Aiding Reflective Navigation in a Dynamic Information Landscape: A Challenge for Educational Psychology

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9 **Abstract**

10 Open access to information is now a universal phenomenon thanks to rapid technological
11 developments across the globe. This open and universal access to information is a key value of
12 democratic societies because, in principle, it supports well-informed decision-making on individual,
13 local, and global matters. In practice, however, without appropriate readiness for navigation in a
14 dynamic information landscape, such access to information can become a threat to public health,
15 safety, and economy, as the COVID-19 pandemic has shown. In the past, this readiness was often
16 conceptualized in terms of adequate literacy levels, but the contemporarily observed highest-ever
17 literacy levels have not immunized our societies against the risks of misinformation. Therefore, in
18 this Perspective, we argue that democratisation of access to information endows citizens with new
19 responsibilities, and second, these responsibilities demand readiness that cannot be reduced to mere
20 literacy levels. In fact, this readiness builds on individual adequate literacy skills, but also requires
21 rational thinking and awareness of own information processing. We gather evidence from
22 developmental, educational, and cognitive psychology to show how these aspects of readiness could
23 be improved through education interventions, and how they may be related to healthy work-home
24 balance and self-efficacy. All these components of education are critical to responsible global
25 citizenship and will determine the future direction of our societies.

26 **1   Introduction**

27 We live in the age of nearly universal access to information. With decentralized news outlets,
28 growing access to open science, and worldwide social media coverage, individuals can be more
29 broadly and diversely informed than ever before. Open access to information is a key value of
30 modern democratic societies, as only thoroughly informed citizens can participate in society and
31 make informed decisions about the directions in which they wish their society to evolve. It seems,
32 however, that despite open and multisource access to information, individuals fail to make
33 thoroughly informed choices at both societal and individual levels. In this Perspective, we aim to
34 examine why such failures may happen and how they could be remedied in education.

35 The ongoing COVID-19 crisis exposed, and perhaps augmented, society-wide difficulties with
36 critical processing of dynamically changing information. This may have impeded many important

37 outcomes such as sufficiently high vaccination rates, which, in turn, impose health, social, and
38 economic losses on entire societies. Misinformation and other environmental factors outside of an
39 individual's control have certainly contributed to such losses (Okuhara et al., 2020; Engledowl and
40 Weiland, 2021; Montagni et al., 2021). However, in this Perspective, we focus on the lack of
41 individual readiness for navigating the dynamic information landscape, which may exacerbate poor
42 decision-making under the pressing conditions of the prevailing global crisis. As educational
43 psychologists, we suggest that equipping citizens with such readiness is a pressing challenge for
44 contemporary education that needs to be targeted at all stages of individual development across the
45 lifespan. We are certainly not alone in this view, as prolific literacy research has shown for several
46 decades (e.g., Cervetti et al., 2006; Leu et al., 2017). Literacies are essential competencies, skills and
47 dispositions that support individual comprehension and use of "information in daily activities to
48 achieve goals, develop knowledge and potential" (cf. OECD, 2000, p. x; Leu et al., 2017). Since
49 improving literacies is only part of the solution, we sketch out a more complex and comprehensive
50 picture of the challenge ahead by coupling literacy research with relevant research on rational
51 thinking and cognition. We argue that fostering responsible citizenship demands, at the very least,
52 literacies, rational thinking (i.e., reflective, effortful processing of information), and awareness of our
53 own information processing (i.e., using psychological knowledge to take stock of own mental
54 operations; Figure 1). Throughout the paper, we recount evidence-based solutions developed within
55 each of these research fields to offer concrete suggestions for education stakeholders.

56 **2   Open Access, Literacies, and Rational Thinking**

57 **2.1   Open Access Endows the Citizen with New Responsibilities**

58 Openness and Participation are critical to democratic citizenship (Knight Commission Report, 2009;
59 Şimşek and Şimşek, 2013). Openness implies that everybody can reach the information that supports
60 civic and personal decisions, which serves to facilitate Participation, that is, joining and using
61 information systems to solve civic and personal issues (Knight Commission Report, 2009). As open
62 and multisource access to information secures these values, it cannot be realistically controlled by
63 democratic governments (Eysenbach, 2008). This emancipation from top-down control forces
64 individual citizens to assume responsibility for their own navigation in the dynamic information
65 landscape (Weiland, 2017). Citizens need to learn how to identify and critically process relevant
66 information (Eysenbach, 2008), and how to position themselves in relation to a myriad of views,
67 values, and ideas (Weiland, 2017). The COVID-19 crisis is one example that clearly showed that
68 citizens were not ready for such navigation.

