Learning to Inform Oneself
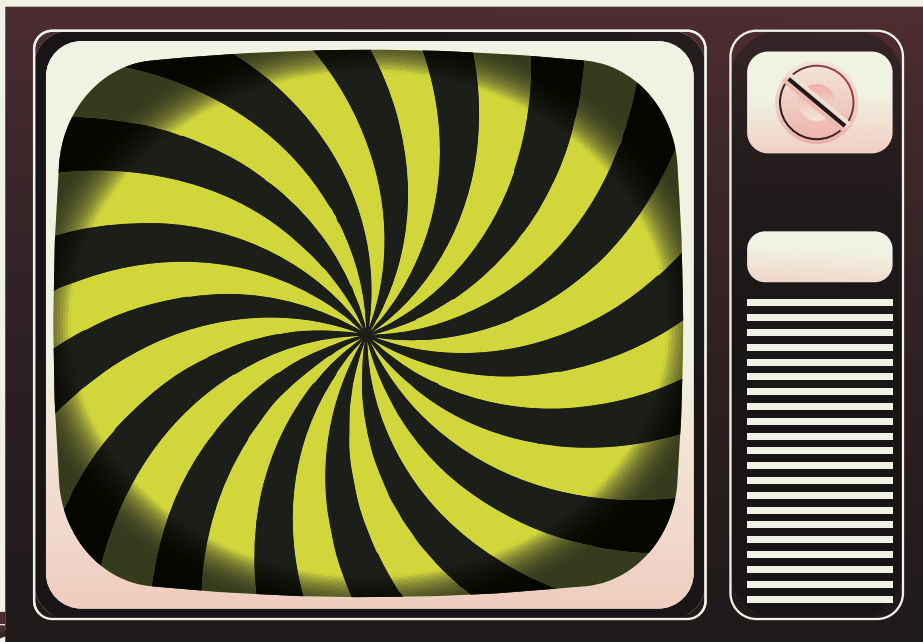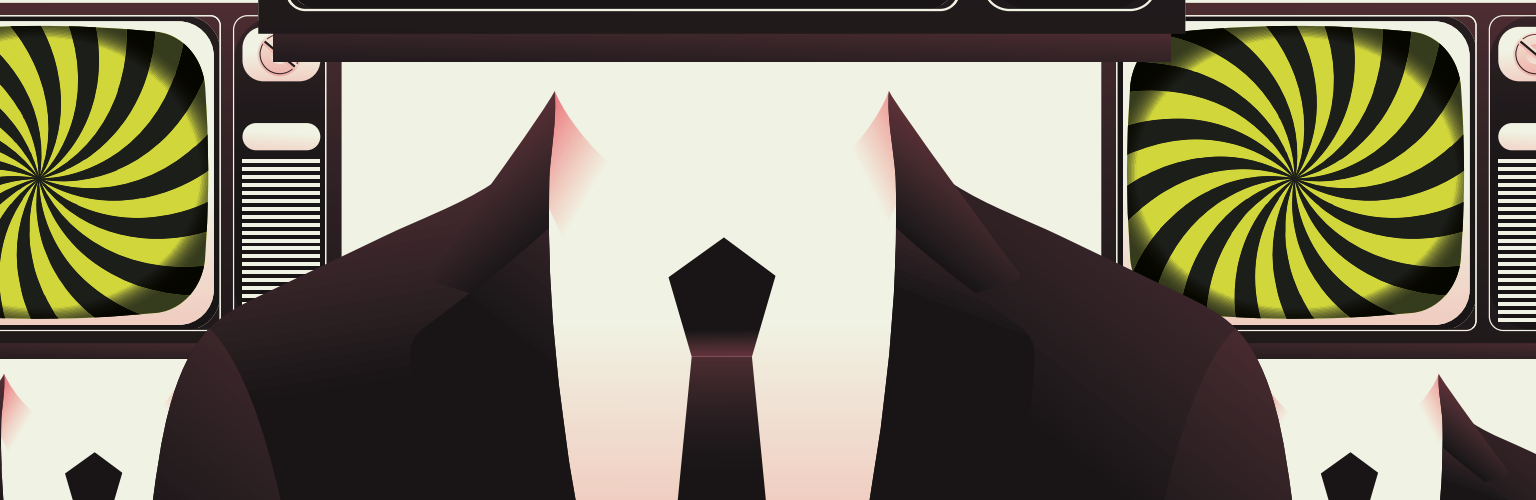
An Approach to Critical Thinking

