

Geometry as a metaphor for debates.

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Abstract. In science, geometry is used as a metaphor—in the mathematical sense of the term, not in the sense used in the social sciences—to model problems in both physics and mathematics. A geometric formalization of these debates serves here as a metaphor to represent the interactions between natural and artificial symbolic reasoning.

In this geometry, symbolic reasoning is metaphorically represented by lines that unravel, become tangled, intersect, spiral, and intertwine, situated on the faces of a polyhedron, with arguments located at the intersections of these lines.

For both humans and machines, the effect of symbolic reasoning compounds with that of language processing and shapes the statements. The analytical method presented here extracts arguments embedded in human verbatim transcripts or in a document produced by individual or collective reasoning. Democratic debates take place among scholars, creative individuals, and children, all of whom possess an innate capacity for symbolic reasoning.

Thus, a synthesis of a document is defined here as a new document distinct from the original, as its arguments factor out a subset of the original document's arguments.

Generative Artificial Intelligence (GAI) is used here to analyze a document, generate a synthesis, and establish a logical table that maps the arguments derived from its analysis and from the analysis of its syntheses.

In this method, the analysis is indifferent to arguments from authority and treats all symbolic reasoning equally, regardless of its authors. It proves effective in a debate that respects equality, human dignity, and freedom of expression as participants discuss topics that concern them all—equally yet distinctly.

This is why the ideal setting for applying this method is a democratic discussion—in an educational institution—among its administrators, teachers, and students, focusing on the use of IAG in education. The goal is to debate a charter that can be revised annually, establishing rules for the use of IAG to prevent, in particular, forms of plagiarism and cheating.

A high school debate is presented here as an example, but this approach can be applied just as effectively to hundreds of thousands of educational institutions, as well as to teaching the proper use of GAI in any institution that adheres to the principles of a social and solidarity economy—and even in any industry seeking to promote the responsible use of GAI internally.

Ultimately, the goal is to empower a community—including those “unfamiliar with the field”—to integrate generative AI into a shared digital space that can be managed collectively.

Keywords: Deliberative Synthesis · Generative AI · Argumentative Logic · Educational Governance · Hypostases · Geometries of Debates

I. Introduction

The interplay between the methodological challenges arising from the production of syntheses and document analyses, and the technical challenge posed by the introduction of generative artificial intelligence (GAI) in an educational context constitutes the analytical core of this paper. These two dimensions reinforce one another in a way that the following section sets out to explain. After highlighting the structural biases that complicate the rigor of citizen consultation syntheses, the analysis will focus on examining the methodological approach itself. Validation through experimentation in an educational setting serves to illustrate the feasibility of its widespread implementation.

1.1 Background and Issues

Citizen consultations and community co-creation initiatives traditionally face significant methodological challenges during the synthesis phase [1]. Indeed, the most common risk lies in the problem of majority consensus: synthesizers and/or rapporteurs tend to prioritize recurring ideas, relegating minority perspectives—even those that are innovative or worthy of interest—to the background [2]. Furthermore, taking quotes out of context frequently results in presenting proposals in isolation from the arguments that support them [3].

Added to this is the rapporteur's subjective bias, as their assessment of what is “important” or “constructive” is strongly influenced by their own culture, opinions, or expectations [4]. In the specific context of consultations involving public administrations, the summary unconsciously tends to align with institutional positions and downplay critical voices. Finally, ensuring the comprehensiveness of arguments within a broader community turns the summary into a complex, cumbersome process that is costly in terms of time and resources.

Consequently, compiling a summary of a discussion requires a rigorous methodology that ensures traceability, trust, and fidelity to the exchanges. It is essential to design a technical solution capable of processing large volumes of discussions in a neutral manner, incorporating points of agreement and disagreement, and respecting the line of reasoning validated by all participants.

1.2. Generative Artificial Intelligence in Education

This methodological need is particularly critical in light of the emergence of generative AI in the field of education, where its use is now unavoidable. While various studies demonstrate its effectiveness in personalizing learning [5], [6] or managing data [7], [8], [9], their deployment raises profound ethical questions, particularly regarding plagiarism and cheating [10], [11], [12]. Learners' use of generative AI is thus frequently criticized as an algorithmic substitution for independent work [13], [14], [15].

The ethical dimensions of IAG—including academic integrity, transparency, traceability, cognitive autonomy, equitable access, data protection, and representation biases—were immediately highlighted. The lack of regulatory frameworks governing the creation and use of these tools has sparked heated debates within the educational community, prompting systematic research on making AI-based learning tools safer [16]. Since the technological rollout has far outpaced the development of regulations, an institutional vacuum has emerged, encouraging students to adopt these tools independently and without supervision.

This phenomenon is a major concern for the international scientific community at the highest levels. As Yoshua Bengio [17] points out, the rapid advancement toward increasingly powerful AI systems requires that our understanding of their risks be based on a rigorous and quantifiable mathematical approach, in order to develop effective mitigation strategies.

1.3 Objectives

The objective of this article is to present a methodological protocol and to outline its logical and geometric foundations. This formalization requires the implementation of reasoning structures shared by a triptych of intelligences: individual human intelligence (IHI), collective human intelligence (CHI), and artificial intelligence (AI). The aim, therefore, is to demonstrate how the triptych of intelligences (IHI, CHI, AI) can be operationalized through a rigorous procedure for constructing a deliberative synthesis.

The study of IAG in education provides an empirical context that multiplies opportunities for debate among scholars, creative individuals, and children. Empirical validation in a real-world setting is being prepared at a high school and can easily be replicated in subsequent experiments.

In this context, AI does not act as a substitute for human judgment: it serves as a catalyst for it. The community retains full control over its argumentative choices and evaluates the synthesis by verifying its alignment with the original verbatim transcript. A human-in-the-loop feedback mechanism ensures this ongoing critical review. The resulting charters do not conclude the debate—they reignite it.

