

Many truths, many knowledges, many forms of reason: Understanding middle-school student approaches to sources of information on the internet

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Abstract

Sourcing information related to socio-scientific issues requires sophisticated literacies to read and evaluate conflicting accounts often signified by disagreement among experts, multiple solutions or misinformation. Much of the previous work exploring how young people approach conflicting information has tended to focus on students in the secondary and tertiary years, often taking an epistemic approach to analysis, rather than a literacies lens. At the heart of such endeavours, however, is the need for sophisticated reading skills accelerated by shifts to digital platforms to source information. Given the limited empirical studies in the field of literacy that articulate how middle school students approach sources of information, this study investigates 45 middle school students' (13–14 years of age) self-reported strategies for investigating health risks associated with mobile phone use. We asked the students to imagine that a close friend was worried about the health risks of using their mobile phone and had asked them for advice. Students were then prompted to describe how they would search for information about the issue and how they would know if the information was reliable. Our analysis identified three dominant themes in the interview data, namely: (i) mistrust of the internet—people can be reliable

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sources; (ii) reliable sourcing requires consensus across sources; and (iii) criteria help to determine a reliable source. An interesting finding was the level of scepticism of the internet expressed by students. We draw on examples from the students' interview dialogue to illustrate the themes and engage in discourse related to their approaches including implications for teaching in English classrooms.

KEYWORDS

digital, literacies, literacies, reading, socio-scientific, sourcing

Key insights

What is the main issue that the paper addresses?

Sourcing information related to socio-scientific issues requires sophisticated literacies. This paper investigates middle school student approaches to evaluating sources of information related to mobile phone health risks. It explores to what extent students report evaluative skills in their search for information and what sources they draw upon.

What are the main insights that the paper provides?

Analysis revealed that students reported: (i) mistrust of the internet—people can be reliable sources; (ii) reliable sourcing requires consensus across sources; and (iii) criteria help to determine a reliable source. An interesting finding was the level of scepticism of the internet expressed by students.

INTRODUCTION

Sophisticated sourcing skills are vital for reading to make meaning of conflicting information in society today. However, research continues to document how students often find it difficult to implement the evaluative reading strategies they need (Barzilai et al., 2015; Kiili et al., 2021; Linn & Eylon, 2006; Scholes et al., 2021; Yang & Tsai, 2010). This is particularly true when students need to evaluate knowledge claims related to socio-scientific issues, or controversial, socially relevant, real-world problems informed by science (Bråten et al., 2019; Scholes, 2022; Strømsø & Bråten, 2014). By their very nature, socio-scientific issues represent open ended problems often signified by disagreement among experts, multiple solutions or ethical dilemmas, and include, for instance, debates related to genetic engineering, global warming, health pandemics and fish farming. As students encounter conflicting claims, they need to develop a critical-analytical stance to read, interpret and evaluate information (Bråten et al., 2014; Lunn Brownlee et al., 2021; Mason, 2018). This reading of texts may also include attending to and making decisions about the conflicting sources based on who produced them and the credibility of the content provided (Bråten et al., 2019).

With an understanding of the complexity of the literacy skills needed for evaluating sources that offer conflicting evidence on socio-scientific issues, in this article we are interested in exploring how middle school students approach such a task. We consider evaluative sourcing as attending to, critically reflecting on and interpreting multiple sources of information based on criteria (Bråten et al., 2018) rather than merely retrieving material at face-value without any interrogation of its validity. Our interest in researching middle school student literacy practices for sourcing—as well as the evaluative and critical-analytical skills—is prompted by the limited empirical research about how this age group approaches conflicting socio-scientific information (Paul et al., 2019) as previous work has tended to focus on older cohorts and has taken an epistemic, rather than a literacies, lens (e.g. Barzilai et al., 2015; Bråten et al., 2019; Delgado et al., 2020). In this way, much of the previous research has focused on upper secondary (e.g. Bråten et al., 2019) or tertiary students (e.g. Bråten et al., 2009) with analysis grounded in educational psychology. At the heart of such endeavours, however, is the need for sophisticated reading skills, and for teachers, an understanding of how to advance student evaluative literacies in English classes, with these literacy skills increasingly complicated by accelerated shifts to digital platforms to source information (Coiro, 2021; Coiro & Dobler, 2007; Leu et al., 2015; Scholes et al., 2021). New skills, strategies and dispositions may be required to locate, evaluate, synthesise and communicate information online (Leu et al., 2004).

To contribute to the field, we adapted a mobile phone socio-scientific scenario (Bråten et al., 2014) for a cohort of 45 middle school students (13–14 years of age) and asked them to talk about the strategies they would use to search for information about health risks associated with *mobile phones* (e.g. mobile, smart or cell phones but hereafter referred to as a mobile phones). We asked the students to imagine that a close friend was worried about the health risks of using their mobile phone and had asked them for advice. They were then prompted to describe how they would search for information about the issue and how they would know if the information was reliable. Asking the question about reliability was intended to prompt participants' evaluative thinking about how they would trust and justify the evidence they sourced (Bråten et al., 2009).

This scenario was chosen as many middle school students are familiar with mobile phones and are at the age when they own or regularly use these devices to investigate topics of interest. It is also a timely scenario, as socio-scientific issues related to mobile phones remain topical and there is still no evidence-based consensus on associated health risks and multiple sources of 'truth' about such use (Khurana et al., 2009). As such, mobile phone research is arguably 'science in the making' (see Latour, 1987) as new evidence comes to light and young people may have to reason and justify their standpoints concerning trustworthiness and decision making on issues connected to health that are ever-evolving.

