

Algorithmic Citizenship and Educational Processes: towards an algorithmic citizenship literacy for systemic responsibility

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Abstract: This paper contributes to the debate on contemporary education within co-evolutionary pedagogies, which interpret the human–environment–technology relationship as a single informational ecosystem, the infosphere, where identity, rights, and life opportunities are increasingly mediated by algorithmic infrastructures. As societies move from “digital citizenship” to a more concrete form of algorithmic citizenship, individuals are no longer simply users of tools: they become profiles calculated, evaluated, and governed through datafication and systems of recommendation, scoring, and filtering. The paper addresses a guiding question: how can educational processes prepare individuals to enact a responsible algorithmic citizenship, able not only to use AI, but to understand its logic, interrogate it, and, when necessary, transform it? To advance current work on digital citizenship and AI literacy, the paper develops two complementary directions: it frames schools and universities as laboratories for algorithmic governance, including attention to AI’s material/ecological footprint; it proposes algorithmic citizenship literacy as an integrated literacy spanning data, algorithms, platforms, rights, digital ecology, and civic participation, shifting the focus from functional adaptation to systemic responsibility within the infosphere.

Keywords: algorithmic citizenship; artificial intelligence; education; AI literacy; systemic responsibility.



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1. Where we “live” today: infosphere and co-evolution

An initial image helps to fix the central issue. A student opens the electronic gradebook and sees a grade calculated and displayed by the platform; a parent receives a notification; the teacher consults a monitoring dashboard that flags those who are “at risk.”¹ In a few seconds, evaluations, predictions, attention priorities, and micro-decisions are set in motion. The pedagogical point is not only the tool’s efficiency, but the **form of world** it designs: what it renders visible, what it conceals, who is normalized and who exceeds the norm (Williamson, B. 2017; Williamson, B. 2018).

¹ Predictive dashboards (e.g., “at risk” flags) can generate feedback effects and self-fulfilling prophecies (for instance, by intensifying monitoring and shaping expectations for certain students).

Coevolutionary pedagogies invite us to read the human–environment–technology relationship as a dynamic network of interdependencies. Within this network, social practices produce data; data feed models and services; services return decisions and recommendations that affect educational, professional, and civic opportunities. This circularity unfolds within what Floridi defines as the *infosphere*: a single environment in which the distinction between online and offline is attenuated and in which human and artificial agents co-determine living conditions, identity, and possibilities (Floridi, 2013).

In this framework, education cannot be reduced to a training-oriented question (“how can we use technologies well?”). It must pose a political and formative question: who decides what is possible, for whom, and on the basis of which data? This is where the notion of *algorithmic citizenship* is situated, understood as the way in which subjects are made governable (and, at times, governed) through computational infrastructures that classify, recommend, filter, and assign scores.

2. From Digital Citizenship to Algorithmic Citizenship

For many years, educational discourse has focused on digital citizenship: online safety, netiquette, privacy protection, source evaluation, and conduct on social media. This was a necessary step, but today it is insufficient. The current asymmetry lies in the fact that we do not interact only with content or tools: we interact with systems that transform our experience into computable signals (*datafication*) and reuse them to predict and steer behaviors (van Dijck, J., 2014).

A decisive shift occurs when subjectivity is treated as a profile: a probabilistic representation, continuously updated, that “speaks” in place of the subject within automated environments (from content selection to access to services, up to surveillance and control practices). From this perspective, citizenship becomes increasingly a matter of algorithmic visibility: what one is, or what one can do, also depends on how one is calculated (O’Neil, C., 2016).

In recent debate, *algorithmic citizenship* refers precisely to a form of citizenship shaped by algorithm-mediated interactions, in which rights, access, and recognition may depend on automated classifications and on criteria that are not always explicit. A highly effective image, in cultural and critical terms, comes from James Bridle’s project *Citizen Ex*: the idea of an “algorithmic passport” that shows how our online identity is recomposed across multiple jurisdictions, producing variable and often opaque rights (Bridle, n.d.).²

Operationally, we can define algorithmic citizenship as:

1. the way individuals are seen, evaluated, and governed by algorithmic systems in crucial domains (education, work, welfare, security, mobility);
2. the capacity of subjects to understand, negotiate, and contest such systems, individually and collectively.

² *Citizen Ex* is an artistic and critical project that makes visible the “jurisdictions” and variable rights produced through data. It is useful as a cultural device for discussing the opacity and fragmentation of digital identity.