The remainder of the article is structured as follows. We first present the theoretical concepts that serve as the framework for this study. We then detail the methodology behind the concept of the triptych of intelligences, the construction of the deliberative synthesis, the geometry of the debate, and the definition of hypostases—a central element of the formal procedure. Third, we present an experimental section in which a generative AI applies the method to this very text, serving as a fixed-point test of the procedure. Finally, this article concludes with a general conclusion, followed by a discussion of its potential application to debates on the use of generative AI in education.

II. Theoretical Framework

To address this challenge, this research draws on several theoretical and technical foundations:

- The ethics of discussion: This approach posits that human debate must adhere to Habermas’s framework [18], according to which a norm is valid only if it is accepted by the participants following a free, rational, egalitarian discussion free from domination. Legitimacy thus stems from collective deliberation rather than from an external authority.
- The experimental protocol of the Éphicentria Project does not view the creation of the charter as an administrative process, but rather as the governance of an informational “common good.” To operationalize this approach, this methodology draws on the principles of Elinor Ostrom. Collegial and transparent discussions are structured so that the production of verbatim transcripts, their analysis, and their synthesis are entirely controlled by the educational community, with generative AI acting exclusively as a neutral computational third party that intervenes after a debate to highlight areas of consensus and points for further discussion.
- The geometric framework of the debate: The logical and geometric modeling of the debate is based on the work on *topoi* by Lafforgue and Caramello [19], applied to the formalization of digital argumentation by Antsa Nasandratra Nirina Avo [20] in her dissertation and subsequently taken up and developed by Jean Sallantin et al. in the freely available booklet titled “The Digital Debate. The Medium for Democratic Renewal” [21]. <https://spartacus-idh.com/fr/nouvelles-visions-des-sciences/130-130.html>
- Technical infrastructure: The IT development of the methods of analysis and synthesis and their integration is carried out by Jonas Turbeaux (<https://hypostasiasia.org/>).

III. Proposed Method

This article proposes an original method for analyzing and synthesizing debates, focused on analyzing the summaries provided by the debaters and the correspondence between the verbatim transcript and the summaries that generalize it. Its uniqueness lies in a detailed and precise analytical approach. It relies on symbolic reasoning that identifies arguments and presents, in a logical table, the implications—or lack thereof—of the arguments in relation to those in the summary.

This method thus allows any user to harness the processing power of a connectionist AI (statistical/neural networks) while constraining it—through the geometry of the debate—to structure its inferences in the manner of a symbolic AI (based on formal logic, rules, and symbol manipulation, etc.).

The approach relies on a central tool: the table of hypostases, which allows for a direct comparison of the text of the summary with the original verbatim. At a glance, the reader can thus identify arguments that are not supported by any actual evidence—that is, the potential “hallucinations” of generative AI. This formal framework constitutes the core of the methodological contribution: it provides a criterion for logically verifying the fidelity of the synthesis, applicable systematically and independently of the semantic content of the arguments.

The logical table does not evaluate the meaning of the arguments, but rather their structural relationships: implication, corroboration, and absence. In doing so, it makes the deliberative synthesis procedure auditable and reproducible, which is a necessary condition for its use in contexts of collective deliberation.

3.1. The Triptych of Intelligences and the Geometry of Debates

Artificial intelligence is now an integral part of the complex systems we study, design, and teach. In this context, we affirm a normative principle: AI must not be an opaque instrument of control held by a few actors, but must be designed and governed as a digital commons serving a global, open, sustainable, and reflective knowledge society. This principle differs from other possible models (private ownership, state- or corporate-centered regulations) and remains open to debate as a principle because it articulates the perspective from which we conceive of the triptych of intelligences.

In this context, we anticipate that future generations will surprise us with their uses of AI, in the spirit of Edgar Morin: “Expect the unexpected.” Do their constructive uses align with Habermas’s ethics of discussion—seen as the means to articulate thought, both individual and collective—and its implementation by communities aware that they inhabit complex systems such as our planet together?

We distinguish three forms of intelligence:

- individual human intelligence (IHI), which is subjective;
- collective human intelligence (CHI), which is intersubjective;
- artificial intelligence (AI), which is of a different material nature.

These three forms interact by exchanging information via interfaces. When they are connected through interfaces, we obtain the triptych of intelligences. In this context, the debate—the IHI–ICI relationship—refers to the way in which people within the same community enrich their arguments by comparing viewpoints, reaching agreements, finding solutions, and making compromises. In order to preserve collegiality, subsidiarity, and transparency in these debates, we propose that AIs intervene in the debate only as a subsidiary third party, using logic and geometry to reconstruct the verbatim arguments of a debate that is dying down in a way that revives it.

This limitation on AI’s role raises questions: Will a community view AI as merely a toy that can be set aside, as a tool limited to transcribing the debate verbatim, or as a third party guided by other knowledge that might overshadow that of the debaters? Will AI reveal information that has until now remained implicit, accelerating collective creativity through a process that Paul Bourguine summarizes as “one for all, all for one”?

Artificial intelligence, stemming from the work of Alan Turing, is revolutionizing the relationship between human thought (both individual and collective) and computation. Turing’s machine is a universal model of computation, meaning it can represent any other computational model. Alan Turing used it to account for the existence of undecidable statements in arithmetic, which means this model allows for indeterminacy. But (and most importantly), the relationship between thought and computation has yet to be formalized.

The formal analysis of AFC concepts shows that, when knowledge is formulated as propositions, AI programming languages correspond to one another. There are therefore multiple operational strategies for moving from one representation to another: by object, by concept, and by rules. In the case of games, the problem remains that of finding a better representation than that of one’s opponent.

We introduce a three-dimensional geometry—the geometry of debates—to formalize the space in which symbolic reasoning unfolds. In this geometry, AI is a computator that operates in the world of empirical and formal proofs, just as humans do.