New research is needed if we are to prepare students in literacy classrooms to make meaning of the endless amounts of conflicting information that they encounter each and every day on the internet (Coiro, 2021; Coiro et al., 2016; Coiro & Dobler, 2007; Mills et al., 2022). We were interested in contributing evidence-based understandings to extend student literacies in schools and to prepare them to read and evaluate conflicting evidence (Chinn et al., 2020, 2021; Lin & Johnson, 2021). As educators, however, we need to understand how students approach sourcing to be able to respond appropriately (Castek & Coiro, 2015). The line of investigation in this study aims to add new knowledge about the strategies students draw on to search for information so that educators can prepare their students for evaluating conflicting information (Lin & Johnson, 2021; Mills et al., 2022). First, we present critical research which informs our current study, focusing specifically on the demands of reading to source information in the digital age. We then detail the qualitative methods highlighting how the thematic analysis was conducted. Third, we present our findings related to the themes

that emerged, concluding with our interpretation of the implications for reading pedagogical practices for English classrooms.

Sourcing literacies

New modes of communication require new literacies, particularly as people increasingly engage with online search engines, hyperlinked webpages and multimodal media, and move from traditional print-based texts with material anchors to non-linear reading (e.g. jumping from page to page and from site to site) with disruptions from popups, alerts, notifications, hotspots or links (Mills et al., 2022). Leu et al. (2013) note the way that new literacies of the internet include the skills, strategies and dispositions necessary to successfully use and adapt to rapidly changing information technologies. Key, here, is that as information technologies change and evolve, these literacies are continually evolving in response. This ongoing evolution can cause tensions in the field as scholars interested in literacies continue to perpetuate a lack of conceptual clarity about such a notion, and risk oversimplifying digital reading as a singular entity analogous with reading text on a screen (Coiro, 2021).

The internet undoubtedly offers endless sources of information on topical issues; however, research continues to highlight that young people are often not prepared to make meaning of conflicting accounts of evidence (Kiili et al., 2021) and the achievement gap for online reading may be widening based on access to technology resources and experience on the internet (Leu et al., 2015). Interventions that foster student reading from multiple information resources has increased over the last two decades (e.g. Brante & Strømsø, 2018; Bråten et al., 2018). However, there has been limited work in the elementary years (e.g. Macedo-Rouet et al., 2013) with Paul et al. (2019) pointing to the way elementary students default to the stance of the benevolent-expert author and Kuiper et al.'s (2008) study of fifth grade students identifying an absence of any incidents of trustworthiness evaluations. Coiro and Dobler's (2007) work with skilled adolescent readers suggests that successful reading on the internet requires cognitive flexibility and complex applications of prior knowledge sources, inferential reasoning strategies and self-regulated reading processes.

While debates continue about the role that print and digitally mediums play in text comprehension (Singer & Alexander, 2017), reading online clearly requires a range of traditional skills to decode, comprehend, and synthesise information but also skills to actively navigate hyperlinks, construct personal reading paths and evaluate a range of sources with various levels of reliability (Scholes, 2022). We consider sourcing as attending to, evaluating, and interpreting information (Bråten et al., 2018). Successful sourcing online then also requires cognitive skills to engage with multiple and often conflicting multimodal texts (Mason et al., 2010; Mills et al., 2022) and ways to deal with the intangible nature of the world wide web. In this way, the advent of online information expands the skills students need to engage with texts in and outside their classrooms (Lankshear & Knobel, 2011) with personal approaches to meaning making affecting processes and outcomes of sourcing (Bråten et al., 2011). However, the literacy curriculum and pedagogy in middle schools may struggle to keep up-to-date and account for the accelerated technologies and related demands (Coiro, 2021).

Shifts from print-based decoding to reading in digital technologies involves very different material experiences in how we engage the body and mind (Mills et al., 2022). Print-based texts are characterised by a high level of stability, deriving from materiality. Arguably, readers do not need to focus on the delivery of the texts and can focus solely on the content (Bolter & Grusin, 2000). A physical book can be held, touched and felt by the reader as an embodied, immersive experience. A tablet, iPad, computer or phone is a multimodal and multifunctional technological device that does not engage the tangible

experiences of turning pages, contributing a very different tactile experience that provides access to a wide array of information and unpredictable reading pathways that may be overwhelming. With digital online texts, the tangibility that helps navigate the text is arguably reduced. The 'material anchors' with which the meaning of the text is associated are lost, and therefore the need for critical decision making is foregrounded where the reader must actively search and navigate hyperlinks to construct personal reading paths through a range of sources with various levels of both readability and reliability (Scholes, 2022; Wolf & Barzillai, 2009).

