

Cognitive Reflection and Vulnerability to Misinformation among High School Students: Correlational Study

Rafael Jasper A. Cabanado, Crystel Mae T. Arandunque, Ria Mae B. Alpino,
Joseph S. Callanta, Paulene Joy B. Tolentino, Hazelyn H. Dela Cruz
Cavite State University - Silang Campus, Silang Cavite, Philippines

*Corresponding Author Email: paulenejoy.tolentino@cvsu.edu.ph

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Abstract. With the advent of modern means of communication during the twenty-first century, misinformation travels as fast as factual information. Hence, this study explores the relationship between cognitive reflection and vulnerability to misinformation. Using the descriptive correlational research design, 346 high school students who are Facebook users participated in the study. Anchored on the cognitive reflection test MCQ-4 and the vulnerability to misinformation scale, Pearson correlation was used to identify the relationship between these variables of the study. High School students reported a low level of cognitive reflection, indicating that they have a low tendency to hide their intuitive thoughts and are more guided by their quick thoughts. On the other hand, individuals with a moderate level of vulnerability to misinformation exhibit a moderate difficulty in evaluating the authenticity of online information and differentiating facts from fiction. Consequently, they tend to construe fake information as real. There was a significant negative relationship between these variables. The less they engage in slow, laborious, and analytical thinking, the more vulnerable they are to believing in fake news. It is recommended that more factors be explored that could moderate the relationship between these two to foster analytical thinking and lessen the vulnerabilities of high school students to fall for fake news.

Keywords: Cognitive reflection; Fake news; High school students; Social media; Vulnerability to misinformation.

1.0 Introduction

In the twenty-first century, advancements in digital communication have led to false information spreading more than verified facts and evidence-based information. It is a challenge among media practitioners to combat the proliferation of misinformation because it dramatically affects the reliability of news circulating on the internet and hardens the process of filtering and verifying different uploaded content. Misinformation refers to information that contradicts the best available evidence and relevant expert consensus when the information is conveyed, following Vraga and Bode (2020). This definition recognizes that what constitutes misinformation is time-bound and shaped by the evolving state of evidence and the evolving understanding of the matter by experts. Although misperception is highlighted in this context and the potential for misunderstanding these two constructs, it is crucial to remember that they represent distinct concepts. Interestingly, Filipinos' primary sources of information are the internet and social media platforms, particularly Facebook. According to Rodriguez-Moreno et al. (2021), since classes and activities are also incorporated in social media, there is a notable increase in students' reliance on digital media, particularly social media platforms, for educational purposes. Social media

platforms such as Facebook, YouTube, and Twitter became primary resources for communication, collaboration, and information sharing among students (Belmonte et al., 2024). Despite its benefits, concerns arose regarding the proper usage of social media in educational settings, including potential distractions and exposure to misinformation. According to Lalu (2022), former vice president Leni Robredo's observation that the Philippines has become known as "ground zero" for misinformation drew global attention to the country's challenges with disinformation. On the other side, 9 out of 10 Filipinos agreed that misinformation is a problem in the country, based on the survey of Pulse Asia conducted in September 2022 (Lalu, 2022).

Given the complexities and the deceptive nature of online information, there are foundational skills that every individual, especially adolescents, must develop to effectively assess the validity of the information that has been published and spread online across various social media platforms. These foundational literacies are evaluated in international benchmarks like the PISA Programme for International Student Assessment. PISA literacies (reading, mathematics, science) provide a framework for understanding the capacity of students to apply what they have learned. These skills are needed to interpret, assess, and respond effectively to information disseminated across digital platforms, which aligns with the study of misinformation and vulnerabilities.

In the PISA Assessment and Analytical Framework (OECD, 2019), students' performance is evaluated based on the domains or the core school subjects defined as: reading literacy, mathematical literacy, and science literacy. Reading literacy refers to students' ability to understand, use, and critically engage with texts to support personal goals, learning, and social participation. It involves locating and selecting relevant information from various sources, comprehending and integrating ideas from sentences or passages, and evaluating texts' credibility, quality, and coherence, especially when faced with conflicting information and contradicting multiple texts. Mathematics literacy is applying, interpreting, and reasoning with mathematics across various contexts, using concepts, procedures, facts, and tools to describe, explain, and predict real-world phenomena. Science literacy encompasses engaging thoughtfully with science-related issues, demonstrating skills to explain phenomena, design and assess investigations, and interpret scientific data as an informed and reflective citizen.

