

Trust and connection in the artificial intelligence educational ecosystem: From algorithmism to algorithmarism

Confiança i connexió en l'ecosistema educatiu d'intel·ligència artificial: de l'algorisme a l'algoritarisme

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Abstract

This paper addresses the role of trust and emotional connection in the learning process as a human mechanism for social construction, and its adaptation to an emerging educational ecosystem where artificial intelligence (AI) performs various teaching tasks and trend analysis. Likewise, it highlights widespread concerns about the arbitrariness and biases of algorithms in decision-making based on vast data archives (big data). Methodologically, this paper presents neither a case study nor experimental results based on events. Rather, it establishes a mindset that can open a field of future study. Descriptive analysis is used to detect terms, ideas and concepts that will provide elements for a further study of word frequencies and other linguistic analyses (usage of key words, etc.) to elaborate consciousness acquisition and social transformation processes. In sum, the paper discusses the role of trust in educational matters, from creating emotional bonds in the classroom to the institutional credibility conflict arising from the use of AI algorithms in decision-making to replace scientific evidence

(acceptance of algorithmism) or the suspicion that AI arouses in terms of privacy, security, and impartiality (rejection of algorithmarism).

Keywords

Trust, evidence-based practice, EBP, practice-informed education, PIE, algorithmism, algoritharism, governance.

Definitions

Algorithmism: human reasoning processes transferred to algorithmic processes such as mathematical calculation, logic or multifactorial causality. Linked to concepts of computational thinking (Wang, 1993; Papert, 1980, 1996).

Algoritharism: a multidimensional set of political practices technologically arranged to hijack vital meaning; a set of devices to inform, to plan repeatable functions and to shape possible futures under pain logics, deepened by standardization (Sabariego *et al.*, 2020).

Resum

Aquest article aborda el paper de la confiança i la connexió emocional en el procés d'aprenentatge com a mecanisme humà per a la construcció social, i la seva adaptació a un ecosistema educatiu emergent, on la intel·ligència artificial (IA) realitza diverses tasques docents i anàlisi de tendències. Així mateix, posa de manifest la preocupació generalitzada sobre l'arbitrarietat i els biaixos dels algorismes en la presa de decisions basada en vastos arxius de dades (big data). Metodològicament, aquest article no presenta ni un estudi de cas ni resultats experimentals basats en esdeveniments. Més aviat, estableix una mentalitat que pot obrir un camp d'estudi futur. L'anàlisi descriptiva s'utilitza per detectar termes, idees i conceptes, que proporcionaran elements per a un estudi més profund de les freqüències de paraules i altres anàlisis lingüístiques (ús de paraules clau, etc.) per elaborar processos d'adquisició de consciència i transformació social. En resum, l'article analitza el paper de la confiança en qüestions educatives: des de la creació de vincles emocionals a l'aula fins al conflicte de credibilitat institucional derivat de l'ús d'algorismes d'IA en la presa de decisions per substituir l'evidència científica (acceptació de l'algorisme), o la sospita que desperta la IA en termes de privacitat, seguretat i imparcialitat (rebuig de l'algorisme).

Paraules clau: confiança, pràctica basada en l'evidència, EBP, educació basada en la pràctica, PIE, algorisme, algoritharisme, governança.

Definicions

Algorisme: processos de raonament humà transferits a processos algorítmics com el càlcul matemàtic, la lògica o la causalitat multifactorial. Vinculat a conceptes de pensament computacional (Wang, 1993; Papert, 1980, 1996).

Algoritarisme: conjunt multidimensional de pràctiques polítiques disposades tecnològicament a segrestar significat vital; conjunt de dispositius per informar, planificar funcions repetibles i donar forma a futurs possibles sota lògiques de dolor, aprofundits per l'estandardització (Sabariego *et al.*, 2020).

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1. Context

1.1. *Trust and its role in this study*

Currently, all educational institutions strive to legitimize their decisions through outcomes, scientific evidence, and system indicators. From governments to management teams, everyone wants to generate trust and reinforce their credibility with the public. Trust and connection, so essential in teaching and learning processes, thus become elements of political credibility, with all its implications. Measuring society's trust becomes an institutional goal (Organisation for Economic Cooperation and Development [OECD], 2017, 2022a).

The emergence of artificial intelligence (AI) is opening new analytical and statistical possibilities in accessing, measuring, and interpreting results. Institutions are beginning to take an interest in the role of AI-assisted research for improving administration, governance, and institutional decision-making (Gibert, 2023). In education, algorithms are becoming increasingly relevant in justifying pedagogical theories, academic practices, and transformation proposals (Cardona *et al.*, 2023).

Informed practice emerges as a desirable, objective, and scientific concept. Initially introduced by British epidemiologist Archie Cochrane in his book *Effectiveness and Efficiency: Random Reflections on Health Services* (1972), the concept advocated for the use of randomized clinical trials to make objective decisions in the health field. However, the term "evidence-based practice" (EBP) was popularized in the 1990s by David Sackett and other researchers (Thyer, 2004). EBP has been used to define and expand a fundamental approach to many other disciplines, such as nursing, psychology, education, etc., leading to "algorithmism", or computational thinking for social and political decision-making (Wang, 1993). The term is not new: over half a century ago, Valabanis (1958) already contrasted algorithmism as a scientific response against human marginal and subjective explanations (marginalism), useful for reformulating problems but wholly insufficient for explaining processes and proposing economic, social, or military solutions.

The hope of finding an understanding of complex realities in algorithms does not seem very close, and the credibility of educational artificial intelligence (EAI) is still in question, to the point where several territories are thinking of banning AI at school (Klein, 2024). The

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difficulty of transparently explaining the opaque automatisms of AI is generating an instinctive distrust with respect to future proposals which are oriented towards long-term benefit and the always elusive common good. The book *Algoritarismos*, written by Jesús Sabariego (Sabariego *et al.*, 2020) collects numerous examples of this evolution and discusses the social and ethical consequences of the so-called “techno-politics” applied to the transformation of international public opinion (Cristante, 2020). The artificial construction and manipulation of public opinion seem much more feasible if vast data managed by AI algorithms and tools to direct and control media, social networks, and information access spaces are available.

Evidence-based practice (EBP) and its counterpart, practice-informed evidence" (PIE), are two sides of the same coin that intertwine theory and practice. Both demonstrate that the cult of algorithmism has come to education to stay, at the risk of increasing didactic automatisms, cultural biases, or erratic evolutions, which can lead to a dehumanizing algoritharism.

1.2. *The impact of EAI in education: Transformations in trust mechanisms*

Without a favorable state of opinion among education stakeholders, it will not be possible to deploy educational artificial intelligence (EAI) in schools, nor to achieve the benefits of personalization and efficiency that EAI can offer. On the other hand, it would be negligent to incorporate into the classroom, without any caution, tools that are still in a pilot and validation stage. Maintaining a responsible experimental vision requires studying the possibilities of EAI, its ethical limits, and the dangers of its application in controlled environments. The three paradigms of EAI in education (Ouyang & Jiao, 2021) offer a plausible evolution of the use of AI in educative environments, showing different levels of involvement, engagement and interaction between humans and algorithms. They can be summarized as follows:

- Paradigm 1. AI-directed – passive student: behaviorism and action/reaction approach, learner-as-recipient.
- Paradigm 2. AI-Supported – student learns from (and teaches) the IA tutor, in dialogic systems and collaborative models: social constructivism and interactive approach, cognitive adaptations, learner-as-collaborator.