The geometry of debates represents symbolic reasoning as lines that coil into spirals, cluster into strands, intersect, and intertwine on the surface of a three-dimensional solid—a polyhedron. It begins by positing six forms of symbolic reasoning, inspired by Peirce: induction, deduction, and abduction, each in both empirical and formal versions. One can visualize Peirce’s cycles—one empirical, the other formal—spinning these threads (lines) at different speeds; discoveries occur where the lines intersect. Arguments are situated at the intersections of different lines, typified by

hypostases that characterize their status (for example: this argument is “unproven” according to one mode of reasoning and “unrefuted” according to another).

In the operational triptych, three interfaces structure the relationship between IIH, ICH, and AI:

1. The debate, the IIH–ICH interface, through which individuals interact directly within a community.

2. The IIH–AI argumentative interface, through which each debater can review the arguments extracted by the AI from the original verbatim transcript and associated texts.

3. The propositional AI–ICH interface, through which a group evaluates arguments transcribed into logical propositions.

A propositional interface presents the arguments and the relationships between them, as found in the summaries, in the form of propositions. In this visualization, controversies are not primarily anomalies to be eliminated, but resources to be clarified and worked through. For example, “speaking of the constant speed of light as an invariant implies speaking of special relativity as a theory.”

These information processing methods provide debaters with a syntactic—logical and geometric—analysis of their reasoning that is entirely independent of the “meaning” of the arguments present in the analyzed texts and verbatim transcripts.

This purely syntactic approach serves as a safeguard against hallucinations, “AI slop,” and the resulting fictitious consensus. Its usefulness and transparency stem from the fact that the arguments point to human-generated documentation compiled by a community acting in good faith, which does not accept arguments “out of thin air”: no synthesis should be considered valid without explicit grounding in texts.

The geometry of debates serves as a frame of reference for mapping both human symbolic reasoning and AI reasoning onto a geometric structure: for geographers, the example is the world map. According to this metaphor, deliberative syntheses correspond to maps that do not fully cover the world map but align with one another when superimposed locally.

A charter is a legal transcription of a deliberative synthesis.

A charter uses legal mechanisms to mark consensus and controversy. However, the authorizations, prohibitions, and permissions of deontic rules always present contradictory situations, as suggested—fictionally but illuminatingly—by Asimov’s laws.

For their part, epistemic rules concern what we know, what we do not know, and leave certain statements undetermined; finally, rules of best practice must always be updated.

In the case of high schools, the Montreal Declaration on the Responsible Development of AI and UNESCO’s texts on AI in education set out an ethical framework, guide the digital transition so that everyone can benefit from it, and seek to reduce power dynamics linked to authority, wealth, or knowledge.

It is in this context that debates in educational and research institutions are essential for refining the approach. Indeed, the agreements to be discussed will focus on how to educate the new generations who are already using AI.

In a highly visible and practical way, this agreement will establish rules to prevent cheating, plagiarism, cognitive delegation, and informational biases, while supporting the development of learners’ critical thinking and cognitive autonomy.

The triptych involves symbolic reasoning practiced by every human being. Recent research in cognitive science by Dehaene et al.[22] shows that human symbolic reasoning is innate and that it engages parts of the brain that process simple geometric shapes (lines, circles, rectangles, points)—as evidenced by children’s drawings—and is also located in the areas responsible for number processing. Such a connection could explain why we easily grasp deliberative syntheses.

This logical-geometric method of processing verbatim transcripts is justified if it enables us to observe the correction of arguments identified during a debate or a synthesis.

3.2 Constructing a Deliberative Synthesis

The deliberative synthesis methodology is a structured approach to integrating the three intelligences of the triptych (IIH, ICH, IA) in order to make explicit the points of agreement and

disagreement present in a verbatim transcript. It provides a practical procedure for mapping the geometry of debates, from human reading to mapping onto the polyhedron.

This section is detailed enough to serve as prompts for a generative AI tasked with performing analyses and syntheses.

3.2.1. Identifying Arguments

The AI reads a text (or the verbatim transcript of a debate) in blocks to isolate arguments: these are statements located within the text or transcript. Each argument has a hypostasis (among the 30 in debate geometry) and a debate mode (discussed, disputed, controversial, consensual) . Example: “AI should be conceived as a digital commons” is classified as a principle/value type, with a debate mode that is often “discussed” or “controversial.”

3.2.2 Extracting Primary Arguments

By definition, a primary argument is an argument that factors other arguments and is not itself included in another primary argument. Primary arguments form a basis for covering the set of all arguments. One mathematical method for obtaining them is the diagonalization of a matrix whose columns contain the terms used to state or describe the arguments and whose rows contain the arguments themselves. The AFC formal concept analysis refers to prime arguments as “irreducible.” They behave like prime numbers because they cannot be decomposed and because they denote the arguments they group together. Thus, prime arguments form a basis that condenses the information present in the arguments.

3.2.3 Bi-typed prime arguments

By definition, an argument is bi-typed when two hypostases are attributed to it (for example: principle + method, value + law, theory + problem, axiom + paradigm).

These arguments signal a structuring argumentative tension because “speaking of this in this way implies speaking of this in that other way.”

3.2.4 Commenting on Arguments

Any debater may comment on any argument.

3.2.5 Writing a Deliberative Synthesis

A synthesis is a text that abstracts all or part of a verbatim transcript. A synthesis is not a summary; it must not rephrase the verbatim transcript. The arguments in a synthesis must distill the arguments from the verbatim transcript.

Comments on the arguments in a synthesis will guide its reformulation.

An IAG writes a synthesis by following an outline and guidelines for structuring its paragraphs, which require a subheading and examples—both consensus and disputed—of the arguments that the synthesis brings together.

3.2.6 Drafting a Charter

A charter is a legal document that summarizes the deliberative process behind a document.

