficient reading skill to understand and interpret results of lateral searches.

Most students mentioned cognitive and/or contextual factors when explaining how the Internet contributes to political polarization, but the curriculum did not affect awareness. Additional direct instruction is needed to help students understand how cognitive and contextual factors interact to foster polarization, including the role of algorithms in promoting polarized online content. Such instruction may help students recognize the need to fact-check online information and thus decrease their susceptibility to misinformation (van Baar & Feldmann, 2021).

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