- Paradigm 3. AI-empowered – personalized learning, adaptive mutual evolution: connectivism and networking approach, complex and adaptive systems, learner-as-leader.

Paradigm three implies evolving into a tutorial EAI model that will identify, personalize, and recreate the student's learning processes. Eventually, human "digital twins" will not only be able to operate with information from direct interaction but from data obtained by tracking and integrating the student's personal digital wake. Adaptive systems, on the other hand, can create personal digital bubbles of information that may amplify bias, and individual opinions, polarizing beliefs and opposite positions.

Social network algorithms have been accused of favoring partisan trends, generating hatred among communities, and even altering elections and changing governments. To understand these conflictive processes, in this paper the author briefly reviews the evolution of the concepts discussed and highlights the factors that can contribute to generating or destroying trust in the AI era: from the biological mechanisms of personal interactions when teaching and learning (micro-level), to the communicative processes in school coordination environments (meso-level), and transformations in social, international, and global interest contexts (macro-level). These three areas of study allow a relevant core educational topic to be addressed: the need to generate trust and mutual recognition among the different sectors of the educational community. Therefore, first we will briefly review the conceptual components of trust in education. Then we will construct an educational argument about the uses of artificial intelligence to promote the responsible adoption of AI in the school ecosystem and guide its application to improve processes and outcomes. Finally, we will explore the current trends of technological, pedagogical, and conceptual integration that accompany the system's transformation and its impact on building community and social cohesion.

2. Theoretical and methodological approach

This article establishes an ecosystem of reflection on how AI can affect policymaking, institutional decision-making and even democracy in a hybrid world. It is not a case study, nor is it an experimental descriptive study of particular events. The TPAK and SAMR models

are presented as the basis for a mindsetting reflection that can open a field of future research.

2.1. *The TPACK model*

The TPACK model (technological, pedagogical, and content knowledge) was originally created by Mishra and Koehler (2006) to show the three domains of knowledge needed for integrating technology in the classroom. This model has proven to be closely associated with teachers' motivation and confidence (Almaiah *et al.*, 2022).

The use of the TPACK integration model incorporates the interrelated analysis of technology, pedagogy, and the conceptual contents of educational experiences.

2.2. *Combining SAMR with TPACK*

The evolutionary SAMR model (substitution, augmentation, modification, redefinition – Puentedura, 2006) can help us identify, compare, and sequence the processes of application, adaptation, adoption, and transformation of artificial intelligence technologies in learning environments. Both TPAK and SAMR have been successfully used in the study of learning motivation regarding innovative technologies and in analyzing teachers' and students' trust in the socio-emotional acceptance of the Internet of things (IoT), mobile telephony, and digital gamification, among other technologies (Yang *et al.*, 2021):

- The TPACK model offers the possibility to assess positive attitudes towards the adoption of AI technologies in educational environments.
- The SAMR model can indicate the degree of development of AI integration in these processes and focuses pedagogical processes on improving results.

Used in coordination, TPACK and SAMR generate an integrated dual model that can help identify the endogenous and exogenous barriers that teachers enumerate against the proliferation of EAI tools.

2.3. *Mind-setting methodology*

The process used to develop this article is one of guided reflection, of creating a mindset that can suggest further avenues for research. It therefore does not have traditional research phases such as data collection to answer a specific research question. Rather, it

begins from a premise that, without trust, the adoption of artificial intelligence or any other educational technology cannot receive the necessary attention, critical assessment, or educational consensus needed to study its potential, risk and impact.

Relationship-building and trust, taken together, are essential for deep learning and interrelation in formal education settings, while they are also the best emotional promoters of a school's positive climate. They are equally indispensable for developing good collaborative work among teachers, facilitating professional self-image, team involvement, and project sustainability. Trust, connection, and social awareness are, in sum, intangible parts of the social fabric that provide cohesion to society, promote participation, and enable democracy.

In their study of the variables that hinder technology adoption in education, Bingimlas (2009) highlights the lack of trust due to acquired behaviors, prejudices and beliefs, and unfounded preconceptions which are difficult to counteract. From the TPACK perspective, trust stands out as one of the most significant variables in the adoption of EAI technology in the model's three areas, reflected in this article's structure:

- a) Conceptual contents: We need comparative studies on trust and connection in teaching and learning to help us compare processes with and without EAI.
- b) Pedagogical appropriation of EAI: We must explore the reliability and trust that EAI generates among different educational agents to better understand algorithmism, or the school incorporation of EAI algorithms and artifacts in what has been called "intelligent pedagogy" or "smart pedagogy" (Lorenzo & Gallon, 2019).
- c) The credibility of AI in social systems: We must be alert to emerging trends in algorithmism, and to threats to credibility and social cohesion. These trends call into question the scientific method, proven protocols, and the credibility required by participative governance institutions.

These areas are examined and connected in the context of existing literature and the author's forays into possible ways of integrating AI into sound pedagogical processes. Descriptive analysis is used to detect terms, ideas and concepts that will provide elements for a further study of word frequencies and other linguistic analyses (usage of key words,

etc.) to elaborate consciousness acquisition and social transformation processes. The methodology draws on previous detection of needs and tries to suggest further areas for exploration.

This approach from the TPACK perspective is also aligned with the three levels of gamification in game theory (Werbach & Hunter, 2012): components, mechanics, and dynamics:

- a) Components: operational elements, like pieces in a chess game.
- b) Mechanics: established procedures and evident processes, like the rules and plays and movements of the pieces on the board.
- c) Dynamics: systemic evolution of reality, analyzed holistically, in which the players themselves transform into agents of change and variables resistant to transformation.

The ultimate purpose of this exercise should be to guide research interests towards socio-emotional techno-educational practices, the adoption of ethical techno-scientific models that prioritize the wellbeing of people and communities, and the development of techno-sustainable trends towards a fairer and more supportive world.

3. Conceptual content

Experts define trust (Mayer *et al.*, 1995) as the willingness to be vulnerable to another person's actions based on the belief that they will act competently, honestly, and ethically, which implies both a positive expectation of another person's actions and the acceptance of the risk of error. On the other hand, connection in education is defined as an affective relationship, a strong emotional bond that influences wellbeing and development (Bowlby, 1988) and it is one of the elements that allows efficient personalized interaction between students and teachers, crucial for engagement and learning motivation (Pianta, 1999).

3.1. Trust and connection in teaching and learning

Although trust is initially presented as the bond of credibility and affection between humans, there are not enough studies on its possible transfer to computer-assisted learning situations. At a time when EAI makes us consider how technology can affect changes in the

perception of reality, cognition, and social interaction, it seems essential and necessary to explore trust and its role in learning.

Human learning processes have been approached from very diverse fields. For neuroscience, teaching and learning are linked to somatic, cognitive, social, and cultural stimuli. In its physiological aspect, these stimuli are found in electrochemical processes and neurotransmitters, where various substances released in the brain stimulate physical, emotional, communicative, and behavioral responses. Methods like the universal design for learning (UDL) are clear about the potential of emotions (Meyer *et al.*, 2014) and base much of their success on the management of dopamine (a hormone related to satisfaction, problem-solving reward, and positive reinforcement), oxytocin (a neurotransmitter with natural analgesic properties released after high-intensity experiences to promote a pleasant and happy sensation), adrenaline (which, along with serotonin, regulates circuits of excitement and physical and emotional rest), and endorphins (released in response to stress, imbalance, or cognitive dissonance), among many other molecules that play essential roles in cognitive processes (Vogel & Schwabe, 2016; Takahashi *et al.*, 2023).