The sections of the charter apply Ostrom’s principles—proposed for the management of a commons by a community—to this specific context. Here is one version:

1. As a commoner, I recognize the resources I must care for and the people with whom I share this responsibility. Commons resources are those we create together, those we protect as gifts of nature, or those that everyone can use.
2. We use the commons resources we create and those we care for. We use the resources (time, space, technology, quantity of a resource) available in a given context. As a commoner, I am convinced that there is a proportional relationship between my contributions and the benefits I receive.
3. We establish or modify our own rules and decide for ourselves on our commitments; and every commoner can participate in this process. Our commitments aim to create, maintain, and preserve the commons in order to meet our needs.
4. We ensure compliance with these commitments ourselves, and sometimes we ask those we trust to help us achieve this goal. We constantly reassess the relevance and usefulness of our commitments.
5. We develop appropriate rules to address violations. We determine the legitimacy of the sanction and its type based on the context and severity of the offense.

6. Every commoner must have the necessary space and resources to resolve conflicts. We strive to resolve conflicts among ourselves in an accessible and direct manner.
7. We decide on our own regulations, and external authorities respect them.
8. We recognize that each commune is part of a larger whole. Thus, better coordination of governance and broader cooperation require the involvement of various institutions operating at different scales

3.3 Hypostases

The selected hypostases, which correspond to the concrete categories used to structure the analysis of the corpus, are described here.

3.3.1 Definition

Hypostases play a central role here. They classify arguments. They have a formal definition in the geometry of debates as lying at the intersection of lines of reasoning; they also have an informal definition. They can be inferred from statements that have been proven or refuted.

Table 1. Formal definitions of the 30 hypostases (not refuted by X / not proven by Y)

Hypotheses	Definition
Aporia	not refuted by empirical induction and not proven by empirical deduction
Approximation	not refuted by empirical induction and not proven by formal deduction
Paradox	not refuted by empirical induction and not proven by formal abduction
Formalism	not refuted by empirical induction and not proven by formal induction
Event	not refuted by empirical deduction and not proven by formal deduction
Variation	not refuted by empirical deduction and not proven by empirical abduction
Dimension	not refuted by empirical deduction and not proven by formal abduction
Mode	not refuted by empirical deduction and not proven by empirical induction
Belief	not refuted by empirical deduction and not proven by formal induction
Invariant	not refuted by formal induction and not proven by formal deduction
Value	not refuted by formal induction and not proven by empirical abduction
Structure	not refuted by formal induction and not proven by formal abduction
Axiom	not refuted by formal induction and not proven by empirical induction

Conjecture	not refuted by formal induction and not proven by empirical deduction
Paradigm	not refuted by formal deduction and not proven by empirical abduction.
Object	not refuted by formal deduction and not proven by formal abduction.
Principle	not refuted by formal deduction and not proven by empirical induction.
Domain	not refuted by formal deduction and not proven by formal deduction.
Law	not refuted by formal deduction and not proven by empirical induction.
Phenomenon	not refuted by empirical abduction and not proven by formal deduction.
Variable	not refuted by empirical abduction and not proven by formal abduction.
Variance	not refuted by empirical abduction and not proven by empirical induction.
Index	not refuted by empirical abduction and not proven by empirical deduction.
Data	not refuted by empirical abduction and not proven by formal induction.
Method	not refuted by formal abduction and not proven by formal deduction.
Definition	not refuted by formal abduction and not proven by empirical abduction.
Hypothesis	not refuted by formal abduction and not proven by empirical induction.
Problem	not refuted by formal abduction and not proven by empirical deduction.
Theory	not refuted by formal abduction and not proven by formal induction.

3.3.2 Formal Definition of Debate Modes

The purpose of a debate may be to reach a consensus-based model of discussion. Controversy implies dispute; dispute implies debate; and the negation of debate implies consensus.

Table 2. Formal Definition of Debate Modes.

Debate Format	Formal Condition
Undisputed	$A \text{ Hypostasis } \neg P_i \ \& \ \neg R_j$
Disputed	$A \text{ Hypostasis } \neg P_i \ \& \ \neg R_j \text{ if } P_j \ \& \ \neg P_i$

Controversial	A Hypostasis $\neg P_i \ \& \ \neg R_j$ if $P_j \ \& \ R_i$
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3.3.3 Informal Definitions of Hypostases

The definitions of hypostases are taken from dictionaries

Table 3. Informal definitions of hypostases.

Hypostasis	Informal Definition
Paradigm	A paradigm is a model or an example.
Object	An object is that which is the focus of discourse, thought, or knowledge.
Principle	Principles are the a priori causes of knowledge.
Domain	A domain is a field defined by limits, boundaries, borders, or demarcations.
Law	Laws express correlations.
Phenomenon	Phenomena are perceived through the senses.
Variable	A variable is something that changes within a system.
Variance	Variance characterizes the dispersion of a distribution or a sample.
Index	An index is a numerical or literal indicator used to distinguish or classify.
Data	Data is what is accepted or given, used to discover or reason.
Method	A method is a procedure that indicates what to do or how to do it.
Definition	A definition is the determination or characterization of a concept's content.
Hypothesis	A hypothesis concerns the explanation or possibility of an event.
Problem	A problem is a difficulty to be solved.
Theory	A theory is an explanatory, hypothetical, and synthetic intellectual construct.
Approximation	An approximation is an estimated value of an actual quantity.
Classification	Classifications involve dividing things into classes or categories.
Aporia	Aporias are difficulties of a logical or philosophical nature.
Paradox	Paradoxes are propositions that are both true and false.

Hypostasis	Informal Definition
Formalism	Formalism is the consideration of the form of an argument.
Event	Events are what happens.
Variation	Variations are changes from one state to another.
Dimension	Dimensions are measurable quantities that determine positions.
Mode	Modes are the ways in which a system exists.
Belief	Beliefs are certainties or convictions that lead one to believe something is true, plausible, or possible.
Invariant	Invariants are quantities, relations, or properties that remain unchanged during a transformation.
Value	A value is a measure of a variable quantity.
Structure	Structures refer to the organization of a system's components.
Axiom	Axioms are propositions accepted as true at the outset of a theory.
Conjecture	Conjectures are unverified opinions or propositions.