New theoretical understandings needed to understand new literacies

As students engage with a plethora and wide range of online texts, recent research suggests young people do not engage in deep, critical and evaluative reading—instead they skim, scroll and scan for key words and are often distracted by hyperlinks, popups, alerts, notifications and hotspots (Annisette & Lafreniere, 2017; Mills et al., 2022). Often, they do not take the reliability (and trustworthiness) of the source(s) into account (Bråten et al., 2009; Kuiper et al., 2008). Reading behaviours increasingly include 'stacking' as young people attend to multiple tasks at the same time—using multiple devices to conduct often unrelated tasks—and 'meshing'—as they simultaneously communicate content with others that is being viewed (Davidson & Harris, 2019). The rise of 'fake news' highlights the erosion of gauges to filter the trustworthiness of information in the internet age with the spread of disinformation now global (Lazer et al., 2018). This lack of critical engagement and deep reading of digital materials is illustrated by young people's use of the labels TL:DR (too long; did not read) and SR:MP (skim-read; missed point) as they struggle to cope with the never-ending amount of information to navigate that requires shifts towards new forms of material engagement (Mills et al., 2022).

In a digital area, making decisions about the validity of sources and evaluating information when faced with conflicting texts requires sophisticated reading, interpretation and evaluation (Mason et al., 2010). We would argue these skills pose challenges for many middle school students who may not approach text through a validity lens and need to search for and access knowledge online for academic endeavours. While it is assumed that students have the necessary skills by the time they transition to secondary education, research continues to highlight how superficial engagement with texts remains ingrained (see Mason et al., 2010; Wolf & Barzillai, 2009). Of concern, as students are increasingly presented with controversial, socially relevant, real-world problems (health pandemics, genetic testing, global warming), some may not be equipped with the skills to translate conflicting information into evidence-based knowledge as they progress through school (Stahl et al., 2021).

Reading information online related to socio-scientific issues then adds another layer of complexity to the issue for students. Never before have young people been so exposed to open-ended issues informed by science that draw on their approaches to knowledge. Furthermore, engagement with socio-scientific issues is now part of daily life for many students across the world. Perhaps beginning with the rise of Greta Thunberg as a 'famous' climate change activist, young people from countries around the world are interested in being informed and taking a stance on controversial issues, even walking out of class and marching in the streets to demand action. In the context of such issues however, contradictory information, misinformation (false), disinformation (misunderstood) and advocacy for competing theories abound (Mills et al., 2022). The idea of universal truths has been replaced with many truths, many knowledges and many forms of reason (Lyotard, 1984). Information is not knowledge and with the rise of 'fake news', students may have limited experience in making

the evidence-based judgements needed to engage as informed and active citizens in such contexts (Barzilai et al., 2015).

Understanding student approaches to sources of knowledge

Given the shifting nature of student engagement with controversial information online, we believe that there is a need to understand the practices students draw upon when they seek answers to socio-scientific issues. This is seminal to developing pedagogical approaches to better prepare students to make meaning in online spaces (Castek & Coiro, 2015; Coiro, 2021). To inform understandings, we look to the demands of online tasks related to issues such as mobile phone health risks—the focus of our scenario presented to the students in the study.

As a student approaches the task by googling mobile phone health risks on the internet, they need sophisticated understanding of how to read, decode texts, navigate hyperlinks and construct personal reading paths to then access, synthesise and evaluate findings in a multimodal digital space. There are many demands, as such a task in a hyperlinked space requires complex skills and navigation. As students engage in the task, they will need to draw on print-based skills such as previewing the linear text, making predictions while reading, interpreting the meaning, making connections within and between texts and integrating textual clues with background knowledge. At the same time, they will also need to self-regulate their personal reading pathways amidst endless amounts of information available on the web, avoid distractions by hyperlinks, videos, pop up advertisements and the tendency to skim and scroll through texts, and evaluate the sources (Mills et al., 2022).

There is much to coordinate and navigate online, particularly as companies spend billions to bring users biased information (Econsultancy, 2012) and interfere with the results which appear on search platforms such as Google. Algorithms may change results based on artificial intelligence promoting sites, and results adapt according to personal, political and information biases (Epstein & Roberston, 2015). As students select their first web page, the journey involves making decisions about which hyperlinks to navigate, and in which order, with efficient navigation influenced by sequencing pages that are relevant to the reading goal to maintain logical coherence between the current and the linked page and avoiding big 'semantic jumps'. However, students may also decide to just follow interests or scan aimlessly (Salmerón et al., 2020). Once they are confronted by several mixed modality sources representing different perspectives, or contradicting information about mobile phone health risks, they will then need to evaluate and integrate the information across multiple sources (Salmerón et al., 2020).

There is a constant need to evaluate to make judgements as socio-scientific issues on the web offer multiple accounts that differ in scope, argument, and evidence, with sources also varying in their purpose, credibility, and authorship. Evaluation to justify online knowledge requires comparing or establishing consensus across multiple sources, drawing on criteria to evaluate conflicting perspectives and consideration of the reliability or trustworthiness of the information (Anmarkrud et al., 2021; Barzilai & Zohar, 2012; Mason et al., 2011). Such literacy practices require explicit skills that draw on criterion to establish the trustworthiness of the source and complex to- and- froing to evaluate the information and come up with an answer to the question that instigated the sourcing. Rather than reading to merely find the 'right' answer, evaluative reading involves sifting through multiple sources of information to make an informed decision about the answer, perhaps even integrating different perspectives to construct knowledge (Mason et al., 2011).

In the age of digital convergence, we need empirical data around the decision-making skills young people use to investigate controversial issues in the digital space. Furthermore,

our knowledge is limited regarding whether this age group relies on the internet as a source of knowledge or whether they adopt more traditional approaches (e.g. print-based books, knowledgeable peers, adults, parents and so on). Given the accelerated transition to digital technologies in schools (Lin & Johnson, 2021; OECD, 2021), we assumed that many students defer to sourcing information online, but we were motivated by the need for more robust understanding of student processes. To better understand how students approach sourcing information online and beliefs about reliability, in the following section we present the study that informs this article to explore how a cohort of middle school students approach sourcing information regarding a controversial socio-scientific problem.