69 Soon before the onset of the crisis, vaccine hesitancy, a delay in acceptance, or a refusal of vaccine
70 despite its availability (MacDonald and the SAGE Working Group on Vaccine Hesitancy, 2015;
71 Montagni et al., 2021), was listed among the ten critical global threats by the World Health
72 Organization (2019; Okuhara et al., 2020). Hesitant attitudes toward vaccines became increasingly
73 studied during the COVID-19 crisis, showing that they were associated with poor health literacy
74 (Montagni et al., 2021; Turhan et al., 2021; in particular, digital health literacy, Patil et al., 2021) and
75 a mismatch between affect-laden anti-vaccination messages and statistics-based governmental
76 communication (Okuhara et al., 2020). In the cognitively and emotionally challenging "infodemic",
77 understood as an overabundance of information on virus-related matters (Duplaga et al., 2019; WHO,
78 2020; Patil et al., 2021), the citizens were left to their own devices. Despite higher-than-ever literacy
79 rates, the public was poorly prepared for universal access to information and failed to assume the
80 responsibilities that come with such access. Paired with poor readiness for selecting, evaluating, and
81 processing information, universal access to information became a threat, not an aid.

2.2 Literacies are Key but Insufficient

Universal access to information is here to stay but using it to individual and societal advantage rather than disadvantage demands better readiness, and it is better to foster it late than never. The notion that the age of access demands specific skills, and that educational systems across the world should support individuals in honing these skills, is not new. For over two decades now, educational psychologists have investigated a myriad of literacy skills (i.e., literacies) that support individual navigation in the dynamically changing information landscape (Cervetti et al., 2006; Şimşek and Şimşek, 2013; Leu et al., 2017). Literacy became a popular buzzword in educational psychology and an umbrella term for multiple, multimodal and multifaceted skills (Cervetti et al., 2006). Literacy for 21st century citizenship is digital, complex, and dynamic, but it builds on traditional literacies, such as reading, writing and comprehension (Leu et al., 2017). These traditional literacies need to be applied in the digital world, in which information is no longer provided in a single modality (e.g., audio only), a single flow (e.g., without simultaneous advertising), or by a limited group of individuals sharing similar values, views, and ideas. The line between the addresser and the addressee is fuzzy, as each member of the online community may smoothly move on the continuum between these roles. Therefore, 21st century literacies demand not only technical readiness for the modern technologies, but, critically, control over one's own information seeking and processing, awareness of the complexity of the social world (Cervetti et al., 2006; Leu et al., 2017), and a balance between emotional engagement and emotional distance toward arguments presented by others (Gee, 2012; Olin-Scheller and Tengberg, 2017).

Technical readiness is typically a minor challenge for "digital natives" (Prensky, 2001; Valenza, 2006; Harris, 2008) or "insiders" (Lankshear and Knobel, 2006, Wimmer and Draper, 2019), who are children and adolescents raised amid rapidly evolving technologies from their birth (Neumann, 2016). However, evidence from educational and developmental psychology showed that digital natives, despite technical readiness, lack critical literacy and struggle with seeking, selecting, and evaluating information, and are not by default skilled or critical consumers of information (Valenza, 2006; Harris, 2008; Wineburg et al., 2016). Digital natives typically prioritize most accessible information sources and effortless processing (Shenton and Dixon, 2004; van Deursen et al., 2014; Loh and Kanai, 2015), and show age-specific difficulties in deploying attention to relevant information. Younger children (at 8-10 years) struggle with inhibiting irrelevant yet salient and engaging information (Eastin et al., 2006) and typically do not question its accuracy (Hirsh, 1999); older children lack sufficient knowledge base and analytical skills to contextualize and analyze the information, and often prioritize the form of the information over its content (Watson, 1998; Agosto, 2002; Sundar, 2008). This suggests that critical literacy learning should be adjusted to children's cognitive developmental stage (Eastin, 2008) and fostered in education (Bernstein, 2000; Gee, 2012; Leu et al., 2017; Olin-Scheller and Tengberg, 2017) because it is central to the new responsibilities that follow from universal access to information. Critical literacy, "the ability to argue from evidence, values and different perspectives (Skolverket, 2011) and to go beyond the individual and personal, and relate knowledge to more general and abstract notions (Bernstein, 2000; Gee, 2012)", as defined by Olin-Scheller and Tengberg (2017, p. 428), must be paired with age-appropriate statistical literacy and scientific literacy to prepare the prospective citizen for the influx of complex, heavily data-based information (Gal, 2002; OECD, 2004; Engel, 2017; 2019; Podkul et al., 2020; Engledowl and Weiland, 2021). To this end, in educational settings, complex information should not be simplified, but rather turned into manageable chunks and presented on multiple occasions (Spiro et al., 2003). Comparing poorly presented information, e.g., misleading data visualizations with well-executed visualizations provided by such tools as *Gapminder* (2022; Engel, 2019) should be also a regular part of classroom activities (Engledowl and Weiland, 2021).