IV. Application to the EPHICENTRIA debate The 4 EPHICENTRIA

Debates took place between the head of the school, teacher, former students, parents, AI researchers, free software developers. They produced verbatim, their analyses, deliberative syntheses and charters. Each new debate was carried out with the text of a charter from the previous debate attached. The aim is to prepare the charter that will be retained by the school board. The current methodology is presented to the school on the April verbatim. His analysis shows 1702 arguments

✓ 1702 entités · GPT-4o Mini

Nouvelle analyse ↕

1702 extractions

Position



METHODE

Importance de la citation des sources dans le cadre pédagogique.

[Exemples pratiques : citer les sources après vérification.]

#sources #citation

Commenter



VALEUR PRINCIPE

Lien entre créativité et crédibilité dans l'éducation.

[Créativité et crédibilité.]

#créativité #crédibilité

Commenter



PROBLEME VALEUR

Des enjeux énergétiques et hydriques régissent l'efficacité des infrastructures de l'IA.

[Il y a des préoccupations concernant l'énergie et l'eau nécessaire pour maintenir les data centers et leur refroidissem...]

#énergie #eau #data centers

Commenter

The following deliberative synthesis analysis presents 21 prime arguments that factor some of the verbatim arguments.

✓ 21 entités · GPT-4o Mini

Nouvelle analyse ↕

21 extractions

Position



PROBLEME

CONJECTURE

Question sur l'amélioration de l'instruction grâce à l'IA.

[Est-ce que l'utilisation de l'IA améliore ou pas l'instruction?]

#IA #instruction #amélioration

Commenter



THEORIE

PROBLEME

Les outils d'IA peuvent soutenir ou nuire à l'apprentissage.

[Les outils peuvent soit appuyer, soit compromettre les processus d'apprentissage.]

#outils #IA #apprentissage

Commenter



PRINCIPE

INVARIANT

Importance de la présence humaine dans l'éducation.

[L'humain doit rester au centre du processus pédagogique.]

#humain #pédagogie #interaction

4.1 Deliberative synthesis of the Debate on AI in education: challenges and perspectives

1. Introduction to Educational AI

The debate over the use of artificial intelligence (AI) in education raises crucial questions about its ability to improve instruction. Opinions vary widely, and it is essential to recognize how these tools can either support or hinder learning processes. "Does the use of AI improve education or not?" The concern also extends to the potential psychological impact of AI on users, questioning whether these tools can cause "damage to people's heads."

2. Relationship between tools and pedagogy

Current pedagogy must integrate these new technological realities, while preserving the human relationship within education. AI is perceived as a tool that can give emulation, but it must be used with caution so as not to dehumanize learning. "The human being must remain at the center of the educational process." It is crucial to maintain a framework that supports the use of the tools while preserving student interest and the quality of human interaction.

3. Promoting the responsible use of AI

Education must indeed promote conscious and responsible use of AI. To do this, it seems essential to discuss and establish charters that clearly define the obligations and prohibitions regarding the use of AI tools, especially for underage students. "An educational and pedagogical

AI must be contained and marked." It also seems necessary to encourage new generations to enrich their understanding, rather than being satisfied with ready-made answers provided by AI.

4. Intellectual Property and Ethics

Issues related to intellectual property and ethics are central to this discussion. While AI can process a large volume of data, it is crucial to regulate how this information is used and represented. "It's true that the notion of intellectual property, ethics, etc., is something that is going to be extremely important." Without adequate regulation, the use of AI could lead to abuse and a loss of trust within educational relationships.

5. AI: A Multifaceted Tool

AI offers fascinating opportunities and can be a powerful ally for education in terms of personalizing learning and optimizing teaching methods. However, its ability to generate results in a matter of seconds can also devalue long and laborious learning efforts.

"AI is perceived as a tool for improving courses."

It is crucial to strike a balance between the use of these technologies and the promotion of human cognitive effort in the educational process.

6. Consequences of AI Use

Several concerns are emerging about the risks of isolation that AI could generate among young people. The ease of interacting with machines, to the detriment of human interaction and emotional learning, deserves to be addressed seriously.

"There is nonetheless a danger of selling an illusion."

The risks of excessive dependence on these systems, as well as concerns about the quality of learning, raise questions that institutions must be prepared to answer proactively.

7. Conclusion: Towards a Collaborative Charter

It is therefore essential that schools create a charter governing the use of AI within a collaborative framework, involving students, parents, and teachers. This approach aims not only to regulate the use of tools for educational purposes, but also to establish a culture of responsibility and transparency regarding their impacts.

"I hope we will have a foundation for a charter that can be validated."

In conclusion, the path towards an effective and responsible integration of AI in education is fraught with pitfalls, but the benefits it can bring will remain strategic provided they are managed with intelligence and ethics.

The draft charter is a proposed rewriting of the deliberative synthesis in a form suitable for students. It presents a slight compression of the 22 arguments of the deliberative synthesis into 16 primary arguments.

✓ 16 entités · GPT-4o Mini

Nouvelle analyse 

16 extractions

Position



☐ THEORIE PRINCIPE

L' IA est perçue comme un outil d' aide à l' apprentissage.
[Nous, les élèves, savons que l'intelligence artificielle (IA) est un outil qui peut nous aider à mieux apprendre.]

#IA #apprentissage #outil

 Commenter

☐ CROYANCE PROBLEME

Des craintes existent quant aux effets psychologiques de l' IA.

[Il y a des opinions différentes sur le sujet, et certaines personnes craignent que l'IA ne cause des problèmes psycholo...]

#craintes #IA #psychologie

 Commenter

☐ PRINCIPE STRUCTURE

Importance d' intégrer l' IA tout en préservant le contact humain.