METHODS

The article draws on a study conducted in middle schools in Australia to investigate student experiences of literacy in science (see also Lunn Brownlee et al., 2021; Scholes et al., 2021; Stahl et al., 2021). In this article we use an exploratory design (Stebbins, 2001) with stimulus material to investigate an under-researched topic in literacy to develop new insights related to middle school student approaches to sourcing information about a topical socio-scientific issue. We report on data to explore one over-arching research question—*To what extent do students report evaluation skills when responding to the mobile phone scenario and, if so, what sort of evaluation skills do they draw upon?* As noted earlier, to answer this research question, we adapted methods for this age group (Bråten et al., 2014) and we presented middle school participants with a scenario based on mobile phone health risks with follow up questions:

Scenario: Imagine that a close friend has told you that he/she (same gender as participant) is worried about the health risks of using their mobile phone. He/she has asked you for advice and you are going to search for information about the issue.

Q1. Where would you go to get information? Why?

Q2. How would you know if the information is reliable?

Our aim was to use this mobile phone scenario to elicit students' approaches to sourcing information more broadly to find out their default source pathway and the criteria they would use to determine reliability of such sources as potential mobile phone health risks represent a controversial socio-scientific issue (Khurana et al., 2009). Health issues associated with mobile phone usage are topical with this age group as they are often new users who may have parental restrictions on their usage of such devices and may be exposed to controversies about health risks.

Participants

Maximum variation purposeful sampling strategy was implemented to document responses in diverse sites (Creswell & Poth, 2018). Following ethical protocols and the approval of principals from two schools, we obtained informed consent from teachers and the students in their classes. We specifically recruited two schools representing different populations—one metropolitan and one rural—as there has traditionally been an urban–rural gap in educational experiences and academic performances. We also recruited participants until we had

an acceptable gender balance and some representation of ethnic diversity, culminating in 45 students aged between 12 and 13 years old (24 boys and 21 girls) attending Year 8 at two sites. These students comprised 36 students who identified as white, while others identified as Russian ($n=2$), Sri Lankan ($n=2$), Italian ($n=1$), Pakistani ($n=1$), Indian ($n=1$), Vietnamese ($n=1$) and Malaysian ($n=1$). The demographics at both schools were considered average based on the relevant Index of Community Socio-Educational Advantage value designated by the Department of Education.

Data collection

To address the research question, individual, one-to-one interviews were conducted with participants to elicit their responses to the mobile phone health scenario. The research team of four all adhered to the interview protocols and maintained ‘an atmosphere conducive to open communication between interviewer and respondent’ (Gubrium et al., 2012, p. 32). Researchers talked individually with participants for approximately 20 min in quiet locations around the school, such as the library resource room. Interviews were audio-recorded and later fully transcribed.

Analysis

The research questions guided our analysis. We used template analysis (King, 2004) to identify dominant themes drawing on existing literature and prior research (deductive coding) and then adapted these themes during a reflective process of analysis (inductive coding). Through this process, a coding template was established that could be used to initially code transcripts and check for consistency. Two team members first coded six interviews each with iterative peer-checking of assumptions and interpretations. Table 1 provides an overview of the three themes that emerged through coding student responses. In the table we illustrate the categories based on our interpretations of themes and examples of the interview narrative that represented the category.

Following this process, the remaining interviews were coded by one researcher with an additional two researchers working to confirm the coding with any discrepancies discussed during team meetings to reach a consensus (Åkerlind, 2012). This systematic analysis informed our theoretical interpretation presented.

FINDINGS AND DISCUSSION

In the following sections we illustrate the findings from our interview thematic analysis. Student responses detailed how they would access information related to the socio-scientific

TABLE 1 Overview of themes that emerged for judging if information is reliable.

Categories	Examples of student responses
Mistrust of the internet—people can be reliable sources	‘The internet is unreliable—ask your parents’ ‘You would not go into Google—ask Mum’
Reliable sourcing requires consensus across sources	‘If it’s on multiple websites its reliable’ ‘See what’s the most common answer’
Criteria help to determine a reliable source	‘I’d use official sites such as health.org.gov ’ ‘You should research the biography of the person who wrote it’

scenario presented to them and their justification related to reliability of the information. To exemplify our interpretation of the findings we present the three themes that emerged from the data (see Table 1), namely: (i) mistrust of the internet—people can be reliable sources; (ii) reliable sourcing requires consensus across sources; and (iii) criteria help to determine a reliable source.

Mistrust of the internet—people can be reliable sources

In our analysis of student responses to the mobile phone health scenario, 24 out of 45 students expressed mistrust of the internet and the need to confer with more trustworthy sources such as parents, adults, scientists and experts in the field. In this way, students conveyed a belief that knowledge is located within a person beyond the students and we coded these responses *mistrust of the internet—people can be reliable sources*. Further fine-grained analysis also indicated that knowledge was represented by one right answer or a universal ‘truth’ taking an objectivist epistemic stance. There appeared to be a didactic relationship in student understandings—with a belief that the question asked required one correct answer.

As one participant, Kelly, explained in the following narrative, parents are a useful source of information because they have personal experience and knowledge:

Author: Why would you ask your parents about mobile phone health risks?