This citizenship does not coincide with legal citizenship (which remains a necessary but not sufficient condition). It is possible to be formally a full citizen and, at the same time, experience systematic disadvantages because a scoring, filtering, or recommendation system produces exclusions or unfavorable priorities. The educational issue then becomes the competence to render debatable what appears “natural” because it is automated.

3. Three Shifts in perspective that change the educational agenda

To understand what is changing in education, it is useful to begin with how we have always defined citizenship, which has traditionally been understood as a legal status that determines membership and rights. Legal citizenship is largely binary: inside/outside. Algorithmic citizenship, by contrast, is graded, situated, and relational. In one database one may be a “reliable customer”; in another, a “high-risk subject”; in an educational platform, a “vulnerable student to be monitored.” Such labels are not neutral descriptions: they are operators that activate procedures, priorities, and control thresholds.

This first shift in perspective becomes even more decisive once we recognize that the most common pedagogical mistake is to stop at the screen: the app, the social platform, the gradebook. Yet behind the screen lies an infrastructure composed of data governance, business models, contracts, proprietary logics, data centers, and labour supply chains. The infrastructure is not a marginal “behind the scenes”: it is the condition of possibility for what appears on the screen.

It is within this framework that, in recent years, important AI literacy frameworks have been produced, defining the knowledge, skills, and dispositions needed to understand and use AI in a critical and responsible way. Among these are the joint European Commission–OECD work (AILit) and Digital Promise’s framework for schooling (OECD & European Commission, 2025; Mills et al., 2024).

These tools are valuable, but they often remain centered on competent interaction with AI. If we want to speak of citizenship (and not only “use”), however, it is necessary to include:

- questions of **justice** (who benefits, who pays, who is excluded);
- questions of **rights** (access, rectification, objection, contestation);
- questions of **participation** (who decides on the adoption of systems, according to which criteria, and through which accountability procedures).

This is where the proposal of an *algorithmic citizenship literacy* is situated: an integrated literacy that shifts the center of gravity from functional adaptation to systemic responsibility.

4. Literacy for Citizenship

Citizenship is exercised not only through rights and duties, but also through the capacity to sustain shared attention and to dwell on complex issues without yielding to the haste of informational consumption. Yet many digital platforms are intentionally designed to capture and fragment attention: notifications, intermittent rewards, badges, and micro-recognitions follow one another to maximize engagement and keep users constantly connected.

This mechanism does not produce only individual psychological effects—such as a reduced attention threshold or habituation to immediate gratification—but also has profound political and social repercussions. The quality of civic participation and the very manner in which public opinion is formed (or deformed) are influenced by these dynamics of dispersed attention and volatile recognition (Zuboff, 2019).

In this scenario, literacy for algorithmic citizenship must include the ability to recognize, decipher, and manage the affective capture strategies deployed by platforms, promoting practices of mindful attention, deliberate slowness, and reflective engagement with complex issues. Only in this way is it possible to restore depth and substance to public discourse and democratic participation.

In educational institutions, the use of algorithmic systems is already a reality: gradebooks, LMSs, proctoring, learning analytics, up to generative AI tools.³ The point is not to demonize or celebrate, but to institutionalize the discussion: according to which criteria is a platform adopted? How are data managed? How are errors and distortions contested? Education can become a practical laboratory of algorithmic governance, taking up the idea of the school as a laboratory of democracy and translating it into the age of automation (Slade, S., & Prinsloo, P., 2013).

This entails promoting an organizational culture in which students, teachers, administrative staff, and families are actively involved in decision-making processes, fostering awareness, critical competence, and collective agency with respect to the digital infrastructures that shape educational everyday life.

Only in this way can educational institutions become models of algorithmic citizenship, capable of combining technological innovation, rights protection, and social responsibility, and of offering tomorrow's citizens the tools to inhabit a society increasingly mediated by algorithms.

Generative AI introduces a further leap: students are not only “targets” of profiling systems, but co-authors who design texts, images, and code together with generative systems. This raises questions about authorship, responsibility, merit assessment, and also about which images of normality and success are embedded in models and then returned as outputs. From the standpoint of algorithmic citizenship, the co-production of discourse and knowledge becomes a terrain for critical practice: it is necessary to develop the capacity to recognize how subjectivities are shaped in collaboration with generative systems, and how these interactions contribute to constructing, or at times limiting, possibilities of expression, inclusion, and recognition. In this sense, literacy for algorithmic citizenship must promote a reflective

³ In educational contexts, learning management systems (LMSs), proctoring, and learning analytics raise issues of privacy, equity, and data governance.

stance, capable of interrogating not only the technology, but also one's own choices and contributions within an increasingly co-authorial digital ecosystem.