The results suggest that many Filipinos lack the foundational literacies needed for critical evaluation of information, especially in complex contexts such as digital content. Reading literacy provides the skills for comprehension, interpretation, and evaluation of different texts. Filipino students obtained an average score of 340 points in Overall Reading Literacy, significantly lower than the OECD average of 487 points. Only 1 out of 5 Filipino students (19.4%) achieved at least the minimum proficiency level (Level 2) in Overall Reading Literacy. Meanwhile, mathematical literacy implies logical thinking, reasoning, and data interpretation. Students achieved an average score of 353 points in Mathematical Literacy, significantly lower than the OECD average of 489 points. Only 1 out of 5 Filipino students (19.7%) attained at least the minimum proficiency level (Level 2) in Mathematical Literacy.

Lastly, scientific literacy highlights an evidence-based way of thinking and not just depending on a shallow presentation of information. Students attained an average score of 357 points, significantly lower than the OECD average of 489 points. Female students obtained an average score of 359 points for Scientific Literacy, which was slightly higher but not significantly different from the average score of male students (355 points). With these skills underdeveloped, adolescents may be more vulnerable to misinformation as they have difficulty assessing credibility, detecting inconsistencies, and using analytical reasoning when encountering news and other information across social media and other digital platforms.

From a psychological perspective, cognitive reflection enhances analytical thinking, enabling individuals to seek accurate answers and resist impulsive judgments (Ivory, 2022). Furthermore, developing news and science literacy provides a foundation to improve how readers consume information. This allows social media users to identify, consume, and share quality information, which has also been linked to susceptibility to misinformation (Vraga et al., 2020). Ecker et al. (2022) noted that repeated exposure to misinformation can lead to its entrenchment in memory, rendering it resistant to correction even when contradicted by new evidence. This phenomenon is exacerbated by social media, where misinformation is easily disseminated. According to Gaw and Soriano (2022), there is a large number of fake news peddler content creators online, intensified by the algorithm of recommended videos, and some social media users are dominated by fake news. Lou et al. (2021) stated that misinformation harms the general public. Its effects include the public being the consumers of tweaked information and decreased capacity to engage in critical thinking when evaluating the contents of various information on different platforms.

This study investigated whether there is a significant relationship between cognitive reflection and vulnerability to misinformation in high school students. Moneva et al. (2020) support the idea that researchers should conduct a study that broadens the public's understanding of the relationship between human reasoning and vulnerability in dealing with fake news. Analyzing the veracity of information across various platforms in these times is harder due to the public's reliance on social media as a primary source of information. In relation to this, several people are convinced that the appealing nature of the information is real. Van der Linden (2022) mentioned the term "illusory truth effect", wherein the public is convinced that the information they see repeatedly is factual, caused by the algorithms of social media platforms. In addition, with social media users being swayed by the appealing nature of fake news, they unconsciously contribute to the problem of misinformation by sharing false news without regard for its truthfulness. As a result, many researchers have explored the reasons for the public's vulnerability to fall prey to the claws of misinformation, concentrating on political, psychological, and media literacy perspectives.

To address the public's vulnerability to misinformation, here comes cognitive reflection. This concept involved pausing while analyzing the authenticity of information. Given Filipino adolescents' low proficiency levels in core literacies, examining cognitive reflection becomes particularly relevant in understanding their vulnerabilities to misinformation. Thus, this study explores how cognitive reflection interacts with literacy skills to influence adolescents' ability to discern misinformation online. Although this process is slow, it makes the person immune to the serious effects of misinformation through engaging in critical thinking. Greškovičová et al. (2022) found that high school students find it challenging to assess the truthfulness of the information they encounter. Similarly, Breakstone et al. (2021) noted that these students lack the skills to determine whether the information they see is fact or fake. These findings highlight the necessity for various stakeholders to take appropriate steps to equip the youth with essential skills such as critical thinking and media and information literacy to alleviate the impact of misinformation.

This study integrated the fields of journalism, mass communication, and psychology. This is done by analyzing misinformation, which is deeply connected to mass communication and journalism, through the lens of psychology, by investigating the role of cognitive reflection in the public's vulnerability to misinformation. It aligns with calls for an interdisciplinary approach to understanding and mitigating misinformation's effects as Shu et al. (2019) stated that various fields should help each other to help the public to be free on the claws of misinformation, hence, adapting an interdisciplinary approach, particularly in fostering students' analytical thinking and critically evaluate the information they encounter, particularly on social media, thereby facilitating a more informed and resilient youth in the digital age.