Kelly: Because they have *been through all the experience* with phones and all that, and *they would know*.

Author: How would you know if the information is reliable?

Kelly: Because your parents have been through it and they would know what's healthy. *They would know* that it's unhealthy for you because they used to be on their phones when they were younger.

In Kelly's account, information is transmitted from adults based on their experiences and there is a lack of inquiry about evidence, as people's knowledge is trusted and valued. In this way, we identified an absence of any trustworthiness evaluation (Kuiper et al., 2008). Similarly, another participant, Alex, thought it was important to seek out information from ‘people that I trust like parents’, illustrating a sense of acceptance of such transmission with no need to evaluate the reliability of such perspectives (Anmarkrud et al., 2021).

According to the students in this category who valued people's input to address the mobile phone scenario, general searches on Google and sites such as Wikipedia were particularly tenuous and could not be trusted. This is regardless of the fact that Wikipedia is highly regarded as a prominent health information resource by many professionals, with editors voluntarily editing existing content and translating studies and reviews into plain language for users (Smith, 2020).

Apparent in the data were growing concerns about the vast amount of disinformation available online. It may be that these students have internalised concerns about algorithms, misinformation (false), disinformation (misunderstood) and competing theories that infiltrate the internet (Mills et al., 2022). Alternatively, this scepticism may reflect a broader societal concern that young people need to be protected from the dangers of the internet, which does not necessarily reflect strategies for accessing and evaluating such information. The following excerpt illustrates Taylor's scepticism about the internet—common among the students in this category—with concern that you cannot find an objective ‘truth’ and the need to confer with people, such as parents, as a reliable source:

I'd Google ... but probably *ask my parents* that as well. Because there's *things on the internet that aren't true*, so you just do not know what to believe, so if you ask your parents, they'd probably give a bit more details.

While Taylor originally defaulted to 'Google' to access information, mistrust of the internet shifted the focus to identifying what is true as he/she perhaps seeks a universal 'truth' or sourcing the 'right' answer is the goal without any need for evidence-based judgements (Barzilai et al., 2015). Given that the flow of information offers many truths, many knowledges and many forms of reason (Lyotard, 1984), this would appear limiting.

A common reason cited for mistrusting the internet was scepticism about sites such as Wikipedia. This scepticism appeared to be based on their perceptions related to the lack of reliability, as students believed it was 'really easily hacked and there are lots of opinions that are really different' (Cara). The presence of subjectivity appeared to concern Cara. Students were knowledgeable about the fact that Wikipedia is written as a collaborative effort by volunteers, and regularly updated, yet there appeared to be little knowledge of any checks and balances in place to combat misinformation. For many students, it was these factors, as well as the fact that 'anyone' could contribute to the website, that made Wikipedia unreliable. For instance, examples of responses included:

Because like Wikipedia is unreliable, people could just go on there, edit it, and put it back on.

(Tara)

You should see who wrote it; if it's Wikipedia, it's obviously not reliable because anyone could write it.

(Dylan)

For some students, their words suggested that reliability was something which could never be 'known'. For example, Adrian suggested it was impossible to know whether something on the internet was reliable because 'Reporters, especially, they can say whatever they want. They can put it on the internet'. While these students still spoke about using the internet to find information, they tended to express scepticism and beliefs about the unreliability of sites. In fact, because of the need to find the 'right' information and concerns around the trustworthiness of websites and hacking, particularly sites like Wikipedia and Google, these students deferred to adults. For instance, they suggested they would seek out people who work in the field as a way of validating the accuracy of the information. As Josie explained:

Josie: You would not go into Google 'cause Google's not always right, because you would not wanna just Google it.

Author: Where would you go?

Josie: To someone that's job is to help people with stuff like this. Because they would obviously know the answer. 'Cause it's like their job.

Author: Well how would you know if that information is reliable?

Josie: Because it's coming from someone who knows a lot more about that than someone who does not know. I'd go to someone like a school helper maybe.

As Josie describes her mistrust of 'Google', we see here how even when prompted, students within this cohort struggled to discuss reliability in a complex way as the knowledge is 'coming from someone who knows a lot' implying a default to an adult who holds the knowledge, transmission of knowledge from another person and only one source of truth.

Scientists, or experts, were commonly named as reliable sources for information that could be obtained directly such as face-to-face because, ‘Yeah, you go to a scientist because they would know more than you could find on the internet or from a trusted friend’ (Jack). In Jack’s commentary, the scientist is positioned as an expert (Kuiper et al., 2008) and as a better source of information than the internet or a trusted friend, but we noticed that this reliance discounts the broad array of information related to health issues such as mobile phones across multiple sources. As Tobi went on to explain;

Scientists have a lot more experience than people like me, who do not really have much idea. I’ve only had a phone for not even a year, so ... I do not really have an idea about things like that. But a scientist would have studied this for a while and then done experiments with different students and seen the different outcomes and then compared them. So, they would have a bit more of an idea.

In Tobi’s case, a scientist appears to be the gateway to knowledge with no hint that science related to the issue may be conflicting or evolving with new evidence in the making (Khurana et al., 2009; Latour, 1987). Students who spoke about accessing information through scientists or experts suggested they were more reliable because they had experience in the field and had done the research. For these students there was no indication that science can be contested or that there may be ongoing controversy over the potential health risks of mobile phones (Khurana et al., 2009). In our analysis of the narratives, many students appeared to default to people owing to their mistrust of the internet. Rather than sourcing information and evaluating the evidence, people beyond the student were highlighted as important sources of knowledge and the information they could provide was unquestionable.