129   Critical literacy relies on cognitive skills, but it cannot be achieved without students' emotional
130   investment. Educational psychologists showed that students need to learn how to self-regulate their
131   own investment by striking a balance between emotional engagement and emotional distance toward
132   their own and others' arguments when discussing social issues (Gee, 2012; Olin-Scheller and
133   Tengberg, 2017). Inhibiting own emotional attitudes is a prerequisite when evaluating own and
134   others' arguments and can be effectively trained in the classroom context, by, for instance, drawing
135   students' attention to the affect-laden but irrelevant arguments that they present in response to a
136   controversial issue (Olin-Scheller and Tengberg, 2017). This requires metacognition, understood as
137   active monitoring of own thoughts and emotions, and switching between own and others'
138   perspectives (Flavell, 1976). Although this ability develops early (Marulis et al., 2016), it becomes an
139   educational priority only in adolescence (Eysenbach, 2008; Olin-Scheller and Tengberg, 2017). In
140   adolescence, citizens become increasingly autonomous, and drift away from reliance on traditional
141   authority figures (i.e., intermediaries; Eysenbach, 2008) toward support from peers and less
142   authoritative sources of information (i.e., apomediaries; Eysenbach, 2008). Individual autonomy
143   continues to develop in adulthood, and is typically associated with gains in cognitive ability,
144   literacies, and self-efficacy. Low capacity and/or insufficient belief in one's own capacity can push
145   even adult citizens into reliance on traditional authority figures and uncritical, unreflective processing
146   of information (Eysenbach, 2008). Therefore, critical literacy is only a bare minimum for individual
147   readiness during global crises.

148   **2.3   Literate Citizens Are Not Rational Thinkers**

149   Navigating the information landscape demands critical literacy, paired with other relevant literacies,
150   such as media literacy, health literacy, and statistical literacy. To date, various interventions have
151   aimed to boost relevant literacies in individuals, perhaps stemming from a belief that a sufficiently
152   literate individual will be able to scan, select, and evaluate the information landscape to make
153   thoroughly informed choices. Empirical research findings on human rationality, however, suggest
154   otherwise, showing that literacies are fundamental but not sufficient for individual readiness. Several
155   models of human cognition showed that information processing roughly follows two separate routes:
156   either a peripheral, fast route with mental shortcuts and simple rules (i.e., heuristics) or a central,
157   cognitively effortful route with a reflective, metacognitive outlook on the available information
158   (Sundar, 2008; Stanovich, 2009; 2018). Having access to these two processing routes (or systems,
159   Stanovich, 2009) is highly adaptive, but overreliance on the heuristic route can lead to multiple
160   cognitive biases (Sundar, 2008; Stanovich, 2009). Therefore, people who are sufficiently literate in
161   terms of health and statistical knowledge may nevertheless suffer such cognitive biases (Stanovich,
162   2018) and make irrational choices as to whether, for example, to vaccinate themselves and/or their
163   children against COVID-19 due to the anti-vaccination messages. The messages are typically
164   communicated through affect-laden, salient imagery focused on vaccine toxicity and its side effects
165   and consequently tend to trigger fast, heuristic processing (Okuhara et al., 2020). Even individuals
166   that reflectively weigh the benefits and risks of the vaccine against the risks of COVID-19 infection
167   may struggle with overriding the worry caused by the heuristic processing of such information
168   (Okuhara et al., 2020).