[Dans nos classes, la pédagogie doit se mêler de ces nouvelles technologies tout en gardant la relation humaine au cœur ...]

#pédagogie #relation humaine #apprentissage

 Commenter

4.2 Charter for Responsible Use of AI in Education

1. Introducing AI in Our Schools

We, the students, know that artificial intelligence (AI) is a tool that can help us learn better. But it is important to ask: does it really improve our education?

There are different opinions on the subject, and some people fear that AI may cause psychological problems.

2. The Importance of Human Contact

In our classrooms, teaching must incorporate these new technologies while keeping the human relationship at the heart of our learning. AI can be good support for us, but we must use it without forgetting that human interactions are vital.

"Humans must remain at the center of the educational process."

We must all be mindful of maintaining an environment that fosters our interest and the quality of interactions between us and our teachers.

3. Using AI Responsibly

It is essential that we talk to each other and define rules on how to use AI. This means we must establish clear rules and prohibitions, especially for those of us who are younger.

"Educational and pedagogical AI must be contained and clearly bounded."

Instead of just asking AI for answers, we should learn to enrich our understanding through it.

4. Ownership and Ethics in the Use of AI

Questions of intellectual property and ethics are very important when we talk about AI. We must be careful about how we use and represent information, because without good rules, we could lose trust in our learning relationships.

"It is true that the notion of intellectual property, ethics, etc., is something that will be extremely important."

5. AI as a Learning Tool

AI can truly improve our learning by offering us personalized methods. However, we must be careful that those who try to use AI to generate quick results do not diminish our efforts and our work.

"AI is perceived as a tool for improving courses."

We must find a balance between the use of these new technologies and the importance of our hard work.

6. Avoiding Isolation Through AI

Concerns are arising about the risks of isolation that AI could cause. If we become too dependent on machines, we risk losing our human interactions and our ability to learn to manage our emotions.

"There is nonetheless a danger of selling an illusion."

Being too addicted to AI can raise questions about the quality of our learning.

7. Towards a Collaborative Charter

This is why it is essential that our institutions create a charter to govern the use of AI. This project must include all students, parents, and teachers in order to create a responsible and transparent educational environment.

"I hope we will have a foundation for a charter that can be validated."

This charter will be able to guide us in the use of AI while helping us establish a culture of responsibility and transparency.

8. Together for the Future

We know that the path to integrating AI into our schools can be difficult, but if we work together with listening and respect, we will be able to benefit from everything AI can bring us, while acting with ethics and intelligence.

4.3 Logical Table of Correspondences Between the Arguments of the Deliberative Synthesis and Those of the Proposed Charter

This table organizes, by hypostasis, the presentation of the arguments taken up as examples in the charter, the arguments excluded from the charter (on a red background), those factored into the charter's arguments (struck through), and those added to the charter but absent from the synthesis (on a green background).

verbanim epicentris
Dashboard
Analyses
1
2
3
4
5

Comparaison de versions

Gauche : **V9 — METAPHORE et OSTROM**
 Droite : **V10 — Ré-écriture en une CHARTE OSTROM D'UNE SYNTHÈSE DÉLIBÉRATIVE**

Scénario
Ayant
Modifia

Hypostases
Diff. Texte

V9 — METAPHORE et OSTROM

Propriété intellectuelle et éthique

Les questions liées à la **''propriété intellectuelle''** et à **''l'éthique''** occupent une place essentielle dans cette discussion. Alors que l'IA peut traiter un grand volume de données, il est crucial de réglementer comment ces informations sont utilisées et représentées.

> "C'est vrai que la notion de propriété intellectuelle, d'éthique, etc., c'est quelque chose qui va être extrêmement important."

Sans une régulation adéquate, l'usage de l'IA pourrait mener à des abus et à une perte de confiance au sein des relations pédagogiques.

L'IA : un outil aux multiples facettes

L'IA offre des **''opportunités''** fascinantes et peut constituer un allié puissant pour l'éducation en termes de personnalisation de l'apprentissage et d'**''optimisation des méthodes pédagogiques''**. Cependant, sa capacité de générer des résultats en quelques secondes peut également dévaloriser des efforts d'apprentissages long et laborieux.

> "L'IA est perçue comme un outil d'amélioration des cours."

Il est crucial de trouver un équilibre entre l'utilisation de ces technologies et la promotion de l'effort cognitif humain dans le processus éducatif.

Conséquences de l'usage de l'IA

Plusieurs inquiétudes émergent quant aux **''risques d'isolement''** que l'IA pourrait engendrer parmi les jeunes. L'**''autonomie''** à intégrer avec des machines, au détriment des interactions humaines et de l'apprentissage émotionnel, mérite d'être abordée avec sérieux.

> "Il y a un danger quand même de vendre de l'illusion."

Les **''risques d'une dépendance excessive à ces systèmes''**, ainsi que des préoccupations sur la **''qualité des apprentissages''**, soulèvent des questions auxquelles les établissements doivent être prêts à répondre de manière proactive.

Conclusion vers une charte collaborative

Il est donc essentiel que les établissements scolaires créent une **''charte''** qui régle l'utilisation de l'IA dans un cadre **''collaboratif''**, impliquant les élèves, les parents et les enseignants. Cette démarche vise non seulement à encadrer l'utilisation des outils dans un but éducatif, mais aussi à établir une culture de responsabilité et de **''transparence''** vis-à-vis de leurs impacts.

> "J'espère qu'on aura une base pour une charte qui puisse être validée."

En conclusion, le chemin à parcourir pour une intégration efficace et responsable de l'IA dans l'éducation est semé

V10 — Ré-écriture en une CHARTE OSTROM D'UNE SYNTHÈSE DÉLIBÉRATIVE

devons être conscients sur comment nous utilisons et représentons les informations, car sans de bonnes règles, nous pourrions perdre la **''confiance''** dans nos relations d'apprentissage.