2.0 Methodology

2.1 Research Design

The researchers used a correlational design to determine the answers to this research problem. The researchers gathered data on at least two variables and analyzed them to determine whether a connection is present between them. Correlational research design is used when a researcher wants to study the relationship between variables, and they have no control over any of them (Bhandari, 2021). In this study, the said design was used to test if a relationship possibly exists between cognitive reflection and vulnerability to misinformation among high school students.

2.2 Participants and Sampling Technique

The researchers utilized cluster and convenience sampling and calculated the sample size using G*Power analysis, which included 346 high school students (junior and senior) who are Facebook users from Silang, Cavite. This target population was based on the study of Greškovičová et al. (2022), wherein it was found that high school students have difficulty assessing the veracity of online information.

2.3 Research Instrument

Cognitive Reflection Test (CRT)

A standardized instrument was used, namely the Cognitive Reflection Test (CRT), developed by Frederick (2005) and revised by Toplak et al. (2014), to assess the respondents' ability to engage in reflective thinking rather than relying on intuitive responses. The test consists of multiple-choice mathematical problems that prompt participants to suppress impulsive answers and engage in analytical reasoning. This test consists of seven items

and has four options. Correct answers indicate slow but effortful thinking, while incorrect answers indicates that the respondent used intuition in answering the test. The reliability of this test, computed via Cronbach's alpha, is 0.81, indicating strong internal consistency.

Vulnerability to Misinformation

The tool that measured vulnerability to misinformation was adapted from Moneva et al. (2020). It consists of 10 items rated on a 5-point Likert scale, with scores ranging from 1 (Never) to 5 (Always). The reliability of the instrument, assessed via Cronbach's alpha, is 0.81, indicating strong internal consistency. Scoring follows an interval-based interpretation: respondents scoring ≥ 4.21 are considered Completely Vulnerable, while those scoring ≤ 1.80 are Not Vulnerable. Higher scores suggest greater difficulty in evaluating online information and a stronger tendency to accept misinformation.

2.4 Data Gathering Procedure

After evaluating this research's specificity, the researchers prepared the materials they needed to collect the data they needed. The researchers obtained the approval of school administrators and parents before collecting data from the students. After gaining the approval of authorities and parents, the researchers informed the students (through an informed consent form) about the study's objectives and confidentiality clauses before proceeding to data gathering. Due to the easing of pandemic restrictions, data was gathered face-to-face using the paper-and-pencil method. The research instruments used are adapted and standardized. The data collected from the respondents will be analyzed and organized using Microsoft Excel and Jamovi Software. The researchers ensured the confidentiality of all the data, and it will be used solely for educational and research purposes.

2.5 Data Analysis Procedure

The researchers utilized data analysis through the use of JAMOWI version 2.4. The participants' levels of cognitive reflection and vulnerability to misinformation were assessed using mean and standard deviation to summarize the central tendency and variability of the data. Pearson's r correlation coefficient was utilized to gauge the degree of relationship between cognitive reflection and vulnerability to misinformation. Pearson's r values range from -1 to +1, where values closer to -1 or +1 indicate stronger relationships, while values near 0 suggest weak or no correlation. The relationship between two variables is generally considered strong when their r value is larger than 0.7 (Mindrila et al., 2019).

2.6 Ethical Considerations

The researchers followed the ethical guidelines in conducting this study so that the rights of the respondents were not violated. A request letter was sent to the school principals because the respondents are minors. The researchers had a dialogue with the school principal to discuss the study's flow and ensure the students' safety. Also, the researchers obtained the parents' consent the day before administering the research instruments. Moreover, the researchers provided an informed consent form to the participants to ensure they had sufficient knowledge about the specifics of the data gathering procedures. This ensured that the respondents were voluntarily participating in the study and had the freedom to withdraw if they chose to do so.

3.0 Results and Discussion

3.1 Level of Students' Cognitive Reflection

The mean and standard deviation of cognitive reflection among participants. The M of 1.29 ($SD = 1.45$) indicates that the participants exhibited a low level of cognitive reflection. This finding suggests that high school students predominantly rely on quick, automatic, and effortless thinking rather than engaging in slow, deliberate, and analytical reasoning. Their cognitive processes are more intuitive, meaning they are less likely to pause and critically evaluate the accuracy of their initial responses. Students with low cognitive reflection may struggle to suppress impulsive thoughts and instead rely on immediate, surface-level judgments. This limited engagement in deeper analytical processing could affect their decision-making and problem-solving abilities, particularly when assessing the credibility of online information. The tendency to accept information at face value without further scrutiny may contribute to greater susceptibility to misinformation. Mosleh et al. (2021) stated that individuals with higher scores on the Cognitive Reflection Test demonstrated a greater ability to discern credible information on social media. This was evident in their tendency to follow diverse accounts and share news from reliable sources. However, despite this, teenagers often exhibit overconfidence in their ability to detect deceptive news stories and recognize manipulative content. According to self-reported data, they believe they can identify misinformation but frequently struggle to do so (Herrero-Diz et al., 2020). This finding supports the study's result,

indicating that students with low levels of cognitive reflection may lack the necessary analytical skills to critically assess online information, making them more susceptible to misinformation.