Reliable sourcing requires consensus across sources

Of the 45 students we talked with, 14 students gave answers which we coded—*reliable sourcing requires consensus across sources*—as responses focussed on finding multiple sources, including a range of websites and people with similar answers, to ensure reliability. Here we noted awareness of subjectivity. These responses implied that information needs to be cross-checked or triangulated. This checking involved looking for similarities in the information presented, and common answers, rather than conflicting accounts which would need to be evaluated. As the following examples reflect, student searches on the internet appeared to be based on finding consensus across common answers:

I think that I would just search on the internet and then look at multiple things to see if *anything is similar*. Well, if they were reoccurring issues or things, then I know it wasn’t one person who thought of that and it’s approved I guess.

(Kate)

Probably the internet because it has a lot of stuff and I can go on a few different websites and see what the *most common answers* are. Well, I’d go on quite a few websites, ‘cause if a lot of them are saying it’s this answer, or similar to this answer, it probably is that.

(Tessa)

I'd look through multiple sites to see if I could *find the same answer*. Yeah, I'd just look through different sites and see if there's the same answer.

(Jesse)

You might have to go to more than one website and if it's all varying then you'd have to see if you can *find two the same* and that might be probably more reliable, but if they are all varying, like a lot different then it's probably not quite reliable.

(Bella)

Yeah, it's hard to know if one's reliable or not. So, I'd probably check multiple websites and see if they have got *like the same information* so then I can kind of see if it's reliable or not. Yeah, like check multiple websites.

(Jake)

No evaluation of the information appeared to be needed but instead there was a reliance on finding content which was repeated. Given increasing issues with confirmation bias and algorithms on the internet with artificial intelligence promoting sites, and adapting results to personal, political and information biases (Epstein & Roberston, 2015), it may well be that the students will very quickly be offered similar accounts of the same perspectives during their search on the internet (Mills et al., 2022), without the need for evaluation of controversial accounts.

In a similar way, Josh recommended cross-checking by asking multiple people about their experiences:

Josh: Personal experiences, I think, because I think I've had personal experiences of where I've gotten a little bit addicted [to his mobile phone]. And I think this one's more people's experiences.

Because on the internet, it can just be ... Well, it can be true, like the websites and where you got it from. But asking real people, not on the internet, like, 'Oh, have you been on your phone recently?' and asking all these questions and writing the notes down, it could be more helpful.

Author: How would you know, if the information is reliable?

Josh: Because if you are asking real people in front of you, it's true because they have experienced it. Mainly just personal opinions, I think.

We noticed in this narrative that Josh refers to people as reliable and more helpful because 'it's true' based on people's experience. It is also interesting to note that Josh refers to asking questions and writing notes, perhaps a form of personal research. For student responses included in this category, students did indeed offer approaches to determine the reliability of the sources; however, this was limited to comparing multiple websites or people's opinions. These approaches appear to discount the value of research and evidence-based information that is readily available on the internet.

Criteria help to determine a reliable source

In our analysis we coded seven of the 45 student responses as *criteria help to determine a reliable source*, as these young people looked to evaluate information based on their personal criteria, language features or credentials. These students conveyed more trust of the

internet, and this appeared to be because they had a means of evaluating information. For these students, more trusted websites included official education or organisational sites or sites that they had heard about in internet safety talks at school. They drew on strategies to use criteria to determine what they believed to be reliable information, implying more sophisticated approaches to the task.

Tom, for instance, explained that there could be different perspectives on mobile phone health risks offered on the internet and explained that he would 'probably tell the friend the different points of view. That could all be helpful and right.' This was one of the few responses that demonstrated an understanding that there may be variations in perspectives on the health related issues related to mobile phones. Tom was also one of the few students who identified that different points of view could be helpful to know. When probed about what advice would be the most reliable, Tom explained that he would draw on his own beliefs as a criterion and choose the 'one that most makes sense'. In the following narrative Tom elaborated:

I'd probably go on the internet. So, I would probably search up what to do when you are worried about health risks caused by your phone. Something like that. I'm not gonna just go on one and be like okay, I do not trust that. I'm gonna go on quite a few of them, see which ones come up the most, and I'd also go off what I think as well. Like if I think it's actually good or if it's a stupid idea. After I'm done looking at all the websites, and I see which ones I think are pretty good, I'd search up the specific one, like is that good for whatever, like the health risks and see what all these other ones say.

Here we see Tom cross-checking but going a step further to use personal criteria based on 'good' or 'stupid' advice to make judgements about the sources, relying on his judgement about what is 'actually good' information. In this way, criteria were used to see 'which one sounds the best and the most reliable and reasonable'. He would look for information that sounds the most correct and reasonable 'because there's other stuff that doesn't sound right or just is made up. It won't be right, and it won't work, so it won't be the best data or information.' For Tom, there was an awareness of many sources of knowledge.

For other students, the criterion was based on expertise. For instance, Noah thought the reliability of the author was important and said:

Noah: I'd probably go to the internet, really, because I guess there's lots of studies and research that have been put up on the internet and that you can see, and I guess you can get advice from that.

Author: So how would you know if the information is reliable?

