MERJ

Young Children and the Need for Critical Literacy and Epistemic Cognition Skills in the Post-Truth Era

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Abstract

Many children are active on the internet and on social networks, but their capacity to evaluate online information is limited. However, in the current era of post-truth and the infodemic, even young children are exposed to inaccurate information online. They need to understand how the internet works and how to evaluate the information they find there. In the digital information age, critical literacy is important for everyone. In this article, I focus on an aspect of critical literacy that has been neglected in the field of media education, namely epistemic cognition. I argue that children—even young ones—need to learn epistemic cognition skills and epistemic practices. I also argue that the AIR model of epistemic cognition theory and theories of making thinking visible could be used as a basis for teaching children critical literacy and metacognition in the post-truth era. I use these theories to create a framework that also includes principles of reliable science and journalism. Science and journalism are part of the so-called Constitution of Knowledge, an epistemic operating system that establishes rules for transforming disagreement into knowledge. In addition to critical literacy, children need scientific literacy, which can help them understand how accurate information and knowledge are (in ideal situations) created and evaluated, both on and offline.

Keywords: critical literacy, information evaluation, epistemic cognition, scientific literacy
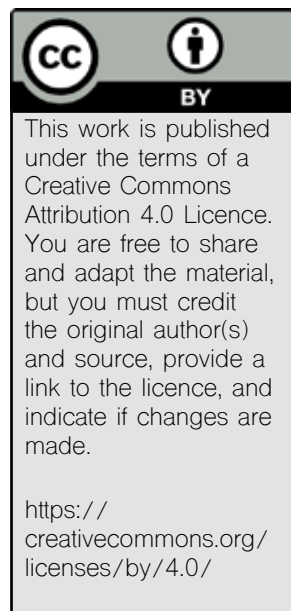
Introduction

Misinformation and disinformation online have been identified as one of the most important contemporary challenges to society (World Economic Forum, 2014; Wardle & Derakhshan, 2017; Colomina et al., 2021). At the same time, young children's lives have become intertwined with digital communication, entertainment, gaming, and

education (Ofcom, 2011; Danby et al., 2013; Chaudron et al., 2018; Erstad et al., 2020), and children may be exposed to misinformation and disinformation in different digital environments. However, young children have little understanding of the internet (Mertala, 2018; Murray & Buchanan, 2018; Eskelä-Haapanen & Kiili, 2019), and individual children's trust in online information varies markedly (Eskelä-Haapanen & Kiili, 2019). Children around nine to 12 years old begin to gain a better understanding of the internet's technical and social complexity (Yan, 2005) and start to be aware of its negative aspects and to develop different coping strategies (Murray & Buchanan, 2018).

The information children access on- and offline plays a central role in the formation of their beliefs, knowledge, attitudes, and views of the world. It is therefore surprising how little research has focused on young children's critical media and information literacy. Critical literacy has received very little attention in existing research on the literary practices of children zero to eight years old (Kumpulainen & Gillen, 2020). Furthermore, the internet is a quite specific information environment, and specific epistemic beliefs are needed for reading and learning online (Eskelä-Haapanen & Kiili, 2019). However, most existing studies of these beliefs, which concerns for example certainty of knowledge on the internet and justification of knowing, have focused on older students and adults (Strømsø & Kammerer, 2016).

Young children today develop reading comprehension and literacy skills while also learning to use the internet and internet-based devices. The internet can be seen as an epistemological tool; internet use can positively alter users' epistemic beliefs when they have appropriate guidance and engage in self-reflection (Tsai, 2004). Learning that the internet contains diverse and conflicting information may foster beliefs about the complexity and tentativeness of knowledge and the need to evaluate information (Strømsø & Kammerer, 2016).

The purpose of this article is to develop a theoretical framework for teaching and learning critical literacy in the context of young children's internet use. These skills can help children interpret information in the post-truth era, a time when the spread of mis- and disinformation online has increased. In this context, critical literacy is one aspect of media literacy. The traditional definition of media literacy has had many iterations since it was originally defined by the Aspen Institute in 1992. This definition identifies four phases of media literacy: access, analyse, evaluate, and produce communication in a variety of forms (Tyner, 1998). These key concepts are not based on empirical research on learning but draw on theories of media literacy. The list of media literacy skills is also surprisingly similar to Bloom's taxonomy of educational objectives (knowledge, comprehension, application, analysis, synthesis, and evaluation) and its iterations. For example, Anderson and Krathwohl (2001) identify the educational

objectives of remembering, understanding, applying, evaluating, and creating. On a practical level, media literacy practices are also thinking practices. I argue that, in the field of media literacy education, more attention needs to be given to research and pedagogies about thinking, reasoning, and epistemic cognition skills and practices.