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Information, whether from traditional or digital media, dominates our daily lives. Each individual, immersed in an incessant flow of data, is faced with a considerable mass of information. And if today everyone can receive it, everyone can also create and distribute it. This is why knowing how to distinguish between true information—that is, information based on facts or supported by science—and information that is merely opinion-based, is becoming an essential competency to include in education. Drawing on media literacy literature and the findings of a study[1] on the influence of digital media on the spread of misinformation, conducted with students aged 17 to 25, we propose educational approaches to strengthen young adults' critical thinking skills and develop attentive information, digital and media literacy.

Between truth, opinion and ignorance

In general, information is used to support a statement, serve an intention or pursue a goal. Today, more than ever, we are witnessing an information war—spanning both traditional and digital media—to get one's point across. Controversial topics and divided opinions are commonplace. Any subject can be exploited to serve a thesis or its antithesis. This opposition of discourses is omnipresent in the various media. Whether it's wars and conflicts, the confusion between science and pseudoscience (such as astrology, homeopathy and biomagnetism), historical realities versus denialist discourse, or climate issues—which are of particular concern to us in our work—every field is threatened by disinformation discourse emerging in the media.

Let's take a closer look at climate issues to gain a better understanding of the current situation. Although the issue of global warming is well established and supported by the Intergovernmental Panel on Climate Change (IPCC)—which brings together weather and climate scientists from every continent—many people continue to deny the existence of these changes currently underway, or the human responsibility for them. Certain individuals—commonly referred to as *climate skeptics*, or even *climate* denialists—are behind the propagation of *disinformation*, i.e. the intentional sharing of erroneous information. This disinformation can then be relayed by people unaware of its falsification, who will then spread what is known as *misinformation*: the sharing of information they didn't know was false.

Identifying fake information in discourse calls on a very specific disciplinary field called *critical thinking*. Critical thinking is the development of reasoned, logical and critical reflection on a subject. It leads not

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[1] Interested readers may refer to the publications by Alkhalaf, R. *et al.* (2023) and Michelot, F. *et al.* (2023).

only to the production of a coherent, substantiated discourse, but also to the identification of fallacious arguments (incorrect reasoning masquerading as logic), notably through the identification of rhetorical devices (comprising all discursive manipulation techniques) employed at all levels of the information distribution chain. It is precisely for this reason that educating youth to think critically is of the utmost importance.

Information competencies and critical thinking: an educational challenge

Our work is in the field of media literacy, more specifically the development of information competencies and critical thinking in a digital context. The emphasis placed on these notions is widely underscored internationally, notably by UNESCO (2013), as well as in Quebec, where we find them in the *Digital Competency Framework* by the Ministère de l'Éducation et de l'Enseignement supérieur (MEES, 2019). Information literacy is the 4th dimension of the Framework, while critical thinking is the 11th dimension. Undeniably, the development of critical thinking and information competencies must go hand in hand in education to cope with misinformation. And although the importance of understanding major contemporary issues—such as environmental questions[2]—is scarcely touched on in these documents, these information, digital and media competencies are essential to understanding them properly.