Noah: Well, I guess if you go down to a *bottom of a website it has the author and stuff, so you can click on that and see if they are a reliable person, if they are from a university or they have won a university degree or something like that.*

Noah's response was interpreted as more sophisticated as he included criteria for evaluation as well as more complex understandings of how to access information and determine reliability. Jamie similarly spoke about trusting experts on the internet, suggesting they would Google the names of the authors/experts to find additional information about their expertise. According to Jamie, reliability can be determined based on the credentials of the author:

Because there's usually a *bibliography of who wrote it on the internet website and who did it, and you would read it. If they were famous and people knew*

them, you would type the name of them, and then if it said Professor Fluffy Bottom or you would search them.

Furthermore, Jamie suggested doing some research about the author would provide reliability to support the claims made on the website, providing a tool for evaluating the evidence (Kiili et al., 2021).

In a similar manner to Jamie, David gave a complex answer and spoke about how you can not only look for specific expertise but also look for that expertise on specific types of websites.

Author: Where would you go to get information?

David: Probably *official sites such as* [health.org.au](https://www.health.org.au), like those sites because you *cannot go to the news, because that's their point of view*, I know this because of the debate on video games. There's unlikely to be books about this as *humanity's at the point where most information is recorded on technology and if there is a book, you can read it but it's not going to be very open to many sources of information, it's just one source*. Yes, so go to official sites, I would not go to personal sites and if I did go to scientists' sites *I would compare all of them to see if there's a variable or it was personal*.

Author: How would you know if the information was reliable?

David: If you generally know the company or person or scientist who made it, if you know them well and you trust them then yeah, that would be reliable. I *generally trust .gov and .org sites* because if they are .com it means you are getting paid so people can make up stuff like Buzzfeed to get free money, *but if you do .org or .gov, I believe that it is educational* not a fake website.

Here, we see that David displays an understanding of the complexities of online research, highlighting the importance of knowing who an author is, but also of author intent to make an evaluation. The dialogue seems to be suggesting that creating information for altruistic reasons makes that website more credible than someone who shares information where there is a payment involved.

In this category, students offered more complex responses that illustrated that they had some criteria for sourcing information related to mobile phone health risks and a process for dealing with conflicting perspectives to consider the trustworthiness of the information (Anmarkrud et al., 2021; Barzilai & Zohar, 2012). These responses tended to be more complex and detailed sophisticated processes for navigating online sourcing of information by selecting information resources based on features of the sources, such as the credentials of the authors (Bråten et al., 2019). The range of strategies, however, was limited to personal criteria, language features or credentials. The students' self-reports did not provide insights into strategies based on prior knowledge, inferential reasoning or the need to self-regulate reading processes (Coiro & Dobler, 2007) owing to the increased demands as readers move from print to engagement with online search engines, hyperlinked webpages and multimodal media that would concurrently offer disruptions from popups, and ongoing distractions (Mills et al., 2022).

CONCLUSION

In answer to our research question, the majority of students in our study did not report sophisticated skills for evaluating information related to the mobile phone scenario. Of the 45 students in the cohort, 24 students expressed mistrust of the internet and the need to confer

with more trustworthy sources such as parents, adults, scientists and experts in the field, taking such information at face value and as the 'truth'. While many of these students said that they would default to experts such as scientists to address the mobile phone scenario, we wonder if they would have expressed such faith in a post-COVID world where communication around the pandemic has seriously eroded trust in scientists for many individuals across nations (Algan et al., 2021). A further 14 students used cross-checking of multiple sources looking for common answers to ensure reliability but did not express any need for evaluation of these sources.

Only seven students indicated strategies that implied the use of criteria to determine reliability and as a means of evaluating information. These students appeared more comfortable engaging with online platforms to access information. A surprising finding was the amount of scepticism that students expressed about the internet. This lack of engagement with the internet as a source of evidence-based information was unexpected given the increasing reliance on technology-mediated communications in schools and society more broadly (Lin & Johnson, 2021; Singer & Alexander, 2017). In the Australian context, where the study was conducted, there has also been a history of teaching critical literacy with the curriculum asking teachers to develop student skills and dispositions to analyse and understand texts (<https://www.australiancurriculum.edu.au/f-10-curriculum/english/key-ideas/>). However, it may well be that the skills needed to evaluate texts are becoming more complex and teachers require support to facilitate more epistemic informed pedagogical approaches—something that has been identified as a global problem (Chinn et al., 2021).

Our findings show that students do not rely only on information from the internet but rather rely on multiple sources to research a problem. While teaching evaluation of information has always been a pre-requisite in the curriculum, it may be that the digital age is posing complex challenges for both students and teachers. This suggests that digital platforms place new demands on students to make meaning of conflicting information as they try to reconcile socio-scientific dilemmas (Coiro et al., 2016) and would benefit from learning how to use criteria to make evidence-based judgements as they read and evaluate conflicting evidence (Chinn et al., 2020; Lin & Johnson, 2021).

Not only did many students express little faith in the internet, but many students displayed a strong distrust or at least scepticism, suggesting that they have been explicitly taught to some degree about the (un)reliability of the internet. This aligns with Burgess and Anderson's (2020) suggestion that there are assumptions made about the savviness of young people in online forums, particularly in terms of 'the lack of academic engagement with technology integration in many urban homes' (p. 1). These assumptions require problematising. Here we draw connections between the student and the learning environment. Schools themselves may be distrusting of the internet more broadly, where Mirra et al. (2018) suggest an overall 'protectionist approach' to media and digital learning within schools where content is characterised as 'a genre of informational text roughly equivalent to print-based forms like essays or books and focuses on teaching students to understand its structure and purpose to avoid being manipulated' (p. 14). Given that students were interviewed in their schools, they may have expressed their mistrust of the internet, believing that such a perspective was the 'correct' answer in the given context.