Young children's internet use and inaccurate information online

In the United Kingdom, YouTube is the most popular website among five to 15-year-olds (Ofcom, 2017; 2018; 2019; 2020/2021), followed by TikTok, Instagram, Snapchat, and Facebook (Ofcom, 2020/2021). An EU Kids Online survey confirms that YouTube has become increasingly popular in Europe, followed by Instagram and other prominent apps (Smahel et al., 2020). The use of these popular sites and apps is restricted for children under 13. However, it is well known that age restrictions are not foolproof: significant numbers of children under 13 report using social networking sites or apps (Livingstone et al., 2011; Ofcom, 2020/2021).

Children aged zero to eight often watch their favourite TV programs and music on YouTube (Chaudron et al., 2018). Chaudron, Di Gioia, and Gemo (2018) find that very few children under six access anything online other than YouTube film clips, their favourite TV programs, and digital games. Children nine and older use the internet and social networking sites and apps in more diverse ways.

Online activities can be categorized in different ways. EU Kids Online identifies eight activities: watching video clips, listening to music online, communicating with family and friends, visiting social networking sites, playing online games, using the internet for schoolwork, browsing for things to buy or to see what things cost, and looking for news online (Smahel et al., 2020). Children participate in all these activities. This indicates that children use the internet daily for many different purposes.

Daily internet use, including the use of social networking sites and apps and video sharing platforms (e.g., YouTube and TikTok), exposes children to inaccurate information. The algorithms on platforms such as YouTube and TikTok provide recommendations based on the user's interests and viewing history, but these recommendations may be biased. For example, the COVID-19 pandemic has led to an abundance of misinformation related to the virus on Instagram (Quinn et al., 2021). The quality and reliability of information on COVID-19 vaccines on YouTube is poor (Chan et al., 2021), and TikTok's algorithm can lead users to viral misinformation, as well as far-right and hateful content (Little & Richards, 2021).

Three-quarters of children aged ten to 18 in 11 countries have encountered disinformation online, and one-third of these children

reported that they encountered even more disinformation during the COVID-19 pandemic lockdowns in spring 2020 (Lobe et al., 2021). A so-called infodemic has occurred alongside the COVID-19 pandemic. This infodemic is infecting our information sphere, but it is not only source of inaccurate information online.

Forty-three percent of 12 to 15-year-olds in the United Kingdom have seen news stories online that they thought were fake news (Ofcom, 2018). Furthermore, a survey of 26.000 15 to 24-year-olds in 26 countries (Plan International, 2021) revealed that 46% of adolescent girls and young women have felt sad, depressed, stressed, worried, or anxious due to online misinformation and disinformation. Discriminatory, racist, violent, and otherwise harmful content also makes children and young people feel unsafe online. According to the EU Kids Online Survey (Smahel et al., 2020), only 60% of European children aged nine to 16 report feeling safe online always or often.

Almost half of the teens and young people in these large surveys, especially girls, encounter inaccurate information and do not feel always comfortable on the internet. According to the EU Kids Online Survey (Smahel et al., 2020) the difference between boys and girls is nine percentage points: 61% of girls and 70% of boys feel safe online. However, these surveys focus on pre-teens and young people. There are very few large surveys of young children and their experiences with inaccurate information online.

There are many reasons for this gap. Firstly, children who are still learning to read have a limited ability to respond to survey questions. Therefore, surveys targeting young children are usually presented to their parents instead. Secondly, due to the ethically sensitive nature of the topic, it may be difficult or impossible to ask young children questions about inaccurate information online. Thirdly, young children have limited abilities to evaluate information (Kiili et. al., 2018) due their limited capacity for epistemic cognition, which means "the ability to construct, evaluate, and use knowledge" (Greene et al., 2016, p. 45). Epistemic cognition is also an important issue related to critical literacy, and we will return to it later in this article. However, younger children, like older ones, may be exposed to inaccurate information when they use the internet and social networking apps.