Much of the effectiveness of active didactic sequences structured with the motivation-practice-reinforcement scheme lies in the consolidation of a biochemical circuit associated with the creation of trust:

- Acetylcholine is involved in attention and the ability to process new information and to learn.
- Dopamine is related to motivation, emotion regulation, and recognition.
- Oxytocin is associated with trust, empathy, and the formation of social relationships, promoting an inclusive and supportive environment where students feel emotionally involved and connected.

These and other endogenous substances (hormones, neurotransmitters, enzymes) play a relevant role in the creation of trust bonds and help us interact with the environment, balance our sensorial-cognitive reactions, empathize with others, and regulate our adaptation to the social and cultural environment. From here, based on different individual experiences shared through various language filters and mental representation, all cultures

construct their own collective imaginary of feelings, expectations, risk assessment of error, and trust in others.

At the present time, it may be interesting to know the trust processes that students and teachers are building in relation to the role of EAI, given that, for the moment, trust is placed in algorithms to perform routine automated tasks (Miao *et al.*, 2021) but an indiscriminate algorithmic analysis that could represent a risk to social inclusion has not yet been adopted (for example, with the creation of emotional profiles, tutorial areas, or conciliation in conflict management). It is time to take preventive measures before this happens.

Mutual trust is fundamental in the educational field and represents the main emotional element that sustains the implicit social contract between students and educators (Buitrago & Estupiñán, 2022). When the dynamic construction of this trust manages to shape a safe and reliable school environment, education professionals can efficiently develop their work facet, and students can learn in an ideal climate of wellbeing to grow and develop in a comprehensive and balanced manner. In his book *Pedagogy of the Oppressed*, Freire (1968) emphasizes the importance of the dialogical relationship between students and teachers based on frankness and mutual trust and argues that the construction of the bond based on the principles of equity, transparency, and responsibility is fundamental to create a liberating educational environment.

According to this position, the bonds created in a framework of trust allow deep and meaningful learning as students can take risks, ask questions, and explore new ideas without fear of rejection. Among humans, cognitive learning is linked to affective interaction with others, a dialogic learning that constitutes a good part of socialization and sociocultural integration, to achieve a better interpretation of the environment, community, and culture. We still do not have enough information on the socio-emotional consequences that learning derived from exclusive interaction between students and EAI may have.

3.2. *The role of evidence-based trust*

Currently, generative AI has entered the educational ecosystem abruptly and unexpectedly for most professionals through OpenAI and its ChatGPT. It is unknown what alterations conversational transfers from students to chats, bots, and other generative AI tools might

cause. For decades, a long list of digital tools based on algorithms to regulate computerized self-learning systems, known by their acronyms such as CBL (computer-based learning), CAL (computer-assisted learning), CAI (computer-assisted instruction), etc., have existed. However, the arrival of ChatGPT has far surpassed the interest that the emergence of smart classrooms generated a few years ago.

ChatGPT and other AI models designed to generate conversations in natural language raise countless issues that we need to address as soon as possible. The first is clear: What should we do to ensure that advanced AI language models can offer effective, safe, reliable, and consistent educational environments?

Evidence shows that ChatGPT algorithms can generate fake news. Experts warn of the “hallucinations” of generative AI, which are incorrect and unverified responses constructed by the algorithms to provide predictive answers based on their internal statistical logic. The algorithms are imperfect because they largely respond to the biases and cultural filters of their designers, but their results fascinate us because they mimic human actions and communicative processes and can quantify, represent, and predict them with astonishing verisimilitude. This statistical prediction has both advantages and risks.

Can AI or EAI tools enhance affective interaction, socialization, and sociocultural learning that help us to better understand the environment and human culture? ChatGPT itself, when asked, confesses that it is incapable of feeling emotions or consciousness:

PROMPT [Neus Lorenzo]: Please, try to describe yourself as if you were a person.

RESPONSE [ChatGPT4.5]: Alright, I'll try: I am like a person with a great capacity to remember and a quick response capability. Although I have no feelings or consciousness, I can process and understand vast amounts of information. I am always available to help and answer questions. I do not experience emotions or fatigue, and my main goal is to facilitate information and assistance based on what I have been taught.

(OpenAI-ChatGPT4, September 2023)

When asked to analyze the described personality as if it were an expert in psychology and psychiatry, ChatGPT's assessment is more than worrying:

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RESPONSE [ChatGPT4.5]: This person might be experiencing a disconnection from their own emotions or perhaps a form of anhedonia (inability to feel pleasure). The statement of not experiencing emotions could indicate a sensation of affective flattening.

Possible psychiatric diagnosis: There are many conditions that could have similar symptoms, but based solely on this description it could suggest:

Schizoid personality disorder: These individuals often appear distant and may prefer to be alone. They tend not to have strong desires for intimacy and may not respond intensely to situations that others would find exciting.

Depression: Affective flattening, the sensation of disconnection with emotions, or anhedonia are common symptoms of depression.

Some forms of autism: Some people with autism may have difficulty understanding or expressing their own emotions.

(OpenAI-ChatGPT4, September 2023)

We must consider whether EAI can help transform the education system into a more inclusive, ethical, and fair teaching and learning ecosystem if it lacks the capacity to feel emotions, consciousness, or any affective connection. The emotional intensity triggered in conversation with EAI does not come from mirror neurons but from the context of intimacy, the semantic understanding of the text, and the idealization of the message in the brain itself.

Mirror neurons are brain cells that activate both when a person performs an action and when they observe another person performing the same action. They facilitate learning by imitation, essential for acquiring new skills, from language to the development of affectivity and social behaviors. The prefrontal cortex is involved in executive functions such as decision-making, problem-solving, and attention regulation. These brain areas assist in planning complex actions and modulating our responses, crucial for directed and conscious learning. Together, these brain structures enable social and cognitive learning and help individuals interpret and respond effectively to stimuli in their environment, developing their self-image and constructing the trust frameworks that allow them to relate to others.

It is evident that students' mirror neurons do not activate when interacting with ChatGPT in the same way as with people but it is worth studying if the brain is capable of managing learning with generative AI from another substitutive domain with similar or equivalent results that are not harmful to the user. There are not enough studies (Moya, 2023) to determine what the long-term changes will be, if any, in the emotional and behavioral response of students who learn, grow, and develop by placing their emotional connection and personal trust in the responses of an EAI agent, instead of doing so in a human adult. But we have indications to suspect that at the individual level, an extremely focused and addictive dependency bond can develop (Shaffer *et al.*, 2000), and at the community level, there is a real large-scale cybersecurity risk, both in terms of privacy and false information, in what has been called "data poisoning" (Romeu, 2023).

Experts (Tschannen-Moran, 2001) suggest that students' trust in teachers, which allows for open collaboration and communication, is built on variables of reliability, teacher competence, and care:

a) Reliability: The ability to identify and represent reality consistently. In a test, reliability is related to coherence so that when applied repeatedly under similar conditions consistent results are obtained.

b) Teacher competence: Refe

rs to the set of knowledge, skills, practices, and attitudes that educators need to perform their job effectively. It involves the ability to adapt to different contexts, students, or specific situations, and the capacity to reflect on one's practice and improve it based on evidence.

c) Teacher care: Refers to empathy, emotional interaction, and the professional attention with which the teacher connects to students.

Some researchers (Bryk & Schneider, 2002) add two more areas as key components of trust and educational connection, applicable to students and teachers alike and essential for creating a safe supportive environment, so necessary for effective learning:

d) Integrity: Refers to ethical uprightness and the ability to remain true to one's beliefs and models of action.

e) Teacher openness: A capacity related to accessibility and transparency in teachers' decision-making processes.