Interestingly, while it was common for students to discuss the positives of finding consensus across information as a way of investigating reliable information, this attitude did not extend to Wikipedia, a website created around notions of consensus and collaboration—with English Wikipedia averaging approximately 830 million visits per month globally (Wikimedia Statistics, n.d.). Smith's (2020) review positions Wikipedia as a prominent health information resource for the public, patients, students and practitioners seeking health information online. In some instances, the medical community contributes to Wikipedia's health and medical content editing sites as new knowledge comes to light. This approach was evident during

the 2014 Ebola outbreak in West Africa, where Wikipedia's Ebola content was drastically updated, translated to over 100 languages, and viewed more than 89 million times during that year (Shafee et al., 2017). Instead of teaching prerequisite skills for surfing the net, in many classrooms it may be easier to ban platforms such as Wikipedia (Maehre, 2009) with such approaches to censorship now highly visible in responses to concerns around ChatGPT.

Clearly, the process of searching for and making meaning of information online requires teaching reading skills underpinned by epistemic sophistication to interpret, make inferences, integrate multiple documents and justify reasoning (Chinn et al., 2020, 2021; Yang & Tsai, 2010). Reading online can present more challenges for some students—particularly when related to information texts (Singer & Alexander, 2017). When presented with conflicting information related to mobile phone health dilemma, on the whole, the middle school students in our study did not demonstrate an understanding of how to justify knowledge claims by evaluating different sources, often expressing an objective epistemic stance—where knowledge is viewed a right and wrong. This is a concern, as students increasingly engage in knowledge claims related to socio-scientific issues, or controversial, socially relevant, real-world problems (Bråten et al., 2019; Strømsø & Bråten, 2014). As the middle school years prepare young people for more complex literacy demands in the senior years, supporting young people to feel equipped to investigate topical issues and make informed decisions that they can justify would seem a priority. To be active and engaged participants in society, contributing to evidence-based debate about open-ended socially relevant problems related to the environment, agriculture or human rights, for instance, is an important part of informed citizenship and information literacy (Mills et al., 2022).

Educators can teach critical evaluation of information and the skills students need, bringing into the spotlight the role of thinking processes, understanding the fundamental nature of knowledge and how we justify the truth (Scholes et al., 2016; Scholes et al., 2022). Dialogic pedagogies are particularly important to advance such thinking (Lunn Brownlee et al., 2017; Lunn Brownlee et al., 2021). Students can engage in informed dialogic argumentation about alternative perspectives and justify their claims—leading to a better grasp of how competing claims can be evaluated and what kinds of arguments are relevant to evaluating them (Mills et al., 2022). Dialogic argumentation is an avenue for developing competencies in identifying and weighing positive and negative attributes of conflicting perspectives on a particular issue, judging reasons and evidence from different perspectives (Crowell & Kuhn, 2014). This is an essential feature of reasoning—the ability to construct arguments that relate claims to evidence is also important where students need to make rational judgments about controversial issues (Yang & Tsai, 2010).

Engaging students in controversy using strategic pedagogies, educators can teach disagreement, as a genuine, unresolved controversial issue on which even expert views diverge can be applied to literacy practices (Chinn et al., 2020). This approach is particularly important for developing a dialogic reading stance, which can be fostered as students and teacher co-construct meanings, generate multiple interpretations of texts and engage in fruitful critique (Barak & Lefstein, 2022). Such teaching can be challenging and requires positioning texts as contestable as critical reading evokes readers to probe the text's argument and assumptions (Murphy et al., 2009; Scholes et al., 2021).

New pedagogical approaches in literacy classrooms are urgent now, particularly as the flow of conflicting information about issues such as health highlights the need to emphasise evaluating and justifying evidence across curricula (Lombardi et al., 2017; Mills et al., 2022; Scholes et al., 2021). Critical for learning in the digital age, the idea of universal truths has been replaced with many truths, many knowledges and many forms of reason (Lyotard, 1984), requiring sophisticated literacies to navigate potentially conflicting, controversial sources laden with disinformation or misinformation. In this way, traditional practices employed to help students determine reliable sources to serve as evidence for their claims

in research now require a new level of discernment and analysis as ‘teachers and young people collaboratively examine the motives, techniques, and effects of multimodal texts with unparalleled power to influence how citizens think and act in public life’ (Mirra et al., 2018, p. 15).

We would argue that sourcing information in the digital age requires new digital multi-modal literacies that integrate skills to evaluate knowledge claims as readers access conflicting information but also the skills to navigate and read non-linear texts. Reflecting on the self-reports of the 45 middle school students in our study, it may well be that without these sophisticated literacy skills they are unprepared, and the internet is a place of uncertainty when you have limited skills to sift through the plethora of interconnected dynamic sites so that people offer a more convenient mono source of ‘truth’ without the need for any evaluation.

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There are no conflicts of interest to declare.

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Ethics approval was granted from the university funding the research and the Education Department of South Australia. All research participants gave informed written consent.

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