Many different recommendations have been offered for fighting inaccurate information online and protecting children from harmful and untrustworthy content without impinging on their right to information (Internet Matters, 2020; Howard et al., 2021; eTwinning, 2021; UNICEF, 2021). Children have a right to credible, accurate information in digital environments

(United Nations Convention on the Rights of the Child, 2021).
Critical literacy and epistemic cognition
Digital literacy is one component in the fight against disinformation (European Union, 2021). In October 2021, the EU Commission launched an expert group on disinformation and digital literacy to develop guidelines for fighting inaccurate information and teaching digital literacy (Killeen, 2021). EU bodies promote the concepts of digital literacy and media literacy, but critical thinking and critical literacy are part of these literacies (Trültzsch-Wijnen et al., 2020).

According to David Buckingham, literacy, including digital literacy, contains a critical dimension that involves analysis, evaluation, and critical reflection (Buckingham, 2007). Research by European Cooperation in Science & Technology (COST) Action on the Digital Literacy and Multimodal Practices of Young Children (DigiLitEy) draws on Bill Green's (1988) 3D model of literacy as a framework for understanding the holistic nature of young children's literacy practices (Marsh, 2020). Green's 3D model suggests that literacy as a social practice includes operational, cultural, and critical aspects. These elements are interrelated; an individual's development of literacy does not move in a linear manner from operational to critical. This means that critical literacy is part of young children's literacy practices as well; this skill is not limited to older children and adults. The operational and cultural dimensions of literacy enculture or socialize a reader into the dominant forms of culture and meaning making, but critical literacy gives readers access to "the grounds of selection and principles of interpretation" (Green, 2012, as cited in Comber, 2016, p. 12). This gives individuals an understanding how meanings are made and spread through different texts and technologies. Systems of meaning are "always selected by somebody, sectional and represent the world in particular way" (Green, 2012, as cited in Comber, 2016, p. 12).

Traditionally, media education has emphasized critical literacy as a way to explore how ideologies of power are depicted in popular culture and literacy practices (Buckingham, 2003; Share 2009; Hobbs, 2020). Jeff Share's (2009) work focuses on incorporating critical media literacy into K-12 education. His framework for critical literacy is based on cultural studies and critical pedagogy. Critical media literacy "focuses on ideology critique and analyzing the politics of representation of crucial dimensions of gender, race, class, and sexuality; incorporating alternative media production; and expanding textual analysis to include issues of social context, control, resistance, and pleasure" (Share, 2009, p. 12). This approach to critical media literacy is extremely important, also in the post-truth era. However, questions of trust and accurate information online must be examined from a specific perspective; internet users' individual thinking processes and abilities to evaluate information are crucial.

On the topic of young children's critical literacy, little attention has been given to epistemic cognition, which is "necessary for thinking critically about complex issues" (Greene & Seung, 2016, p. 46). Examples are when people determine who and what they believe; choose from among alternatives; and acquire, construct, understand, and use knowledge (Greene & Seung, 2016). According to Chinn and Rinehart (2016), epistemic cognition "is cognition directed at epistemic aims" (p. 476) to discover what is true about the world. Knowing something means believing that it is an accurate "take" on the world (Chinn & Rinehart, 2016; Greene & Seung, 2016). People engage in epistemic cognition every day. For example, children collect their toys in a box for the night and plan to continue playing with them the next day because they know that they can find the toys again.

All literacy practices and reading require epistemic cognition. People engage in routine validation processes when they read texts. They use epistemic monitoring (Isberner & Richter, 2014) to identify violations of their factual knowledge about the world (e.g., "the moon is made of cheese"), implausible claims (e.g., "a man broke his leg, so he called a dentist"), and semantic anomalies (e.g., "trains are soft"). People use epistemic cognition to separate fact from fiction. In many cases, plausibility depends on genre. In a cartoon or animation, it is plausible that a piano might suddenly fall out of the sky. Children, as active audience members, learn the specific language of different media. They learn that there is not a real person speaking from inside the radio; they know that the person in a passport photograph has legs, even though no legs are visible in the photo. But, of course, there are more complex issues that even older people do not always recognize, such as that the doctor in a soap opera is not really a doctor but an actor, or that a photo of a person may have been processed using artificial intelligence, in which case the person in the photo may not exist at all. Wherever there are media representations, people need epistemic cognition to validate the reality of those representations. Some part of this validation is done routinely based on prior knowledge and experience, while another part calls for conscious reflection and epistemic cognition skills; we call these skills critical thinking and critical literacy.