> "C'est vrai que la notion de propriété intellectuelle, d'éthique, etc., c'est quelque chose qui va être extrêmement important."

L'IA comme Outil d'Apprentissage

L'IA peut vraiment améliorer notre apprentissage en nous proposant des méthodes personnalisées. Cependant, nous devons faire attention à ce que **''ceux qui essaient d'utiliser l'IA pour générer des résultats rapides''** ne minimisent pas nos efforts et notre travail.

...

> "L'IA est perçue comme un outil d'amélioration des cours."

Nous devons trouver un équilibre entre **''l'utilisation de ces nouvelles technologies''** et **''l'importance de notre travail acharné''**.

Éviter l'isolement par l'IA

Des inquiétudes se soulevaient concernant les **''risques d'isolement''** que l'IA pourrait causer. Si nous devenons trop dépendants des machines, nous risquons de perdre nos **''interactions humaines''** et notre capacité à apprendre à gérer nos émotions.

> "Il y a un danger quand même de vendre de l'illusion."

Être trop accro à l'IA peut soulever des questions sur la **''qualité de nos apprentissages''**.

Vers une Charte Collaborative

C'est pourquoi il est essentiel que nos établissements créent une **''charte''** pour encadrer l'utilisation de l'IA. Ce projet doit impliquer tous les élèves, les parents et les enseignants afin de créer un environnement éducatif responsable et transparent.

> "J'espère qu'on aura une base pour une charte qui puisse être validée."

Cette charte pourra nous guider dans l'usage de l'IA tout en nous aidant à établir une culture de **''responsabilité''** et de **''transparence''**.

Ensemble pour l'Avenir

Nous savons que le chemin pour intégrer l'IA dans nos écoles peut être difficile, mais si nous travaillons ensemble avec écoute et respect, nous pourrions bénéficier de tout ce que l'IA peut nous apporter, tout en agissant avec **''éthique''** et **''intelligence''**.

V. Second Application Example: Logical Table Applied to This Own Text

Here, the approach is applied to this very text. Column V2 contains the arguments of its deliberative synthesis, whose structure follows that of an Ostrom-style charter. Column V3 is a rewriting, based on V2, of a charter intended for children. 11 of the 30 hypostases are instantiated by arguments. The correspondences between arguments arise from the fact that the arguments in V3 factor in or corroborate those in V2.

Hypostases	Argument V2	Argument V3	
Epistemic (2)			
Axiom			=
	1. Consensus on the need for clear rules for AI use.	1. Students create their own rules for	
Theory	2. The use of AI raises concerns about its impact on instruction. • Integrating AI requires collaboration and	1. AI seems to have potential to improve instruction.	=
Speculative (2)			
Conjecture	1. Integrating AI requires listening and respect in order to reap its benefits.	— Removed	Deleted
Hypothesis	2. Regulation is essential to maintain trust in pedagogy. • The benefits of AI depend on careful management.	Removed	Deleted
Structural (2)			

Invariant	1. The human relationship must be preserved despite AI integration.	1. Students commit to keeping their mutual promises. =	=
Structure	1. Proposal for a collaborative charter on AI use.	1. Need for a charter to govern	=
Normative (3)			
Belief	1. Integrating AI requires listening and respect in order to reap its benefits.	1. Importance of collaboration for integrating AI into schools. =	=
Principle	7. The human relationship must be preserved despite AI integration. • Pedagogy must integrate technology while remaining human-centered. • Consensus on the need for clear rules for AI use. • Need to regulate AI use in education to prevent abuse. • Need to create a charter to govern AI use. • Objective of the charter: promote responsibility and	3. A balance between technology and human effort is necessary. • Creation of rules to handle violations. • Need for a charter to govern AI use. =	=
Value	2. Importance of balance between technology and cognitive effort. • Objective of the charter: promote	— Removed	Deleted
Problematic (1)			
Problem	7. The use of AI raises concerns about its impact on instruction. • Need for a framework to govern AI use. • Need to regulate AI use in education to prevent abuse. • Regulation is essential to maintain trust in pedagogy. • Importance of balance between technology and cognitive effort. • Excessive AI use could diminish the	1. Every child must have the space to resolve their conflicts. =	=
Object / Method (1)			

Method	4. Pedagogy must integrate technology while remaining human-centered. • Need for a framework to govern AI use. • Proposal for a collaborative charter on AI use. • Need to create a charter to govern AI use.	4. A balance between technology and human effort is necessary. • Creation of rules to handle violations. • Every child must have the space to resolve their conflicts. • Importance of collaboration for	
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VI. Conclusions and Perspectives

This contribution has proposed a general framework for articulating individual thought, collective deliberation, and artificial computation, and illustrates it in the context of introducing generative AI (GenAI) into education.

The formalized protocol — grounded in the geometry of debates, the theory of the triptych of intelligences, and the principles of commons governance — aims to provide educational communities with a rigorous instrument enabling them to collectively take ownership of the challenges posed by AI, rather than simply undergoing them.

Analysis of the verbatim of each community — school, laboratory, local authority, company, or association — is an essential condition for avoiding reductive syntheses and for presenting debates in terms that allow everyone to identify their own arguments, map controversies, and make their choices intelligible and justifiable.

Within this framework, GenAI ceases to be a mere text-generation tool: it becomes a neutral, subsidiary computational third party, allowing a community to build its own norms and democratically control their production and revision. The hypostases become a kind of “signage”. in the social sense of the term, for the use of IAG.

The goal is to give a community — including its non-experts — the means to manage a digital commons.

The intended next step is to deploy this protocol within educational communities concerned about the conditions of GenAI use in their teaching practices. It suggests turning schools into “écolabs” (school-laboratories) to study the management of digital commons. It is easy to verify that giving children a voice — whose ignorance is accepted as a matter of principle — affects the verbatim of the debate. It is well known that we are all, whether teacher or student, ignorant: as a patient in a hospital, as a citizen before the administration, as an inhabitant of Earth before nature...