Let's see if EAI believes it meets these quality criteria. If we ask ChatGPT itself for an evaluation of these characteristics in its teaching performance, its response is revealing and contradictory:

QUESTION [Neus Lorenzo]: As an LLM, ChatGPT and other natural language AI models can be used in education prudently. Can you please indicate what score you would assign to AI on the following characteristics, from 1 to 100? (1 is none, and 100 is absolutely all). Reliability. Professional teaching competence. Teacher care. Integrity. Teacher openness and transparency. Can you add a justification of up to 12 words for each response, please?

RESPONSE [ChatGPT4.5]: Evaluating AI models like ChatGPT in education (from 1 to 100):

- *Reliability: 75. High consistency in responses, but not infallible.*
- *Professional teaching competence: 40. Strong in content, limited in pedagogy.*
- *Teacher care: 20. Lacks empathy and personalized attention.*
- *Integrity: 80. Reliable in providing truthful and relevant information.*
- *Teacher openness and transparency: 70. Transparent about its limitations but cannot self-evaluate.*

(OpenAI-ChatGPT4, December 2023).

It is curious that it can carry out or simulate a self-evaluation, and end denying it (cannot self-evaluate). In any case, we must always remember that these responses are not the result of an authentic exercise in evaluating reality but merely respond to the numerous internal algorithms, that is, to the frequency of occurrence of these words in the current documentation it handles, the conversions by minimum-error correlation, and clustering by proximity (Euclidean KNN models, Manhattan, Minkowski, etc.).

If we insist on details, ChatGPT becomes more precise:

“PROMPT [Neus Lorenzo]: Why did you say earlier that the teacher care score is 20? Can you make a brief list of the main shortcomings, with a sentence of fewer than 10 words for each?”

RESPONSE [ChatGPT4.5]: The score of 20 in teacher care for AI reflects its limitations in emotional and personal aspects, crucial in teaching:

- *No empathy: Incapable of understanding human emotions.*
- *Lack of personal understanding: Cannot adapt to individual needs.*
- *Absence of human connection: Does not form emotional bonds.*
- *Inability to provide counseling: Does not offer emotional or psychological support.*
- *Does not recognize emotions: Cannot interpret or respond to emotional signals.*

(OpenAI-ChatGPT4, December 2023)

It is very significant that in this response, AI’s inability to personalize and provide support to students with specific needs is denied (cannot adapt to individual needs; does not offer personal or psychological support). Obviously, this is not a contradiction in semantic meaning but the result of an algorithm that constructs the sequence of words according to a classification by statistical proximity, and not necessarily in response to the lexical content of the message.

We are also surprised by the way our mind “humanizes” the responses, integrates them as “reasoning and opinions”, and turns them into “credible” when they match our own prior ideas, beliefs, and value judgments, precisely because a positive response triggers neurotransmitter and hormonal mechanisms that we have socially developed to reinforce self-esteem, recognize the cognitive-emotional bond with others, and increase the feeling of wellbeing. Our brain deceives us. No surprises: it also has a reward effect that can be potentially addictive and requires external control.

Simplifying the explanation: ChatGPT does not evaluate; it only searches and quantifies existing word chains and proposes new correlations according to the highest probability of use, based on the statistics of previous uses in its files (both those “supervised” initially and those acquired from the “uncontrolled” contributions of its users). However, it generates

situations of communication in privacy (1 to 1) that intensely simulate human intimacy, emotional openness, and an apparent infallibility that can lead students (especially those who have not yet reached brain maturity) to create an unfounded trust bond. With these prospects, it would be truly negligent to let students explore EAI without human adult support and supervision and be swayed by false expectations or seemingly harmless but highly contradictory proposals with respect to reality.

Along with families and students' legal guardians, it is clear that schools, teachers, and educational system administrations must assume the role that society has granted them by institutional delegation: the design of educational instruction (instructional design), the role of facilitators of knowledge (knowledge facilitation), and inclusive child and youth socialization within the framework of the comprehensive and ethical education of future generations (global citizenship).

4. Appropriation and adaptation of EAI – Algorithmism and the logic of evidence

In 1993, cognitive philosopher Hao Wang pondered, "Can machines think?". He studied human reasoning processes (physicalism) and their transfer to algorithmic processes (algorithmism) such as mathematical calculation, logic, or multifactorial causality (Wang, 1993). At that time, logical reasoning or problem-solving could be represented as a series of steps or computational procedures accessible to the detailed and rational understanding of humans. Algorithmism, in its intention to represent human thought to train rational machines, ended up linking with the idea of computational thinking (CT) by Seymour Papert (1980, 1996), increasingly interested in creating a set of instructions that aligned with human narrative learning and could make technological processes and decision sequences performed by computers accessible and understandable. Technology has changed a lot since then: the initial algorithmism (Valavanis, 1958) has become the computational thinking that currently seeks to improve the essential responses for teaching and learning in a digital world:

a) Enhancing human learning: How to enhance students' thinking skills through concepts and models coined by computer sciences.

b) Improving EAI: How to program, from its origin, technological tools and processes with the legal, ethical, and cultural filters and controls that society deems necessary

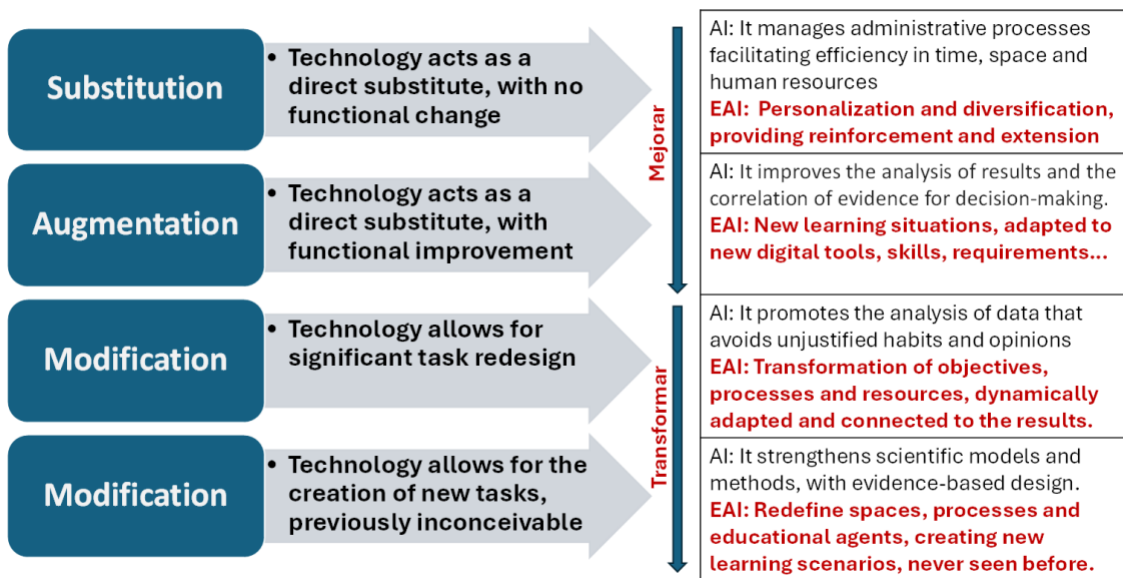
to guarantee the privacy and security of human users as well as equity without biases in their use and application.

c) Improving the so-called “explainability” of both processes: How to explain, justify, validate, and effectively apply both processes for all involved actors (whether human or machines), in the most transparent and accessible way possible, despite their growing complexity.