There are two main theoretical frameworks of epistemic cognition: the multidimensional approach and the developmental approach (Iordanou et al., 2019). In the multidimensional approach, epistemic cognition is understood as a system of more-or-less independent beliefs. The developmental approach conceptualizes epistemic cognition as a unidimensional progression (Chinn et al, 2014; Iordanou et al., 2019).

According to the developmental approach, young children's epistemic cognition is limited to some degree due their level of development. Kuhn, Cheney, and Weinstock (2000) posit four developmental stages of epistemic understanding: realist, absolutist, multiplist, and eval-

uativist. According to this theory, children younger than four are realists. They believe that people's claims are isomorphic to an external reality. Knowledge comes directly from external sources and is certain. Critical thinking is therefore unnecessary, because the world is knowable directly through the senses (Kuhn et al., 2000; Greene & Seung, 2016). According to Kuhn et al. (2000), at the age of four, children's epistemological development makes a significant step forward. They develop the ability to engage in metacognitive reflection, which makes them absolutists. They start to understand that claims about reality can be incorrect, and they acknowledge the need to check the falseness and truth of those claims. For an absolutist, critical thinking means comparing claims to reality (Kuhn et al., 2000; Greene & Seung, 2016). One challenge for an absolutist is comparing multiple information sources (Greene & Seung, 2016). Several studies have also indicated that people who believe that knowledge is certain, simple, and unchanging have poorer reading comprehension than those who believe that knowledge is complex and tentative. Absolutists also tend to select information sources that are consistent with their existing views (Strømsø & Kammerer, 2016).

For absolutists, knowledge still comes from external sources. However, around the age of five or six, children can become multiplists. A multiplist understands claims about reality as opinions; these claims are no longer viewed as facts as in the previous levels. However, multiplists have a subjective understanding of knowledge: "To the extent others judge differentially than I do, it is because they are in state of misinformation or misunderstanding; they do not see the reality that is there to be seen" (Kuhn et al., 2000, p. 313). A multiplist thinks, that people may differ, but there is always only one truth, and it can be known.

The final level, evaluativist, is the optimal level of epistemic cognition development (Greene & Seung, 2016). Those at this level understand the nature of knowledge construction. In a study by Barzillai and Zohar (2012), sixth-grade students with evaluativistic beliefs outperformed absolutist students on a task that involved comparing information from multiple sources. At this level, knowledge is understood as contextual. Evaluativists critically evaluate knowledge based on evidence and argument. This shift reflects a change from naïveté (absolutist) to a sophisticated understanding of knowledge (evaluativist) (Brownlee et al., 2016).

Although the development of epistemic cognition is age-dependent to a certain degree, this progression from realist to evaluativist is not automatic, nor is it based only on age. Few adults reach the level of evaluativist, and the shift from multiplist to evaluativist "is the most fragile developmental transition" (Kuhn et al., 2000, p. 313). Kuhn et al. (2000) provide one very intriguing explanation for many individuals' failure to transition from absolutivism to evaluativism: Western

values of social tolerance and acceptance favour personal taste and opinion over comparisons based on reasoned evaluation and argumentation. Lee McIntyre (2018) further argues that postmodernism and the social constructivist movement play roles in the inflation of truth due to preferences for perspectivism, a position that states that there is no objective way to find truth, only different perspectives on what the world is like. It is challenging to empirically determine why evaluativism is so difficult to achieve, but these discussions provide some food for thought, especially in the age of social networking.

The transition to evaluativism requires educational as well as life experience, but evaluativists are not only found in academic settings (Kuhn et al., 2000). The developmental shift from absolutivism to evaluativism can also occur in individuals of different ages (e.g., Chandler et al., 2002). Bendixen and Rule (2004) suggest, therefore, that epistemological development tends to follow a spiral rather than a linear shape.