169   As the above example showed, cognitive psychologists have repeatedly shown that individuals are
170   prone to the same biases across social strata regardless of their literacy levels, but they may be able to
171   override these biases with sufficient awareness and training (Stanovich, 2018). Instead of resorting to
172   fast, automatic processing that prioritizes ease and speed over rationality, individuals should be able
173   to intentionally choose slow, reflective processing of the information landscape. Educating citizens
174   on the multiple heuristics triggered by salient but irrelevant aspects of communication (Sundar, 2008)

175 may be a good introduction to rational thinking. To some extent, training of rational thinking
176 overlaps with literacy training, as they also involve technical components of statistical and scientific
177 literacy (Stanovich, 2009). Such technical skills involve, among others, learning probability theory,
178 switching between absolute and relative representations of data (e.g., 1000 individuals vs. 25% of the
179 tested sample vs. 1 in 4 tested people got infected) and overriding an automatic tendency to
180 overestimate absolute numbers compared to percentages (Yamagishi, 1997; Stanovich, 2009). Thus
181 far, however, it seems that citizens, lacking systematic training on this matter, have not had a chance
182 to build an awareness of their own cognitive functioning. Without such chances at a society-wide
183 level, many citizens will not be able to take control over their own cognitive functioning, and,
184 thereby, will not achieve readiness for universal access to information. Their information processing
185 will be governed externally, by those who manipulate vividness, accessibility, and salience of
186 information (Stanovich, 2009), such as advertising companies in the modern market-based society.
187 Thus far, the lack of awareness on own information processing had not threatened the economy,
188 health, and survival, and had been overlooked in education. Now that it is generating considerable
189 economic losses for the local and global communities, it will finally find its way to society-wide
190 educational practices. We thus propose that developing a habit of taking stock of one's mental
191 operations should become more prominent in the education of children, adolescents, and adults.

192 Better understanding of one's own information processing is a goal that demands concrete, structured
193 action, with the concept of (ir)relevance of information at its core (Heine, 2006; Eysenbach, 2008;
194 Hobbs and Jensen, 2009; Román et al., 2009; Olin-Scheller and Tengberg, 2017; Bajo et al., 2021).
195 Identifying relevant information is key for critical and rational thinking, since changes of salient,
196 irrelevant information can significantly impact human decision-making (i.e., framing effect;
197 Stanovich, 2009). This skill has been championed by several scholars in recent years, pointing
198 towards conditions in which students can efficiently take responsibility for handling access to
199 information (Lankes, 2008; Weingarten, 2008; Rapp and McCrudden, 2018). Providing students with
200 information of varying relevance and credibility, both in the classroom and in complex real-world
201 contexts, gives them the best opportunity to determine on their own what matters regarding the
202 information flow (Lankes, 2008; Weingarten, 2008; Rapp and McCrudden, 2018). Furthermore,
203 delegating the responsibility for setting up own sub-goals, and selecting information without
204 micromanaging instruction leads to more accurate relevance judgements (Heine, 2006). One way to
205 achieve such tasks may be to construct self-regulated and metacognitive learning environments
206 where students can figure out their own information processing with the help of technologies in
207 learning analytics (e.g., Winne et al., 2019) and cooperation with interdisciplinary professionals.
208 Completing such tasks may further build students' confidence in their own information processing
209 abilities and steer them toward autonomous, critical thinking.

210 **3   Discussion**

211 Over two centuries ago, a French mathematician argued during the French Revolution that citizens
212 need *savoir liberateur,* knowledge built on information raising their awareness of the state of society
213 (De Condorcet, 1994; Engel, 2019). The concept of a well-informed citizen is not new (e.g., Schutz,
214 1964; Strassheim, 2018), but it is, perhaps more than ever, pivotal for contemporary societies. The
215 COVID-19 crisis showed that offering citizens universal access to information is insufficient, and,
216 under some circumstances, detrimental to the common good. Global citizenship demands multiple

217 literacies, rational thinking, and awareness of own information processing[1]. Although broad views of
218 scientific literacy (Choi et al., 2011), critical statistical literacy (Engledowl and Weiland, 2021), and
219 civic statistics (Engel, 2019) have incorporated metacognitive aspects of such literacies, neither
220 rational thinking nor awareness of own information processing have been incorporated into 21st
221 century skills (Dede, 2009). This demands better integration into curricula for school-aged children
222 and adolescents, and informational interventions for adults.