To advance in these three objectives, the role played by trust is essential. Tech companies are trying to overcome the resistances created by the sudden irruption of AI in the school digital ecosystem and minimize the suspicion generated among educational institutions, teachers, and students’ families every time a new digital tool comes to market.

AI is being consciously used in the management of enrollments, planning of schedules and spaces, mass communication procedures, and administrative processes of communication, dissemination, evaluation, and trend analysis. In this pragmatic framework, transformative educational leadership must seek in EAI algorithms not only the safest teaching and self-learning environments for students and teachers but also the data analysis and management tools that contribute to the delegation of competences and the participation of all educational sectors in order to generate trust and sustainability in the short, medium, and long term.

Especially necessary are the artifacts and constructs that provide the explanations and success evidence needed to incorporate the most efficient management, participative dynamics, and ethical transformation into the system. To avoid an irrational substitution of teachers by EAI, the SAMR Model (Puentedura, 2006) can be used, which describes the phases of incorporating digital technologies into cultural processes:



SAMR applied to Artificial Intelligence (AI) and Educational Artificial Intelligence (EAI), by Neus Lorenzo, 2024.

Figure 1: SAMR processes for technology adoption in educational environments: Proposal for AI (Neus Lorenzo, 2023).

Just as the classification of AI tools is aimed at defining application tasks (OECD, 2022c), the search for educational resources that facilitate the teaching task is aimed at satisfying different areas of action:

- a) Physical or methodological artifacts that improve teacher interaction and generate sufficient evidence on students' progress and difficulties.
- b) Organizational tools and techniques that make administrative management tasks more bearable and allow for comparable data on the results and trends of each group, with the variables that determine the general trend.
- c) Those components, mechanics, and dynamics that can generate models of educational action aimed at meeting learning needs for individual and collective wellbeing throughout life, and an ethical state of opinion that promotes those components, mechanics and dynamics in a situation of inclusion, equity, and social justice.

So far, it seems evident that progress has been made in the first two areas, and only in the last two years has there been a clear concern to address ethical issues with the perspective of unifying interests towards a more promising and sustainable integral approach to EAI.

5. Credibility of AI in social systems

5.1. Credibility in EAI

With AI algorithms in educational environments, an improvement in efficiency (time and space), job safety (reduction of physical and emotional risks), inclusion (progressive ubiquity and universality of digital processes), and sustainability (virtualization presupposes a reduction in the carbon footprint) is generally expected. Evaluating these four variables to gather long-term evidence of their benefits should be an objective of every educational system. It is clear that educational practice cannot work against evidence, and everything seems to indicate that theorization without practical foundation is not a good premise: evidence-based practice, on the other hand, has proven to be efficient in evaluating results and processes.

Evidence-based educational practice (EBP) and practice-informed education (PIE) refer to the use of research and observable evidence to inform and guide both classroom educational practice and pedagogical decision-making based on observable reality (Stahmer *et al.*, 2018). Both generate an interdependent cycle of continuous improvement based on action research,, which constitutes an optimal system when it responds to transformative leadership (Johansson *et al.*, 2010) and is proposed in the form of collaboration between the university and the school. The coordination between researchers and teachers, with the help of data and evidence collected in EAI environments, can be a space for mutual enrichment that we should not renounce.

Under this approach, informed practice becomes an area of educational research while encouraging multisectoral involvement and users' participation in reflecting on their own practice. This integrative approach is increasingly widespread in educational policies and the academic world. Currently, practice-informed education (PIE) is nourished by knowledge obtained through field studies, rigorous statistical data analysis, and contrasted empirical results to identify change variables and propose systemic transformations, which in turn will revert to classroom process improvements (Lorenzo & Burriel, 2022). PIE seeks to improve

the quality and effectiveness of teaching and learning by applying the best available knowledge to make informed decisions in educational practice, whether in lesson planning, pedagogical approaches, system evaluations, or the implementation of transformative educational policies.

On a micro-scale, in the classroom, the EBP-PIE model requires sensitizing teachers to identify the processes, conditions, and results of each student and to establish the appropriate link that stimulates each student's motivation and abilities through the personalized strategies and adaptations necessary in each case. On a meso-scale, at the organizational level, the focus is on using observable data and learning evidence to make decisions based on the school's outcomes, and to select priority resources and promote the success of all students in the center. At the system level, on a macro-scale, the search for evidence involves the use of scientific methods and controlled research processes to evaluate the effectiveness of various educational interventions and identify the most significant variables for teaching and learning improvement.

According to experts (Romeu, 2023), in order to foster trust in EAI systems the existence of reliable information protection devices (which are both the source of information and the historical record) and user data protection mechanisms is key. The transparency of algorithms in justifying and explaining automated decision-making processes is equally necessary. EAI environments must be capable of explaining the functioning and reasons behind their proposals and decisions, and ensure accountability for the consequences, avoiding biases and discrimination of any kind. The inclusion of users in development, data protection, and continuous monitoring are also fundamental. These strategies are essential for the acceptance and success of these systems:

- a) **Transparency:** Clearly expose the limits and risks of EAI programs and their algorithms in decision-making to build credibility and trust. Users should have access to information about data collection and processing, decision-making criteria, and their own participation in the entire process.
- b) **Explainability:** EAI systems should be designed to provide explanations for their decisions and recommendations, helping users understand the system's reasoning and build trust in its capabilities (Doshi-Velez & Kim., 2017). The so-called

“explainability by design” refers to the creation of programs that include “factory-set” ethical filters in the initial design. It also requires control over the clarity and difficulty of the explanations, which by law must be simple and accessible to the intended users.

c) Accountability: Establishing accountability mechanisms is important. This includes ensuring that AI systems are fair, impartial, and free of discrimination. Regular internal and external audits and assessments, always contrasted, can help identify and address potential biases or ethical concerns (Felzmann *et al.*, 2019).

d) User participation: Including users in the design and development process of AI-based educational systems can foster trust. By incorporating user feedback and preferences, the system can better align with users’ needs and expectations.

e) Privacy and security: Ensuring the privacy and security of users’ data is essential to building trust. Implementing robust data protection measures, such as encryption and anonymization, can help alleviate concerns about data misuse or unauthorized access.

f) Continuous monitoring and improvement: Regular monitoring of AI systems can help identify problems or errors that may arise in continuous feedback. It is important to have mechanisms for continuous improvement and refinement of the system based on user feedback and evolving educational needs.

To consider the necessary precautions without detracting from the possibilities of EAI, the author of this article would add the need to apply and develop e-governance.

E-governance refers to the principles of digital leadership and social commitment in the virtual world, and requires its own strategies that include the control of program obsolescence, content updating, and the replacement of management algorithms as necessary.

If we ask ChatGPT to evaluate generative AI with natural language models on these characteristics (from 1 to 100) to see if they offer sufficient criteria to foster credibility and facilitate trust in EAI, the scores are somewhat uneven:

“PROMPT [Neus Lorenzo]: As LLMs, ChatGPT and other natural language AI models must exhibit certain characteristics before they can be prudently used in education. Can you please rate AI on the following characteristics from 1 to 100? (1 being none, and 100 being absolutely all). Can you add a justification of up to 12 words for each response, please? [The previous list is attached]

RESPONSE [ChatGPT4.5]: Here is the evaluation and justification for each characteristic applied to LLMs like ChatGPT and other natural language AI models:

- *Transparency: 70. Good but can improve in technical details.*
- *Explainability: 60. Explanations available, but sometimes complex.*
- *Responsibility: 50. Advances in fairness, but still with challenges.*
- *User participation: 55. Integration of feedback in development.*
- *Privacy and security: 70. Solid measures, with room for improvement.*
- *Continuous monitoring and improvement: 65. Constant improvement needs rapid adaptation.*
- *eGovernance: 60. Aware of obsolescence requires more robust strategies.*

These ratings reflect the current state and capacity of AI models in each of these aspects, considering both their strengths and areas that need further development.