However, the understanding of knowledge and knowing that come with evaluativism are necessary for critical thinking (Greene & Seung, 2016) and critical literacy. A review of several studies by Greene and Seung (2016) reports that evaluativists "use more cognitive and metacognitive strategies" and "perform better when evaluating and reconciling conflicting resources" and when "navigating the internet" (p. 48). Therefore, evaluativism could be established as one objective of media education.

The multidimensional framework is another way to theorize epistemic cognition. According to this framework, epistemic cognition can be categorized along four dimensions (Chinn et al, 2014; Iordanou et al., 2019). Two of these address the nature of knowledge, specifically its 1) certainty and 2) simplicity or complexity. The other two address the nature of knowing: 3) the source of knowledge (i.e. the source to which credible knowledge is generated) and 4) the justification for knowing (i.e. the rules and criteria used to evaluate knowledge claims) (Hofer & Pintrich, 1997). Chinn et al. (2014) present an expanded framework for models of epistemic cognition called the AIR model.

The first component of the AIR model is epistemic aims and value (represented by the A in AIR) (Chinn et al, 2014; Chinn & Rinehart, 2016). Aims are the goals or objectives of epistemic cognition. One epistemic aim could be trying to find information for a specific purpose and identify truth. If the truth is worth knowing, the knowledge is valuable. People who care about epistemic aims such as truth may use more appropriate epistemic strategies than those who have no clear aims or whose aims are non-epistemic. For example, having just fun on the internet is a non-epistemic aim; such a user is less likely to be interested in recognizing misinformation. Aims affect how people read and understand media messages and how motivated they are to evaluate information.

The second component of the AIR model is epistemic ideals (I), which "specify the criteria or standards that must be met for [people] to judge that their epistemic ends have been achieved" (Chinn et al, 2014, p. 628). Epistemic ideals are often used in science, but laypeople use epistemic ideals as well. Chinn et al. (2014) propose that laypeople's epistemic ideals fall into five categories: 1) internal structure of reasoning, e.g., whether reasoning is internally coherent and sufficiently complex, 2) connections to other knowledge, 3) empirical evidence, 4) standards for evaluating others' reasoning (e.g., an expert's reasoning is given more weight than that of a layperson), and 5) ideals of good, clear communication. Epistemic ideals are criteria for reliable processes that people use to evaluate information and knowledge.

The third component of the AIR model is reliable epistemic processes (R) (Chinn et al, 2014; Chinn & Rinehart, 2016). These are cognitive processes and reasoning that are used to create and evaluate epistemic products, such as knowledge. Different processes are used in different situations and contexts. For example, observation is a useful process in certain circumstances. In good lighting, a person can verify the existence of an object in front of them using visual perception. However, visual perception does not work as well in the dark. A reasoned argument may be a good process for verifying facts if people have freedom of speech. Some processes are highly unreliable, such as reading tea leaves (Chinn & Rinehart, 2016). As we see, some processes are individual (e.g., observation), some are collaborative (e.g., argumentation), and some are institutional (e.g., peer review) (Chinn & Rinehart, 2016). Research on epistemic cognition explores the different processes people use in different contexts. My aim in this article is to develop a framework for critical literacy based on the AIR model of epistemic cognition. This framework can then be used to teach critical media literacy based on epistemic aims and values, epistemic ideals, and reliable epistemic process.

Metacognition and making thinking visible

As mentioned above, all people, including children, use epistemic cognition in everyday life. However, this cognition is usually heuristic, and it is rarely conscious. For example, fluent processing has been recognized as one of the strongest heuristic cues inducing a bias of truth (Schul & Mayo, 2016). A claim that is easy to process and understand is usually rated as truer than less fluent claims (Schul & Mayo, 2016). This is called fluency bias. Heuristic models for reasoning are invisible; they are a kind of subconscious shortcuts. They are not sufficient for critical reasoning and may even increase misunderstanding and misinformation. I argue that, to increase conscious reasoning, the practice of reasoning must first be made visible. This goal is in line with the tradition of media education and media literacy.