Critical thinking is a complex, multidimensional concept. The definition we propose is a starting point for understanding its essence.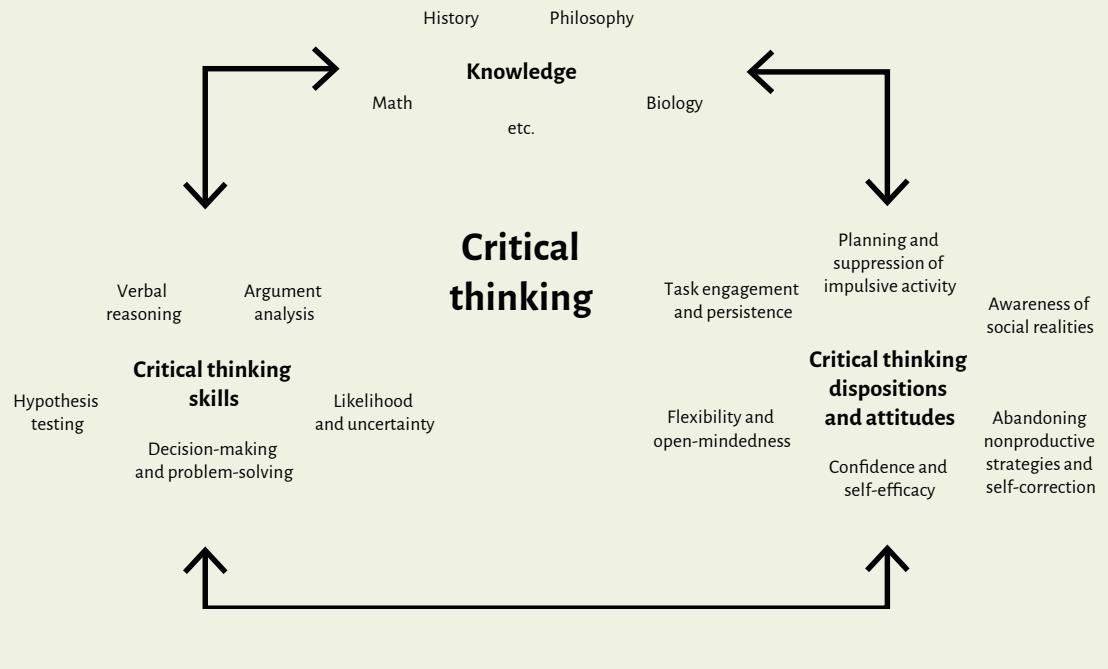 According to Halpern (2007), critical thinking is the "use of cognitive skills or strategies that increase the probability of a desirable outcome. It is used to describe thinking that is purposeful, reasoned, and goal-directed" (p. 6). For example, the use of the dialectical "thesis - antithesis - synthesis" essay structure is a critical argumentative structure that calls on the qualities of critical thinking, in order to lead the audience or readership to the same conclusions as the author. But these skills are not enough. Indeed, according to the formula proposed by Russell (d'Angelo, 1971, cited in Halpern & Sternberg, 2020, p. 3), critical thinking involves a combination of three components: i) critical thinking dispositions and attitudes; ii) factual knowledge; iii) critical thinking skills. **Figure 1** illustrates one way of modelling critical thinking, based on Halpern's definition of skills, dispositions and attitudes (1998).[3]

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[2] For example, in the Framework, we can find a meagre trace of this issue with regard to the ability to act as an ethical citizen in the digital age, which would involve taking into consideration the "social, economic, *environmental* [emphasis added] or professional context in which interactions may take place" (MEES, 2019, p. 10).

[3] We refer readers to the latter text, as well as to Butler and Halpern (2020) for more details on the various components of critical thinking.

Figure 1

Diagram summarizing the components of critical thinking
(inspired by Halpern, 1998)[4]

History   Philosophy

Knowledge

Math   Biology

etc.

Critical
thinking

Verbal   Argument   Task engagement   Planning and   Awareness of
reasoning   analysis   and persistence   suppression of   social realities
                                                                            impulsive activity

Critical thinking   **Critical thinking**
skills   **dispositions**
                                                    and attitudes

Hypothesis   Likelihood   Abandoning
testing   and uncertainty   Flexibility and   nonproductive
                                                        open-mindedness   strategies and
Decision-making   self-correction
and problem-solving   Confidence and
                                                        self-efficacy

We believe, however, that critical thinking needs to be firmly rooted in information competencies, sometimes referred to as *information literacy* or *information culture,* despite some possible nuances between these terms. In fact, to be able to think critically, each person must "be able to recognize when information is needed and have the ability to locate, evaluate and use effectively the needed information" (ALA, 1989). In other words, in a context of information overload, being *information literate* becomes an asset when it comes to selecting useful and relevant information to feed one's critical thinking.