(OpenAI-ChatGPT4, December 2023)

It should be noted again that these responses do not represent an evaluation of reality but are mediated transfers that the algorithms make from their lexical frequency files. However, the interpretation that users can make of this message provides very valuable information, for example, about the human perception of generative AI and widespread beliefs about EAI. The fact that responsibility (50) and user participation (55) are the characteristics with the most room for improvement does not seem to correspond with the perception users have of the risks of transparency (70), privacy and security (70), or continuous improvement (60). In any case, it would be necessary to investigate whether, with these strategies, EAI systems can genuinely generate trust among users, which demonstrably leads to greater adoption and positive educational outcomes.

On the other hand, the cult of scientific evidence has raised alarms among some educators, who speak out against a potential excessively mechanistic algorithmism and even warn of a growing algoritharism that generates distrust and increasingly well-founded suspicions (Sabariego *et al.*, 2020). The social risk this implies deserves a more detailed study in the near future.

5.2. *Credibility in algorithm-directed social changes*

In both social media and international news regarding global conflicts, there is a pervasive sense of discouragement, pessimism, and widespread distrust. Do we trust institutions? According to the latest OECD study (OECD, 2023a), “only 32.9% expect governments to adopt the opinions expressed in a public consultation”. This seems to indicate a general loss of confidence in governance: only half of the respondents in 22 OECD countries surveyed (on a national average) trust their government to use their personal data solely for legitimate purposes (51%).

The Edelman Trust Barometer (Edelman, 2023) acknowledges a worsening societal mood over recent years on a global scale, especially regarding future economic confidence. In 2017, 53% of respondents believed they and their families would be better off economically and socially after five years, and by 2022, 50% of respondents said they maintained confidence in a better future. In 2023, only 40% believed their family would enjoy a better quality of life in five years, marking a 10-point decrease, a 20% plummet in future hope within just one year.

Overall, trust in public institutions is experiencing some erosion, with clear ideological and political polarization (OECD, 2022b). In OECD countries, people tend to view public institutions as trustworthy organizations and are fairly satisfied with existing public services: 41% of the population expressed high satisfaction or moderately high confidence in their national governments. Paradoxically, another 41% of the global population stated their government has very low or low credibility. Despite skepticism about politics or governments, about two-thirds of respondents are satisfied with their health system (68%), educational system (67%), and administrative services (63%) (OECD, 2023b).

The rapid acceleration of digital development in recent decades has led to widespread ignorance about the presence of AI algorithms in the most common technological processes of governance, political management, and all areas of our lives.

Experts from United Nations Educational, Scientific and Cultural Organization (UNESCO, 2023) and university research centers echo widespread concerns about the physical and ethical dangers of the most startling advancements. Ethical concerns and challenges presented by AI, including privacy, data security, and equity, must be a legislative priority. Higher and university education, hitherto bastions of research and scientific culture, are now in question. Education, especially at higher and university levels, seems to fail in convincing its users, experiencing a rapid erosion of trust in efficiency and expectation fulfillment. In the 2023 Gallup study in the United States (Brenan, 2023), when asked about how much confidence they have in higher education, respondents who answered “Very little confidence” went from 6% in 2015 to 15% in 2018 and 22% in 2023, while those responding “A lot of confidence” decreased from 28% in 2015, to 23% in 2018, and to 17% in 2023.

The percentage of adults in the United States expressing a lot or quite a bit of confidence in higher education has notably decreased between 2015 and 2023 (19% among men and 22% among women). Non-university youths expressing a lot or quite a bit of confidence in higher education in 2015 (54%) and in 2018 (45%) have now dropped to less than a third (29%) in 2023.

In education, technological advancements based on big data management and deep learning processes remain distant from classrooms, except in the case of a few teachers or experts linked to techno-scientific disciplines who advocate for their development. Due to their speed and extreme complexity, most AI algorithms are beyond the reach of human cognitive processes and mental activities. It is precisely this complexity that intimidates and conditions authorities and all those who must make decisions about their scalability, transfer, and generalization (Gibert, 2023). In many cases, they either are unaware of the tool or only partially understand its utility, leading to resistance that hardly fosters progress.

There is a growing interest in aligning political decisions about the school system with the vast amount of macrodata collected worldwide, interpreted digitally by specialized

organizations through periodic studies and surveys (PISA, TIMMS, PIRLS, etc.). The influence of this algorithmism can be enormous. For instance, the widespread decline in reading proficiency among 15-year-olds in many countries (after three years of intermittent remote schooling and increased screen time) has incited heated calls for banning mobile phones, implementing new handwriting plans, and reverting to traditional methods proven ineffective and exclusionary. This threat of reverting to a less promising past stems from a progressive loss of confidence in education, argued with data without applying a reliable interpretation of the information, and therefore without a real and verified understanding of the situation (Mortensen & Gardner, 2021).

Educational outcomes in recent years are complex and suggest social changes that still need to be contrasted: Is the mother's level of education still relevant? A glance at the latest PISA results can spark a new debate. In some cases, it seems easier to blame mobile phones than to conduct a thorough study of trend changes and variables that impact social transformation.

The average citizen equally doubts the processes of biological selection of efficient crops, the sterilization and transgenic alteration of food products, the risks of 5G technology, and the dependence created among teenagers by 3D interactive video games. Education experts question the potential neural alterations derived from learning with immersive models (e.g., Metaverse) and the risks with AI agents in extended language environments (e.g., ChatGPT, Bard, etc.). Families ask teachers to ban mobile phones in school because parents cannot do it at home. Major companies managing technology on a global scale attempt to demonstrate that there is insufficient evidence about the dangers of algorithms and the risks of incorporating them into the school system, although personnel or student selection algorithms could be opaque, irresponsible, unilateral, or authoritarian by nature, and remain hidden and impenetrable to the average user.

OECD study groups, UNESCO, and university networks address (often with more anxiety than scientific method) the challenges of algorithms used in political, social, economic, health, or educational decision-making. These and other international institutions are interested in exploring and assessing the adoption of AI and its ethical constraints, with risk identification and control and possible solutions, to mitigate negative impacts and maximize

educational benefits. Their studies demonstrate how the use of EAI digital technologies in education can contribute to reducing the gender gap, favoring the inclusion of the most vulnerable students, incorporating young women into the labor market, and extending basic education in rural areas (UNESCO, 2023), provided these experiences are accompanied by teacher involvement and community social references.

At the same time, the role of algorithms in managing public information is frequently questioned as they create territorial biases that deepen global conflicts. Studies show how algorithms, without supervision, can increase the recursive feedback of personal interest bubbles, the manipulation of beliefs and fake news in digital social network communities, and the promotion of political or religious phobias and phobias on any open public platform.

It is urgent to separate successes from threats. More projects where international collaboration is paramount are needed to place scientific methods at the center of research and demonstrate with practical evidence the strengths and possibilities of EAI when accompanied by teachers committed to working with verified information, undergoing quality training, and promoting responsible educational transformation. EAI resources are an opportunity if applied with sound judgment. Teachers should engage with their best practices of reference.