We do not see thought processes. However, there are methods for

making thinking visible, such as the think-aloud method, which has frequently been used to model cognitive processes (e.g., Eveland & Dunvoody, 2000; Magliano & Millis, 2003; Ferguson et al., 2012; Goldman et al., 2012), but studies focusing on young children are scarce. In the think-aloud method, participants verbalize their thoughts aloud while performing a task (Rotzendaal et al., 2012).

The think-aloud method has used also in the context of media literacy. Rozendaal et al. (2012) used it to explore the abilities of eight-to 12-year-olds to process advertising messages. In this study, when children used the think-aloud method, their own critical thoughts increased their disbelief of advertisements. An explanation for this finding was that thinking out loud "functioned as a cue to increase their motivation and ability to allocate greater cognitive resources […]" (Rozendaal et al., 2012, p. 214). This study reinforces the importance of making thinking visible during literacy practices.

Philosophy for children (P4C) is another method for making thinking visible. This method is based on the work of Professor Matthew Lipman and aims to focus on teaching reasoning and argumentative skills to children. There are many types of thinking, including problem solving, decision making, judgement, and planning (Moshman, 2015). Reasoning is an epistemic form of thinking that aims at reaching true or justifiable conclusions. It can be described as epistemically self-regulated thinking (Moshman, 2015). Like all forms of thinking, reasoning is deliberate and purposeful. However, reasoning differs from some other types of thinking because it requires epistemic cognition and explicit knowledge about knowing and metacognition (Moshman, 2015). When people justify information and arguments, they need to reflect on their own reasoning and justification. Unfortunately, even adolescents frequently lack justification skills (Kiili et al., 2022). Therefore, teaching children to see how they think and what kind of reasoning is accurate when evaluating information is crucial.

Making thinking visible, as with the think-aloud method or P4C, improves children's metacognition, or their understanding of their own thinking and justification processes. Research on epistemic development in childhood has found that even young children have impressive knowledge of the mind and knowledge (Moshman, 2015). This knowledge needs to be developed systematically from early childhood and beyond.

In practice, making thinking visible is a dialogue. It can help people understand their own thinking and epistemic cognition and learn more effective reasoning skills. Just as media education demystifies media representations, making thinking visible demystifies thinking, enhances metacognition, and helps students understand their own reasoning.

Framework for critical literacy

Based on the AIR model of epistemic constitution and the idea of making thinking visible, I have created a conceptual framework for teaching critical literacy in the post-truth era. Models for spotting disinformation and misinformation usually offer some useful suggestions for schoolwork. A good example of this is a compass for navigating the ocean of information that was published by the European Parliament (Bentzen, 2019). This compass indicates specific points to check when facing doubtful information online. However, critical literacy is not merely a checklist. It also involves reflecting on our own thinking processes and understanding how thinking processes work.

The framework (Table 1) includes AIR components of epistemic cognition (epistemic aims and value, epistemic ideals, and reliable epistemic processes). Each of the components of the framework highlights different areas where epistemic cognition skills are needed: aiming to know truth; knowledge of ideals that define good criteria for evaluating testimony and for evaluating and justifying knowledge; and the kinds of thinking and reasoning that belong to reliable epistemic process. Each of these aspects includes some of the

Epistemic cognition	Focus	Principle	Curriculum
Epistemic aims and value	Truth	Constitution of Knowledge	Knowledge of processes of science and journalism
Epistemic ideals	Knowledge and knowing	Justification for believing testimony Justification of knowledge	Identifying epistemic trustworthiness Identifying plausible evidence
Reliable epistemic processes	Thinking and reasoning	Deploying reliable processes Making thinking visible	Epistemic cognition practices and argumentation Identifying claims, assumptions, and biases

Table 1 AIR–based framework for teaching and learning critical literacy

key principles described in this article. These principles can form the basis for a school curriculum operationalizing the framework. In the following section, I will explain the framework in more detail.

Online information is evaluated in a specific thinking environment with special epistemic aims. The evaluator aims to know whether

the information is trustworthy and whether it is truth or false. The first step towards epistemic cognition is then to focus on questions of truth and to examine how the information is supported by arguments and evidence. The AIR-based framework for teaching and learning critical literacy starts with the aim of truth and uses the Constitution of Knowledge as the basis of knowledge production.