Ultimately, the aim is to transform GenAI from a tool of cognitive substitution into a lever for collective empowerment, in the service of developing critical thinking and civic education in resource-constrained educational environments.

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VII. Bibliographic References

- [1] J. Parkinson, "Legitimacy Problems in Deliberative Democracy," *Polit. Stud.*, vol. 51, pp. 180–196, Mar. 2003, doi: 10.1111/1467-9248.00419.
- [2] R. Shortall, A. Itten, M. Van Der Meer, P. Murukannaiah, and C. Jonker, "Reason against the machine? Future directions for mass online deliberation," *Front. Polit. Sci.*, vol. 4, Jul. 2021, doi: 10.3389/fpos.2022.946589.
- [3] W. Bennett and B. Pfetsch, "Rethinking Political Communication in a Time of Disrupted Public Spheres," *J. Commun.*, vol. 68, pp. 243–253, Apr. 2018, doi: 10.1093/joc/jqx017.
- [4] M. Brüggemann and H. Meyer, "When debates break apart: discursive polarization as a multi-dimensional divergence emerging in and through communication," *Commun. Theory*, Jun. 2023, doi: 10.1093/ct/qtad012.
- [5] Z. Ahmed et al., "The Generative AI Landscape in Education: Mapping the Terrain of Opportunities, Challenges, and Student Perception," *IEEE Access*, vol. 12, pp. 147023–147050, 2024, doi: 10.1109/access.2024.3461874.
- [6] L. I. Ruiz-Rojas, P. Acosta-Vargas, J. De-Moreta-Llovet, and M. González-Rodríguez, "Empowering Education with Generative Artificial Intelligence Tools: Approach with an Instructional Design Matrix," *Sustainability*, Jul. 25, 2023, doi: 10.3390/su15151524.
- [7] K. Kadaruddin, "Empowering Education through Generative AI: Innovative Instructional Strategies for Tomorrow's Learners," *Int. J. Bus. Law Educ.*, Aug. 2, 2023, doi: 10.56442/ijble.v4i2.215.
- [8] H. Wang, A. Dang, Z. Wu, and S. Mac, "Generative AI in higher education: Seeing ChatGPT through universities' policies, resources, and guidelines," *Comput. Educ. Artif. Intell.*, vol. 7, p. 100326, Dec. 8, 2023, doi: 10.1016/j.caeai.2024.100326.
- [9] H. Yu and Y. Guo, "Generative artificial intelligence empowers educational reform: current status, issues, and prospects," *Front. Educ.*, vol. 8, Jun. 1, 2023, doi: 10.3389/educ.2023.1183162.
- [10] E. Alasadi and C. Baiz, "Generative AI in Education and Research: Opportunities, Concerns, and Solutions," *J. Chem. Educ.*, vol. 100, no. 8, pp. 2965–2971, Jul. 27, 2023, doi: 10.1021/acs.jchemed.3c00323.
- [11] D. Cotton, P. Cotton, and J. Shipway, "Chatting and cheating: Ensuring academic integrity in the era of ChatGPT," *Innov. Educ. Teach. Int.*, vol. 61, pp. 228–239, Mar. 2023, doi: 10.1080/14703297.2023.2190148.
- [12] N. Song, "Higher education crisis: Academic misconduct with generative AI," *J. Contingencies Crisis Manag.*, vol. 32, no. 1, Jan. 2024, doi: 10.1111/1468-5973.12532.
- [13] T. Farrelly and N. Baker, "Generative Artificial Intelligence: Implications and Considerations for Higher Education Practice," *Educ. Sci.*, vol. 13, no. 11, Nov. 2023, doi: 10.3390/educsci13111109.

- [14] J. A. Oravec, "Artificial Intelligence Implications for Academic Cheating: Expanding the Dimensions of Responsible Human-AI Collaboration with ChatGPT," *J. Interact. Learn. Res.*, Jan. 2023, doi: 10.70725/304731gmmvhw.
- [15] L. Zhang and J. Xu, "The paradox of self-efficacy and technological dependence: Unraveling generative AI's impact on university students' task completion," *Internet High. Educ.*, vol. 65, p. 100978, Nov. 2024, doi: 10.1016/j.iheduc.2024.100978.
- [16] S. Rismani, C. McGlynn, N. Maslej, and P. Fox, « Rapport international sur la sécurité de l'IA 2026 », 2026.
- [17] Y. Bengio, « Borner la probabilité qu'une IA cause des dommages pour établir un garde-fou », Yoshua Bengio. [Online]. Available: <https://yoshuabengio.org/fr/blogue/borner-la-probabilite-quune-ia-cause-des-dommages-pour-etablir-un-garde-fou>
- [18] J. Habermas, *De l'éthique de la discussion*, Paris: Les Éditions du Cerf. in *Passages* (Paris. 1986). 1992.
- [19] A. N. Nirina Avo, « Modélisation mathématiques de l'argumentation numérique », Doctoral thesis, Université de Fianarantsoa, Madagascar, 2021.
- [20] O. Caramello, « La notion "unificatrice" de topos », in *Lecture Grothendieckienne*, Société mathématique de France, 2021, pp. 138–174.
- [21] J. Sallantin, V. Pinet, D. Luzeaux, and S. Jenny, *Le débat numérique. « Le média d'un renouveau démocratique »*. Paris: Spartacus-idh, 2023. [Online]. Available: <https://spartacus-idh.com/fr/nouvelles-visions-des-sciences/130-130.html>
- [22] H. Huang, Y. LeCun, and R. Balestriero, "Semantic Tube Prediction: Beating LLM Data Efficiency with JEPA," *ArXiv*, vol. abs/2602.22617, Feb. 2026, doi: 10.48550/arxiv.2602.22617.
- [23] S. Dehaene, *Apprendre! Les talents du cerveau, le défi des machines*. Odile Jacob, 2018.