Only through a critical awareness of co-authorship and its impacts is it possible to orient the use of generative AI toward more just, inclusive, and responsible practices, restoring to individuals the role of active protagonists in the construction of knowledge and digital society.

5. What is Algorithmic Citizenship Literacy

To prevent algorithmic citizenship from remaining a slogan, a structured literacy is needed: a coherent set of knowledge, competences, and critical stances. In continuity with, but also advancing beyond, AI literacy frameworks (AILit; Digital Promise), algorithmic citizenship literacy can be articulated into six integrated dimensions (OECD & European Commission, 2025; Mills et al., 2024).

- **Data literacy**

Understanding what a datum is, how it is collected, inferred, combined, and transferred; distinguishing between data consciously provided and derived data; reading indicators and dashboards as “situated narratives,” not as neutral reality. The stake here is recognizing that datafication does not only describe: it produces.

- **Algorithm literacy**

This is not about turning everyone into programmers, but about understanding logics of classification, filtering, recommendation, and scoring: who defines categories and targets? Which variables count? How does bias arise, and how can it reproduce inequalities?

- **AI literacy (critical and contextual)**

Knowing families of systems, limits, and risks (errors, hallucinations, dependence on historical data), as well as educational opportunities. In this dimension, international frameworks offer a useful foundation: AILit (EC–OECD) and Digital Promise emphasize understanding, evaluation, and responsible use.

- **Platform literacy**

Reading platforms as economic and political environments: data-based business models, rules of visibility, moderation, proprietary power. Here one develops awareness that citizenship is exercised within architectures that are not neutral.

- **Civic and rights literacy in digital environments**

Knowing and being able to exercise rights related to data and automated decisions (access, rectification, objection, contestation), developing language to demand accountability and procedures that make recourse practicable. Transparency is not a favor: it is a condition of procedural justice.

- **Ecological digital literacy**

Linking the use of AI and platforms to material implications: energy, water, materials, digital labour supply chains, and the locations of data centers. The litera-

ture has shown that the energy impact of model training and the need for reporting are issues that can no longer be evaded.

Synthesis: algorithmic citizenship literacy is not an additional module; it is a transversal key for rethinking civic education, media education, and AI literacy as education for systemic responsibility within the infosphere.

6. What is Algorithmic Citizenship Literacy

A central thesis of this contribution is that schools and universities can function as real laboratories of algorithmic governance, not because they must become technical authorities, but because they are places where forms of coexistence and public justification of decisions are learned.

In this direction, algorithmic citizenship is exercised when:

- criteria and purposes for adopting platforms are made explicit (why this one and not another?);
- clear rules for data management are defined (minimization, access, retention periods);
- procedures for contestation are established (errors, discrimination, inappropriate automatisms);
- practices of evaluation and participation are promoted (audits, committees, consultations).

It is not by chance that, in the debate on algorithmic citizenship, emphases on democracy, inclusion, and explainability emerge as educational and social nodes (Di Tore et al., 2024; Tomasello, 2023). In this way, school and university not only prepare competent citizens, but themselves become environments in which systemic responsibility in the infosphere is practiced daily.

7. Conclusions. Algorithmic responsibility as systemic responsibility

We can return to the starting point: responsibility. Not as individual blame (“you click too much”), but as systemic responsibility, recognizing that digital actions feed systems with social and environmental effects, and that such systems must be discussable, regulable, and redesignable.

Coevolutionary pedagogies remind us that human beings, environment, and technology are not three separate worlds: they are dimensions of the same weave. Algorithmic citizenship is one of the most tensioned knots in this weave: where rights intertwine with data and the environment with digital infrastructures.

The educational challenge is to avoid two extremes:

- technofatalism (“algorithms decide; we can do nothing”);
- uninformed moralism (“just switch everything off”).

Between these extremes lies the constant, reflective commitment of schools and universities: to create shared languages, critical tools, and conscious practices that make it possible to discuss algorithms like any other social or political norm, claiming transparency, equity, and sustainability. The goal is not limited to forming competent users of technologies, but aims to educate citizens capable of interrogating, understanding, and actively influencing the algorithmic systems that affect their lives, promoting collective care for the infosphere as a common good.

Ultimately, the true educational challenge is to cultivate an algorithmic citizenship able to recognize interdependencies among individuals, technology, and environment, exercising critical sense and an ethics of shared responsibility, so that digital innovation is always at the service of democracy and the public good.

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