Science and journalism are examples of this kind of knowledge production and should be included in the curriculum as examples of processes that centre on the use of arguments and evidence to support knowledge claims. For example, scientific knowledge claims are subject to empirical tests, which require evidence. Science makes thinking visible via the scientific method. Science itself is based on the Constitution of Knowledge (Rauch, 2021); it uses a form of knowledge production that is "liberalism's epistemic operating system: our social rules for turning disagreement for knowledge" (Rauch, 2021, p. 14). These social rules, which include epistemic ideals and reliable epistemic processes, are crucial for evaluating information.

The Constitution of Knowledge includes all the rules and values which define liberal science, such as the fallibilist rule and empirical rule (Rauch, 20121). These rules guarantee that knowledge results from the co-operation of a social network where people study, publish, read, discuss, review, and exchange information with others (the fallibilist rule). No piece of information is established as knowledge until it has been demonstrated that the same methods lead to the same results, regardless of who conducts this test of the knowledge and regardless of the source of the information (the empirical rule). Journalism uses similar processes to ensure the accuracy of news. Even though science and journalism make mistakes and although the truth is sometimes impossible to establish, science and journalism are open and ready to correct their knowledge if needed. The ideal stage for both is epistemic evaluativism, where critical thinking is used to evaluate opinions, perspectives, and information. Ideally, science and journalism use critical thinking and critical literacy. When people aim to know how the world is, it is helpful to understand how science and journalism work. Therefore, scientific literacy is also an important component of critical literacy.

To determine the truth (epistemic aim) and evaluate information, people use epistemic ideals and processes that they have found to be reliable. The theory of epistemic cognition has traditionally focused on knowledge and knowing. Knowledge claims can be evaluated as true or false, especially if the principles of the Constitution of Knowledge have been followed. Traditionally, knowledge claims must be supported by, at least, testimony and justification. Testimony means that the expertise and knowledge of trustworthy people support the information. The problem here, of course, is who is

identified as a trustworthy authority. Identifying an authority is complex, but there are some cues that can help clarify this for children.

A trustworthy author usually has expertise in the subject matter, which is different to being a celebrity (Zarefsky, 2019). Celebrities are very present in children's media culture, but it is important for children to learn that celebrities are not experts outside their own fields. Trustworthy authors also have strong track records. An author who repeatedly lies or errs can easily lose their reputation for trustworthiness.

Teaching children to understand expertise beyond celebrity is an important part of teaching critical literacy, especially because children often depend on testimony to a great extent (Harris and Koenig, 2006). By listening other people and making sense of their testimonies, children can access data that they could not gather themselves. Therefore, trusting an authority's testimony amplifies children's access to information. Trusting testimony can also enable children to conceptualize abstract concepts that they cannot observe (Harris & Koenig, 2006). However, children's dependency on testimony also increases their risk of encountering misinformation. Therefore, in the post-truth era, children must learn about the internet and how to identify reliable sources (Zimmermann & Mayweg-Paus, 2021). This includes obtaining knowledge about the producers, individuals, or organizations who create the content that children consume.

Hendricks et al. (2015) studied how laypeople decide to trust experts about scientific information that is beyond their own direct knowledge. Online, it is particularly difficult to use the credibility cues that are available in face-to-face interactions, such as facial expressions, gestures, or appearance (Hendricks et al., 2015). Hendricks et al. found that laypeople assign epistemic trustworthiness based on three dimensions: expertise, integrity, and benevolence. This is in line with previous studies demonstrating that children assign trustworthiness based on knowledge, honesty, and intention (Hendricks et al., 2015). However, these qualities can also be difficult to verify online. Once again, the Constitution of Knowledge can be used to help children understand how scientists and journalists work in social networks where their work and publications are subject to constant review and discussions. This kind of review can filter and verify or falsify knowledge. This is also why it is important to learn to look for more than one source rather than relying exclusively on one respected expert.

Children should also be exposed to news published by trustworthy newspapers and other public organizations. In addition to the right to credible information, children have a right to know how trustworthy institutions and information channels work. For example, in Finland, the leading newspaper Helsingin Sanomat publishes news designed for children online (https://www.hs.fi/lastenuutiset/) and in a paper

version. News production is no longer self-evident, as news consumption is concentrating more and more on social media and messaging.