Table 1. Mean and Standard Deviation of Cognitive Reflection

Variable	Mean	SD	Interpretation
Cognitive Reflection	1.29	1.45	Quick, automatic, and effortless thinking

Several factors may contribute to low cognitive reflection in high school students. First, distractions in the modern world also contribute to reduced cognitive reflection. The prevalence of smartphones, social media, and other technological distractions can fragment attention and impede sustained, focused thinking (Ward et al., 2017). This constant connectivity often prevents students from dedicating uninterrupted time to analyzing complex problems or engaging in reflective activities. Additionally, high school students frequently struggle with hectic schedules. There may not be much time for reflection due to the demands of managing social duties, extracurricular activities, and academic excellence. Constant demands could encourage students to learn at the surface level, emphasizing finishing assignments fast rather than fully comprehending the subject matter. That is why the Department of Education decongested the K-12 curriculum to emphasize necessary competencies such as reading, literacy, and arithmetic.

Furthermore, the lack of emphasis on metacognitive skills in the educational curriculum may hinder students' cognitive reflection. In the theory of metacognition of Schraw et al. (1994), understanding one's own thought processes and applying strategies for effective learning is crucial for developing reflective thinking. If students are not explicitly taught to evaluate and regulate their cognitive processes, they are less likely to engage in deep reflection naturally. Flunking reading comprehension and numeracy skills results in lower levels of cognitive reflection. Students struggle to understand the material they read because their reading and arithmetic skills were not developed during the pandemic's remote learning period. This may have exacerbated these gaps, as students had fewer opportunities to engage in structured, reflective learning experiences (Dorn et al., 2021). Improved reading and mathematical skills play a vital role in understanding standardized tests, books, and the world around us. Based on the findings, these high school students, due to low cognitive reflection, are easily convinced by what they see on social media platforms, making them vulnerable to fake news and misinformation.

3.2 Level of Students' Vulnerability to Misinformation

The mean value of 2.75 (SD = 0.71) corresponds to "Moderately Vulnerable." This finding shows that high school students are moderately vulnerable to accepting and sharing misinformation. They are susceptible to believing and spreading fake news. This suggests that our high school students would fall prey to fake news, especially on social media platforms, as our research shows that they have a moderate level of vulnerability to misinformation. High school students hardly identify news, whether it is fake or factual. Supported by Nygren and Guath (2019), who concluded that Swedish teenagers fail to distinguish the authenticity of false, biased, and vetted news. This was related to the findings of Herrero-Diz et al. (2020), which point out that secondary school students who use WhatsApp share information if it piques and aligns with their interests, irrespective of its veracity.

Table 2. Mean and Standard Deviation of Vulnerability to Misinformation

Variable	Mean	SD	Interpretation
Vulnerability to Misinformation	2.75	0.71	Moderately Vulnerable

Furthermore, high school students believe the news they just read on the internet, according to Al Zou'Bi Dr (2022), media and information literacy could be a factor that enables the public to become educated individuals who can constructively and critically discern various information—using social media as a news source and the less scrupulous treatment of information (e.g., overlooking the reliability of authors and news sources; as cited in Faragó et al. (2024) increases teenagers' vulnerability to fake news. Furthermore, the research indicates that students tend to place heightened trust in the information shared by online personalities, aligning with their interests across diverse social media platforms. In line with this, adolescents pay more attention to vloggers and influencers rather than journalists or news-related pages and sites, a point also supported by Newman et al. (2023) and Orosz et al. 2024, as cited in Faragó et al. (2024). The researchers believe that prolonged engagement with various social media platforms, notably Facebook, due to increased accessibility on personal devices, contributes to students' limited time for seeking and consuming real-time news. This constrained exposure to authentic news sources may diminish the capacity to filter online information effectively. Consequently, the lack of interest in real-time news may lead students to place greater reliance on information encountered online, fostering a

tendency to accept such content at face value.