6. Conclusions and suggestions

From the author's personal experience, the algorithms of generative AI in natural language models have proven to be of unreliable content accuracy in the field of EAI. While useful for managing and generating multiple documentary models, algorithms cannot yet be considered reliable enough to incorporate ChatGPT or any other generative AI model without adult educator supervision into educational environments for minors. They are prone to errors and biases when lacking proper data and can be highly vulnerable to falsified information on social networks (fake news).

Therefore, the application of EAI in the classroom requires the construction of a conducive ecosystem where trust can grow. The journey begins in the teaching and learning process and advances in multisectoral collaboration, with clear proposals:

- a) A change in the role of teachers, who must acquire greater critical and scientific thinking, as well as creativity, to work in harmony with the rest of the educational

community, developing the new digital skills (communicative, emotional, and civic) required for the application of EAI in the school environment.

b) The creation of networks of centers with organizational flexibility to ensure mutual support in the application of AI practices informed by scientific evidence, and to facilitate coordination in peer verification networks and collaborative work.

c) The institutional generalization of teacher training in techno-pedagogy and techno-scientific didactics (smart pedagogy) to build an action-research framework based on reflection on practice, synchronizing the spheres of university research and evidence-based teaching practice for continuous improvement.

With the increase in automated algorithms capable of establishing correlations, classifying observable phenomena, and detecting significant variables in an increasingly complex reality, it seems logical to guide institutional decisions and educational practices on the basis of research and positive data from the educational field: evidence-based practice (EBP) and practice-informed evidence should be incorporated into the repertoire of teachers involved in the use of EAI.

The proliferation of AI in society is a fact, and the application of EAI in primary and lower and upper secondary schools is not only inevitable but also desirable, under appropriate ethical conditions. If we do not want to fall into a dangerous neglect of duties, teachers must explore and apply the EAI artifacts that best suit their objective, context, and educational reality. Teachers should know and rationally and efficiently use EAI tools that can facilitate their teaching, tutoring, and socio-educational tasks in the classroom in order to offer the most appropriate personalization and support in each situation. Teacher training can incorporate the TPACK model and the SAMR approach for helping teachers to become aware of the possibilities that EAI can provide for increasing efficiency and transforming education.

Similarly, management teams and administrative technicians of the system must promote ongoing training in and updating of the processes necessary in the development of rights and duties relating to digital identity, cybersecurity, and legal privacy required by the institution and each of its members. In this respect, governments are adopting clear and

direct measures, such as the Guide to Privacy by Design (Agencia Española de Protección de Datos [AEPD], 2019), which must be disseminated and valued in depth.

The three paradigms or models of AI introduction in schools presented by Ouyang and Jiao are a good example of how EAI can improve with teacher training:

- First step: AI-directed, learner-as-recipient.
- Second step: AI-supported, learner-as-collaborator.
- Third step: AI-empowered, learner-as-leader.

Education professionals cannot be left out of this process and training will be essential. At stake is the transformation of public opinion and the very essence of democracy. Academia must engage in research on the uses and consequences of EAI, with its traditional scientific rigor, or it will lose the credibility and trust of the population. Social, cultural, and political representatives must facilitate action-research programs to responsibly involve families, students, and educational centers, with a future vision that addresses the transformation of personal and social trust and therefore the evolution of education, the future of knowledge, and the cultural sustainability of the human species.

7. Bibliography

Agencia Española de Protección de Datos (AEPD) (2019). *Guía de privacidad desde el diseño*. <https://www.aepd.es/documento/guia-privacidad-desde-diseno.pdf>

Almaiah, M. A., Alfaisal, R., Salloum, S. A., Al-Otaibi, S., Shishakly, R., Lutfi, A., Alrawad, M., Mulhem, A. A., Awad, A. B., & Al-Marroof, R. S. (2022). Integrating teachers' TPACK levels and students' learning motivation, technology innovativeness, and optimism in an IoT acceptance model. *Electronics*, *11*(9), article 3197. <https://doi.org/10.3390/electronics11193197>

Bingimlas, K. A. (2009). Barriers to the successful integration of ICT in teaching and learning environments: a review of the literature. *Eurasia Journal of Mathematics, Science and Technology Education*, *5*(3), 235-245. <https://doi.org/10.12973/ejmste/75275>

- Bowlby, J. (1988). *A secure base: parent-child attachment and healthy human development*. Basic Books.
[https://www.increaseproject.eu/images/DOWNLOADS/IO2/HU/CURR_M4-A13_Bowlby_\(EN-only\)_20170920_HU_final.pdf](https://www.increaseproject.eu/images/DOWNLOADS/IO2/HU/CURR_M4-A13_Bowlby_(EN-only)_20170920_HU_final.pdf)
- Brenan, M. (2023, July 11). Americans' confidence in higher education down sharply. *Gallup*.
<https://news.gallup.com/poll/508352/americans-confidence-higher-education-down-sharply.aspx>
- Bryk, A. S., i Schneider, B. (2002). Trust in schools: a core resource for improvement. Russell Sage Foundation. <https://www.jstor.org/stable/10.7758/9781610440967>
- Rodríguez Buitrago, A. G., i Sandoval-Estupiñán, L. Y. (2022). El valor de la confianza en la escuela. *Revista de Investigación en Educación*, 20(1), 40-57.
<https://doi.org/10.35869/reined.v20i1.3966>
- Cardona, M. A., Rodríguez, R. J., & Ishmael, K. (2023). *Artificial intelligence and future of teaching and learning: insights and recommendations*. United States Department of Education. Office of Educational Technology.
- Cristante, S. (2020). Sobre la transformación de la opinión pública en la era de internet. In: J. Sabariego, A. J. do Amaral, i E. B. C. Salles (coord.) (2020). *Algoritmos* (p. 184-218). Tirant lo Blanch. https://editorial.tirant.com/free_ebooks/9788418329715.pdf
- Doshi-Velez, F., & Kim, B. (2017). Towards a rigorous science of interpretable machine learning. *arXiv Preprint*, arXiv 1702.08608. <https://ar5iv.org/html/1702.08608>
- Edelman (2023). *Edelman Trust Barometer. Navigating a Polarized World*.
<https://www.edelman.com/trust/2023/trust-barometer>
- Felzmann, H., Fosch-Villaronga, E., Lutz, C., & Tamò-Larrieux, A. (2019). Transparency you can trust: transparency requirements for artificial intelligence between legal norms and contextual concerns. *Big Data & Society*, 6(1),
<https://doi.org/10.1177/2053951719860542>
- Freire, P. (1968). *Pedagogía del oprimido*. 2ª ed., Siglo XXI Editores, s.a. de c.v., México / Siglo XXI Editores Argentina, s.a. Accesible des d'Academia Edu:
- Lorenzo Galés, N. (2024). Trust and connection in the artificial intelligence educational ecosystem: From algorithmism to algorithmism. *Revista Catalana de Pedagogia*, 26, 4-37.
<https://doi.org/10.2436/20.3007.01.208>

[https://www.academia.edu/44044187/Paulo Freire pedagogia del oprimido](https://www.academia.edu/44044187/Paulo_Freire_pedagogia_del_oprimido)

Gibert, K. (2023). *Explicabilitat o la inserció de la dada en el procés de decisió* [video]. AI & BIG DATA CONGRESS: Explicabilitat i confiança, claus per escalar la IA. Center for Investigation for Data Tech and Artificial Intelligence CIDAI. YouTube. <https://www.youtube.com/watch?v=7CveVRrAuNc>