However, testimony alone is not sufficient to establish the truth of knowledge claims. Experts also need to support their knowledge claims with justification. Justification (see Table 1) means processes that can justify the knowledge claim. Traditionally, a claim must be supported by evidence. Different theories recommend different types of evidence. David Zarefsky (2019) identifies three major types of evidence: objective data, social consensus, and source credibility; each of these main types includes many varieties. For example, objective data include statistics and examples. Both are objective because the data are independent of the people who make the claims. In addition, evidence can be strong or weak. In this case, statistics are usually stronger evidence than examples. Social consensus includes for example commonplaces, shared value judgements, and shared historical understanding (Zarefsky, 2019). The third type of evidence, source credibility, overlaps with testimony and includes the credibility of a qualified source, which may be a human being but also something else, such as a literary source.

Justification of knowledge is closely related to the Constitution of Knowledge, especially in cases where research and statistics are considered strong evidence. Therefore, it is important to understand the processes of science and journalism when seeking to justify knowledge. There is empirical evidence for example, that scientific literacy decreases anti-vaccination attitudes (Lindeman et al., 2022).

The ideals of scientific explanation are key epistemic ideals. These include, among others, the consistency and coherence of the explanation (Chinn et al., 2014). Once again, scientific literacy plays an important role in epistemic cognition. However, laypeople may use non-scientific epistemic ideals as well (as above). To justify knowledge claims, a person needs to evaluate the internal structure of claims, to identify the assumptions included in the information, to determine whether the information includes cognitive biases, to identify connections to other available information, and to evaluate the quality of the evidence. Justification of knowledge mirrors the thinking of fact checkers, which can give clues for good evaluating practices.

Deploying reliable processes is a third aspect of the AIR-based framework for critical literacy used to justify information and knowledge claims (see Table 1). Reliable processes are processes that produce well-justified beliefs (Chinn et al., 2014). Humans use diverse reliable resources to justify knowledge claims. Some of these processes must be learned through epistemic cognition in the context of the Constitution of Knowledge. For example, it is more reliable to search for information from multiple sources than to simply search for information that confirms one's prior beliefs.

Some reliable processes, such as argumentation, are group processes that can be learned through discussion with others. Deploying reliable processes needs to make these skills visible. This may include exercising reasoning, developing argumentation skills, and engaging in dialogue as well as identifying claims, the structure of an argument, and some of the most common epistemic biases. These skills should also be included in the curriculum of critical literacy.

Conclusion

The framework presented here focuses on different aspects of critical literacy that are based on the theory of epistemic cognition. This framework has many limitations. For example, it does not take power, ideology, or the politics of representation into account. However, this kind of approach is quite common in the field of media education. It is important to understand the motivations and intentions of people who produce and publish media content and to know something about the media representations. This knowledge is also part of critical media literacy.

In this article, I have explored an aspect of critical literacy that has not been discussed much in the field of media education: epistemic cognition. The ability to evaluate online content is becoming more and more important in the post-truth era and during the infodemic. Children, who often start to use YouTube and social media at an early age, are particularly vulnerable to inaccurate information. They need to learn more specific reading and literacy skills so they can evaluate information in their everyday digital environments. The challenge is to differentiate accurate from inaccurate information, to divide the truth from disinformation. Evaluating the accuracy of online information requires a specific kind of critical reflection and an understanding of the nature of information and knowledge.

I have argued that we need to teach children epistemic cognition skills or epistemic practices. These practices are important online. Additionally, the AIR-based model of epistemic cognition indicates important aspects of teaching critical literacy and critical thinking. Epistemic ideals create a foundation for justifying knowledge; this foundation goes beyond everyday heuristics. An understanding of reliable processes for producing knowledge enhances metacognition and argumentation skills and can help children identify different epistemic biases. Children need to know something about their own thinking; thinking processes that are normally invisible need to be brought to light. This requires teachers and educators to create spaces where thinking is valued, visible, and actively promoted (Ritchhart et al., 2011). Making thinking visible and learning good thinking habits develop children's critical literacy. Nobody, even in their adulthood, has perfect critical literacy skills; critical literacy is a lifelong learning process. This process should begin at an early age and continue throughout a person's life.

Declaration of interest

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