3.3 Relationship of Cognitive Reflection and Vulnerability to Misinformation

The relationship between cognitive reflection and vulnerability to misinformation among high school students revealed a significant negative correlation ($r = -0.415$, $p = 0.001$) between variables. Since the p -value is less than 0.05, the null hypothesis was rejected. Pearson's r values of 0.10, 0.30, and 0.50 correspond to small, medium, and large effect sizes. Cohen's guidelines suggest that a medium effect should be noticeable to the careful observer (Cohen, 2022). Given this framework, the correlation of $r = -0.415$ in this study falls within the moderate to extensive range, indicating a meaningful association between the variables.

Table 3. *Relationship of Cognitive Reflection and Vulnerability to Misinformation.*

Variables	r value	Description	p -value	Interpretation
Cognitive Reflection and Vulnerability to Misinformation	-0.415	Moderate Negative Correlation	0.001	There is a significant relationship between variables

This suggests that as cognitive reflection decreases, vulnerability to misinformation increases and vice versa. Supporting the hypothesis that individuals who engage more in slow and analytical thinking are less likely to be misled by false information online. This moderate to large effect size indicates a meaningful and observable relationship, underscoring the importance of fostering cognitive reflection skills in educational settings to combat misinformation. Ali and Qazi (2022) stated that a high Cognitive Reflection Test score is related to greater truth discernment, less trust, but greater use of formal information sources. Adolescents, guided by higher cognitive reflection (enhanced analytic thinking) and a heightened need for cognition, were less likely to believe in fake news. Due to low levels of cognitive reflection, students may struggle to evaluate the accuracy of online information, leading to passive belief and a heightened susceptibility to misinformation. Another study by Lees et al. (2022) found that there is a relationship between higher scores on the Cognitive Reflection Test and lower belief in fake news. Due to the appealing nature of the conspiracy theories, many people are likely to believe them without hesitation. These hoaxes increase the burden on many nations because they persuade many people to exhibit unproductive behaviors, often through false information on social media platforms (Kim & Tandoc Jr., 2022). People tend to believe false information instantly because they have low cognitive reflection (Pickup & Stecula, 2021).

Students with low levels of cognitive reflection may be highly susceptible to misinformation, as they tend to rely on intuitive thinking rather than utilizing their reflective abilities. Due to low levels of cognitive reflection, students may struggle to evaluate the accuracy of online information, leading to passive belief and increased vulnerability to misinformation. Conversely, students with high levels of cognitive reflection may be less susceptible to misinformation, as they tend to rely more on their reflective thinking than their intuition. Because these students possess high levels of cognitive reflection, they experience less or no difficulty evaluating the authenticity of online information, indicative of low vulnerability to misinformation. The study of Ahmed et al. (2022) states that higher levels of cognitive reflection correlate with a decreased probability of sharing misinformation online.

4.0 Conclusion

The findings indicate that high school students predominantly rely on intuitive and automatic thinking, making them more vulnerable to misinformation. Their low level of cognitive reflection suggests that they have a limited ability to critically assess online information, leading to a higher likelihood of believing and sharing fake news. Despite their confidence in identifying deceptive content, they often struggle to discern misinformation. Their reliance on social media further heightens this vulnerability as a primary news source, and their tendency to trust influencers over credible news outlets. The study's results establish a moderate negative relationship between cognitive reflection and vulnerability to misinformation, reinforcing that students who engage in deeper analytical thinking are less likely to be misled. Given this, implementing educational interventions to enhance cognitive reflection is crucial. Schools should incorporate strategies such as lateral reading and gamified misinformation literacy programs to strengthen students' ability to evaluate online content critically. Also, fostering a learning environment emphasizing media literacy and fact-checking practices can help mitigate susceptibility to misinformation. By reinforcing analytical thinking and skepticism, educators can empower students to navigate the digital landscape more effectively, equipping them with the necessary skills to discern credible from misleading information.

5.0 Contributions of Authors

Author 1: Conceptualization, proposal writing, data gathering, data analysis, manuscript writing
Author 2: Conceptualization, proposal writing, data gathering, data analysis, manuscript writing
Author 3: Conceptualization, proposal writing, data gathering, data analysis, manuscript writing
Author 4: Conceptualization, data analysis, ethical procedures and supervision, manuscript writing
Author 5: Data analysis, writing and editing literature review, manuscript writing
Author 6: Proposal writing, data gathering and analysis, ethical procedures and supervision

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7.0 Conflict of Interests

The authors declare no conflict of interest.

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