However, the media education offered in schools today varies from one institution to another and becomes even more fragmented at the post-secondary level. This seems problematic, as students' confidence in their own judgment when confronted with information remains approximate in their eyes. Although researchers, science journalists and teachers are considered reliable sources by young adults, social media are their main source of information. More than two-thirds of young adults use social media for information (67.1% among 20–24-year-olds; Schimmele, Fonoberg & Schellenberg, 2021). This poses a major challenge: navigating in environments where misinformation can spread rapidly, and where individuals often find themselves trapped in opinion bubbles, either because of their social circles (school, leisure, family) or the social media they use. This phenomenon is known as the *echo chamber*. The latter unwittingly reinforces individual beliefs by limiting exposure to a diversity of opinions, facts or discourse, and contributes to ambient misinformation.

4   Note that the components associated with skills, dispositions and attitudes evolve from one author to another and over time. This diagram is adapted from Michelot (2020).

The challenges of information in the 21st century

While misinformation is not a new phenomenon, it has taken on an unprecedented dimension since the advent of the web, particularly since any individual can relay any information via online platforms without any need for reviewing or cross-checking.

Social media platforms, for their part, resolutely encourage the formation of echo chambers. This dynamic is often fuelled by the recommendation algorithms of the various platforms, which present content according to the user's past preferences. This selection of similar opinions can lead to increased polarization. In addition, the feeling of comfort and belonging to like-minded groups can also reinforce this phenomenon.

The spread of fake news in these closed spaces and the absence of confrontation with divergent opinions can hinder dialogue and exposure to contradiction. Regarding climate change, for example, Harkins (2022) noted that belonging to echo chambers encourages the spread of fake news. On the other hand, our study revealed that the issue of misinformation is not a source of concern for a majority of young adults (57%), although it does evoke a wave of negative emotions, mainly anger and frustration. While some results show that exposure to climate misinformation has little effect on an adult audience (Drummond, Siegrist & Arvai, 2020), we can imagine a stronger effect among young adults who are in the process of constructing their ideas and conceptions on a variety of topics.

Results to target training needs

In the study we conducted on the influence of digital media in the spread of climate misinformation, we were particularly interested in young adults' information practices and competencies, as well as their approaches to and perceptions of misinformation on social media. The population studied consisted of students aged 17 to 25 from post-secondary institutions in the Atlantic provinces. The research methodology was mixed, mobilizing first a quantitative approach (based on a survey), then a qualitative approach (based on interviews). For the survey, we mainly used four scales we identified to evaluate key aspects of our topic: critical thinking (Stupple *et al.*, 2017), information competencies (Doyle *et al.*, 2019), belief in climate change (Heath & Gifford, 2006) and conspiracism (Stojanov & Halberstadt, 2019).

Informing oneself more and better

Generally speaking, our research results show that the more people inform themselves, the more competent they become at informing themselves, just as the more they watch a certain type of media, the more they sharpen their ability to assess it. What's more, informing oneself leads to greater knowledge but also greater critical thinking skills concerning a given topic. When it comes to climate change, for example, accurate information on its origins, mainly linked to human activities, can influence people's beliefs, perceptions, and intentions to act. Being properly informed about climate issues can encourage people to adopt environmentally friendly behaviours, thereby reinforcing their awareness of environmental impacts. Finally, our results show that being informed about climate issues helps to identify misinformation, thus reducing the likelihood of spreading it in turn. We therefore see the importance of consistent information practices to support the development of these competencies in young adults.

Criteria for evaluating sources

Here's a list (non-exhaustive, as it must be adapted to each situation) of considerations to bear in mind when evaluating information, making it easier to identify its veracity.