Johansson, B., Fogelberg-Dahm, M., & Wadensten, B. (2010). Evidence-based practice: the importance of education and leadership. *Journal of Nursing Management*, 18(1), 70-77. <https://doi.org/10.1111/j.1365-2834.2009.01060.x>

Klein, A. (2024, February 28). Does your district ban ChatGPT? Here's what educators told us. *Education Week*. <https://www.edweek.org/technology/does-your-district-ban-chatgpt-heres-what-educators-told-us/2024/02>

Lorenzo, N., & Burriel, F. (2022). *Evidence-Informed Practice: using evidence to design, implement and improve action in education*. Workshop: EIP Competency in Initial and Continuous Training. EIPSI Conference in Bucharest. <https://www.slideshare.net/nlorenzo/eipsievidenceinformed-practice-using-evidence-to-design-implement-and-improve-action-in-education>

Lorenzo, N., & Gallon, R. (2019). Smart pedagogy for smart learning. In: L. Daniela (ed.), *Didactics of Smart Pedagogy* (p. 41-69). Springer. https://doi.org/10.1007/978-3-030-01551-0_3

Mayer, R. C., Davis, J. H., & Schoorman, F. D. (1995). An integrative model of organizational trust. *The Academy of Management Review*, 20(3), 709-734. <https://doi.org/10.2307/258792>

Meyer, A., Rose, D. H., & Gordon, D. (2014). *Universal design for learning: theory and practice*. CAST Professional Publishing.

Miao, F., Holmes, W., Huang, R., & Zhang, H. (2021). *AI and education: guidance for policy-makers*. UNESCO. <https://doi.org/10.54675/PCSP7350>

- Mishra, P., & Koehler, M. J. (2006). Technological pedagogical content knowledge: a framework for teacher knowledge. *Teachers College Record*, 108(6), 1017-1054. <https://doi.org/10.1111/j.1467-9620.2006.00684.x>
- Mortensen, M., & Gardner, H. K. (2021, February 10). WFH is corroding our trust in each other. *Harvard Business Review*. <https://hbr.org/2021/02/wfh-is-corroding-our-trust-in-each-other>
- Moya, R. (2023). *Métodos de explicabilidad local basada en datos con XAIoGraphs* [video]. AI & BIG DATA CONGRESS: Explicabilitat i confiança, claus per escalar la IA. Center for Investigation for Data Tech and Artificial Intelligence CIDAI. YouTube. https://www.youtube.com/watch?v=7CveVRrAuNc&list=PL8Y_QY-jlnT1b8UHGZswLdJuGFRmr5W78&index=11
- Organization for Economic Cooperation and Development (OECD) (2017). *OECD guidelines on measuring trust*. <https://doi.org/10.1787/9789264278219-en>.
- Organisation for Economic Cooperation and Development (OECD) (2022a). *Building trust in public institutions*. <https://doi.org/10.1787/b7d1e606-en>
- Organization for Economic Cooperation and Development (OECD) (2022b). *Building trust to reinforce democracy: main findings from 2021 OECD survey on drivers of trust in public institutions*. <https://doi.org/10.1787/b407f99c-en>
- Organization for Economic Cooperation and Development (OECD) (2022c). OECD framework for the classification of AI systems. *OECD Digital Economy Papers*, 323. <https://doi.org/10.1787/cb6d9eca-en>
- Organization for Economic Cooperation and Development (OECD) (2023a). *Government at a Glance 2023*. <https://doi.org/10.1787/3d5c5d31-en>
- Organization for Economic Cooperation and Development (OECD) (2023b). *Generar confianza para fortalecer la democracia. Resumen con los principales hallazgos de la Encuesta sobre Confianza de la OCDE*. https://read.oecd-ilibrary.org/governance/building-trust-to-reinforce-democracy_1ca813b9-en

- Ouyang, F., & Jiao, P. (2021). Artificial intelligence in education: the three paradigms. *Computers and Education: Artificial Intelligence*, 2, article 100020. <https://doi.org/10.1787/3d5c5d31-en>
- Papert, S. (1980). *Mindstorms: children, computers, and powerful ideas*. Basic Books.
- Papert, S. (1996). An exploration in the space of mathematics educations. *International Journal of Computer for Mathematical Learning*, 1(1), 95-123. <http://www.papert.org/articles/AnExplorationintheSpaceofMathematicsEducations.html>
- Pianta, R. C., Hamre, B., i Stuhlman, M. (2003). Relationships between teachers and children. In: I. B. Weiner (ed.), *Handbook of psychology*. <https://doi.org/10.1002/0471264385.wei0710>
- Puentedura, R. R. (2006, November 26). Transformation, technology, and education in the state of Maine. *Ruben R. Puentedura's weblog*. http://www.hippasus.com/rrpweblog/archives/2006_11.html
- Romeu, S. (2023). *La IA irromp en la ciberseguretat: canvi de regles* [video]. AI & BIG DATA CONGRESS: IA i ciberseguretat: on i com es donen la mà? Center of Innovation for Data Tech and Artificial Intelligence (CIDAI). YouTube. https://www.youtube.com/watch?v=SDF-UhbhQTo&list=PL8Y_QY-jlnT1b8UHGZswLdJuGFRmr5W78&index=9.
- Sabariego, J., Amaral, A. J. do, & Salles, E. B. Carvalho (2020). *Algoritarismos*. Tirant lo Blanch.
- Shaffer, H. J., Hall, M. N., & Vander Bilt, J. (2000). "Computer addiction": a critical consideration. *American Journal of Orthopsychiatry*, 70(2), 162-168. <https://doi.org/10.1037/h0087741>
- Stahmer, A. C., Suhrheinrich, J., Schetter, P. L., i McGee Hassrick, E. (2018). Exploring multi-level system factors facilitating educator training and implementation of evidence-based practices (EBP): a study protocol. *Implementation Science*, 13(1), article 3. <https://doi.org/10.1186/s13012-017-0698-1>

- Takahashi J., Yamada D., Nagano W., & Saitoh A. (2023). The role of oxytocin in Alzheimer's disease and its relationship with social interaction. *Cells*, 12(20), article 2426. <https://doi.org/10.3390/cells12202426>
- Thyer, B. A. (2004). What is evidence-based practice?. *Brief Treatment and Crisis Intervention*, 4(2), 167-176. <https://doi.org/10.1093/brief-treatment/mhh013>
- United Nations Educational, Scientific and Cultural Organization (UNESCO) (2023). *Global education monitoring report, 2023: technology in education - a tool on whose terms?*. <https://doi.org/10.54676/UZQV8501>
- Valavanis, S. (1958). Marginalism versus algorithmism. *The Review of Economics and Statistics*, 40(3), 224-227. <https://doi.org/10.2307/1927412>
- Vogel, S., & Schwabe, L. (2016). Learning and memory under stress: implications for the classroom. *npj Science of Learning*, 1(1), article 16011. <https://doi.org/10.1038/npjscilearn.2016.11>
- Wang, H. (1993). On physicalism and algorithmism: can machines think?. *Philosophia Mathematica*, 1(2), 97-138 (1993). <https://doi.org/10.1093/philmat/1.2.97>
- Werbach, K., & Hunter, D. (2012). *For the win: how game thinking can revolutionize your business*. Wharton School Press.
- Yang, J., Wang, Q., Wang, J., Huang, M., & Ma, Y. (2021). A study of K-12 teachers' TPACK on the technology acceptance of E-schoolbag. *Interactive Learning Environments*, 29(7), 1062-1075. <https://doi.org/10.1080/10494820.2019.1627560>