223 Improving cognitive abilities or an overview of such abilities will not suffice when facing the
224 challenges of the 21st century. Therefore, beyond the curricula and interventions at a broader level,
225 we posit that readiness, relevance, and responsibility are important keywords for education in the
226 2020s, the decade of crucial decision-making that will shape the life of every individual in the global
227 community. Given that readiness for responsible citizenship relies on rational thinking, and that
228 overworked or emotionally burdened individuals may be more likely to engage in fast, heuristic
229 processing rather than slow, effortful processing of continuously incoming information (cf. Gillard et
230 al., 2009; Spiliopoulos et al., 2018), we suggest that children, adolescents, and adults are encouraged
231 to replace unhealthy, workaholic habits with healthy work-home balance (e.g., Deloitte Consulting,
232 2010; Bannai and Tamakoshi, 2014; Anxo et al., 2017; Anxo and Karlsson, 2019). Therefore,
233 unhealthy habits instilled in school-age children and adolescents through a tremendous amount of
234 schoolwork should be limited to foster intentional deployment of cognitive resources from an early
235 age. To our knowledge, this has not been investigated in the past, but future experimental studies
236 could, for instance, longitudinally track adults on a spectrum of such habits and their likelihood of
237 using heuristic vs. reflective processing of information. Scholars from educational, developmental,
238 and cognitive psychology need to assume this broad outlook on individual cognition, socioemotional
239 skills and socioeconomic pressures to collaboratively and holistically foster responsible citizenship
240 across all ages, from kindergartners to adults (see, e.g., Ellemers, 2021).

241 Literacy, rational thinking and work-life balance are vital parts of responsible citizenship, but it also
242 requires sufficient self-efficacy that shields individuals against overreliance on authority figures
243 (Eysenbach, 2008). Perceived lack of own impact on the society and non-meaningful, poorly paid
244 jobs or unpaid internships cannot build such self-efficacy in the young citizens. Therefore, we urge
245 adults to include young citizens in important decision-making, and to offer them meaningful, well-
246 paid opportunities to contribute to society and to shape the world of tomorrow. Arguably, young
247 citizens are leaving the educational system with better readiness for the contemporary digital world
248 than older generations (Wimmer and Draper, 2019) and have high stakes in responsible, well-
249 informed decision-making. However, without secure pay and a meaningful job, young citizens will
250 not be able to achieve financial and intellectual autonomy critical to their participation in society.

251 Universal access to information is a double-edged sword. It gives all citizens a chance to shape their
252 societies, but backfires without their readiness for responsible, well-reasoned choices. In this
253 Perspective, based on evidence from educational, cognitive, and developmental psychology, we
254 showed examples of concrete actions that can be taken by education stakeholders to foster citizen
255 readiness. Since the 21st century globalization will certainly continue to scale up poor individual

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[1] Global citizenship, in fact, demands more than education of individuals. In this Perspective, we have focused on such education, but we acknowledge that education of individuals must be coupled with broader environmental and societal changes. On the environmental level, for instance, citizens need external support in rational decision-making, e.g., by offering them prospectively, not temporarily, beneficial default choices (like pension funds or savings plans; Stanovich, 2009). On the societal level, for example, open and universal access to evidence-based information should be facilitated world-wide in order to alleviate post-colonial inequalities in such access (Santoro Lamelas and Belli, 2018).

256 choices into international emergencies, citizen readiness, an essential remedy to such emergencies,
257 should become a top priority for educational psychology.

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261 **5   Author Contributions**

266 **6   Funding**

268 **7   References**

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450 **8   Data Availability Statement**

451 No datasets were generated within this research.

452 **9   Figure Captions**

453 **Figure 1. The proposed model of the relationship between literacies and readiness for**
454 **navigating the information landscape, moderated by rational thinking and awareness of own**
455 **information processing.** Here, literacies are defined as "competencies and dispositions that support
456 individual comprehension and use of information in daily activities"; rational thinking as "reflective,
457 effortful processing of information"; and awareness of own information processing as "using
458 psychological knowledge to take stock of own mental operations". Healthy work-home balance and
459 self-efficacy are also components of the educational sphere that may contribute to readiness for
460 navigating the information landscape.