- In light of my prior knowledge, is the information coherent or relevant?

- What is the source of the publication? Who is the author? Are they an expert on the subject?

- What is the nature of the website or publisher?

- Is the information exact and objective? Are sources cited?

- What are the objectives of the publication? Is there a particular intention (to get people talking, to sell, to inform, to convince, to manipulate, to scare)?

- How old is the information?

Although finding accurate, verified and diversified information is important, it's quite natural for each and every one of us (unfortunately!) to settle for a single source of information as soon as it seems plausible. For this reason, we recommend that students integrate *information routines* that stimulate the search for pluralism by diversifying media sources and seeking out those based on referenced information. On the climate issue, more specifically, we recommend integrating social media accounts of researchers, non-governmental organizations or international organizations that are recognized for their work. By following such accounts,

students become accustomed to reliable information on climate issues, sharpening their judgment and knowledge, which in turn improves their ability to detect misinformation.

Sharpening one's critical thinking skills

Our study showed that building confidence in one's critical thinking increases an individual's vigilance with regard to the credibility and accuracy of information. It also encourages a critical attitude toward social media content, fostering the expectation of referenced, verified information, and of contrasting it. Furthermore, the development of one's critical thinking skills appears to be closely linked to the development of information competencies, corroborating findings from previous studies showing that training young people to think critically on the basis of evidence-based arguments may provide them with elements to help discern scientific misinformation (Farrell, McConnel & Brulle, 2019).

In other words, in a context of information overload, being information literate becomes an asset when it comes to selecting useful and relevant information to feed one's critical thinking.

Another noteworthy finding is that students possess basic information competencies, i.e. the ability to evaluate the source, quality, form and intent of information. Their capacity for self-assessment manifests itself in their awareness of the evaluation mechanisms applied to information, and in their ability to distinguish fact from opinion. However, although it appears that most students possess these competencies, it would seem that they do not apply them systematically, and that these skills would benefit from reinforcement in the educational curriculum.

An effective strategy would be to offer an interdisciplinary training program aimed at developing critical thinking and information competencies related to misinformation and disinformation, at all levels of education (elementary, secondary, college, university). By highlighting the reality of the facts, this approach would raise young adults' awareness of these phenomena and reinforce their vigilance toward platforms, while improving their competencies and the application of the latter.

Avenues for teacher interventions

At this stage, training young people to recognize misinformation seems the obvious thing to do. The question remains, however: what can we do as teachers? Among other things, by integrating elements into pedagogical practices.

An effective and user-friendly way to develop students' critical thinking skills is to encourage discussion, even debate, in the classroom. This approach, valid at all levels of teaching and in all disciplines, requires only a few minutes of class time, but can have a significant impact. Spending ten minutes or so per class discussing the reliability of the content you teach can, for example, be an effective way of developing learners' critical thinking skills. Another approach would be to regularly integrate notions and elements linked to a social issue addressed in the course.

In line with our research into understanding contemporary challenges, in particular combating misinformation and climate education, we humbly propose in **Table 1** pedagogical activities for various disciplines, aimed at exploring climate issues in the classroom and developing students' information competencies and critical thinking skills.

Table 1

Pedagogical activities to develop critical thinking about climate issues

Disciplines	Activities
Mathematics or statistics	Integrating climate statistics into classes to explain descriptive or inferential statistical concepts.
Chemistry	Designing a laboratory to explain how greenhouse gas emissions can be transformed.
Politics	Conducting a document analysis on the manipulation of climate information, linking economic interests and misinformation, while examining the statements of certain politicians.
Arts	Exploiting creativity by directing contemporary artistic vision toward the theme of the environment and sustainable development.
Literature	Identifying the rhetoric and figures of speech used in texts or speeches on the climate.
Philosophy	Propose a philosophy reading group focused on contemporary environmental ethics to discuss works exploring the responsibility of developed countries toward developing countries in the context of climate change.

Such moments of exchange offer the opportunity to correct students' misconceptions in a constructive and well-argued way, and to prompt them to do research online. In this way, you can point them in the direction of reliable scientific references, so that they can see for themselves their misunderstandings and develop their information competencies. To guide you in this process and provide you with adequate support, numerous training courses are available to teaching staff in institutional libraries, through the Réseau des répondantes et répondants TIC (Réseau REPTIC-ITREP Network) or through organizations such as Agence Science-Presse, the Centre québécois d'éducation aux médias et à l'information (CQÉMI) and HabiloMédias.

As our research revealed students' confidence in their judgment to be somewhat fragile, we assume that methods and techniques for detecting misinformation may not be fully implemented by these young adults, who tend to give more credence to external sources than to their own critical thinking. Thus, building students' confidence in their acquired competencies is an essential component for teachers educating their students in digital media critical thinking. Indeed, we believe that confidence is fundamental to the act of critical thinking. Fundamental, because it implies the humility to recognize the limits of one's own knowledge and to concede that it is appropriate to give credit to experts. Central, too, because it involves recognizing one's own prior knowledge and experience, as well as one's ability to go further and progress.

What's more, if preparing young adults to deal with the prevailing misinformation is so vital, shouldn't we also consider improving communication between scientists and journalists, thus ensuring a prominence of authentic information on media platforms?

Toward preventive science popularization

Does "Brandolini's law" or the *Bullshit asymmetry principle* ring a bell? Taken from a Tweet by a computer scientist (Brandolini, 2023), this law—which isn't quite a law—can be summed up as follows: "The amount of energy needed to refute nonsense [let's keep it polite] is an order of magnitude bigger than to produce it." As you can see, the importance of misinformation on social media is all the greater because it requires colossal efforts to offer a substantiated counter-discourse.

While educating young people is necessary to counter misinformation, scientists could do more to take their share of responsibility in combating this phenomenon. Collaboration between scientists, journalists and policymakers would ensure accurate and balanced science communication (Farrell, McConnel & Brulle, 2019). Take the fight against climate change. While presenting the scientific facts of climate change to citizens is essential, it would also be essential to propagate a discourse containing concrete solutions involving actions that can be taken by individuals, in order to inspire collective mobilization and reduce the sense of fatalism, inaction and fear present in many people (Perga *et al.*, 2023). Scientists could then develop relationships with journalists who engage in a solutions journalism approach, to spread knowledge about initiatives that provide concrete, reproducible answers to societal, economic, social and ecological problems (Reporters d'Espoirs, n. d.).

In our view, information prevention is of the utmost importance in establishing well-founded conceptions. However, what can be done about the existing misinformation, which is spreading at great speed? A meta-analysis by Walter *et al.* (2021) has already shown a significant effect of social media interventions to correct health-related misinformation. The work of paleoclimatologist and IPCC director Valérie Masson-Delmotte, who is very active on X to refute misinformation (see her account @valmasdel; Valérie Masson-Delmotte, 2021), can also be cited as an example. On the other hand, the effectiveness of such correction is only demonstrated by a very precise protocol, without which the correction generally proves ineffective (Walter and Murphy, 2018). To correct misinformation, three steps are required: i) exposing the fact subject to misinformation; ii) explaining how it is credible and why we can believe it; iii) correcting the misinformation by deconstructing the argument and revealing its inadequacy.

Conclusion

With the avalanche of information received every moment on our multiple electronic devices, having the right information competencies to identify relevant and objective information is becoming crucial. Faced with the growing complexity of societal issues, an accurate understanding of reality is essential for adopting the right perspective on our social world and making enlightened decisions. Thus, educating young adults throughout their school career to acquire a well-developed information culture and critical thinking skills is an essential challenge to which we, as teachers and educators, must respond.

As part of this research project, resources have been created, notably in the form of summary infographics. They can be consulted on the *Numérique, climat et information* [*Digital technology, climate and information*, Ed.] project website [numeriqueclimat. info/ressources]. ■

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