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# Aied as cognitive assemblage and the concrete utopia of education as a weak effort

## **AIED AS COGNITIVE ASSEMBLAGE AND THE CONCRETE UTOPIA OF EDUCATION AS A WEAK EFFORT**

In this article, we discuss the possibility of adopting an experimental attitude towards Artificial intelligence in education (Aied). We contend that such an attitude requires reconsidering the ways in which we commonly think about both Artificial intelligence (Ai) and education. First, we argue that this reconsideration involves taking seriously the idea that education has always been artificial. This means assuming the embeddedness of education within cognitive technical environments and acknowledging that Ai, as a form of nonconscious cognition, is in fact crucial to education. This perspective also challenges any simplistic desire to control the trajectories of cognitive assemblages. Second, we critically discuss the risks associated with conceptualizations of Aied that fail to distance themselves from current trends in the learnification of education and from the related desire to control even the most minute aspects of educational processes in the name of continuous optimization. In our reading, such forms and uses of Aied eradicate the possibility for both human beings and AI itself to be addressed, interrupted, and put into question by the other, thereby undermining the educational value of this relationship. By contrast, we argue that a valuable way of staying with Aied lies in renouncing the hubris of control and instead searching for forms of Aied capable of unlocking the concrete utopian potential of a weak education. Overall, we contend that combining these two moves offers a promising way to engage with the relationship between the coming into the world of Ai and contemporary educational practice and policy.

**KEYWORDS** *Artificial Intelligence, Education, Cognitive Assemblages.*

## 1. Introduction

We do not need a pedagogy of cause and effect, a pedagogy that just aims to generate pre-specified 'learning outcomes.' We rather need a pedagogy of the

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event, a pedagogy that is orientated positively toward the weakness of education. (Biesta, 2016, p. 140).

We do not need a pedagogy of cause and effect, a pedagogy that just aims to generate pre-specified «learning outcomes». We rather need a pedagogy of the event, a pedagogy that is orientated positively toward the weakness of education (Biesta 2015, 140).

The entanglements between education and Artificial intelligence (Ai) are nowadays a key concern for educators, researchers, designers and policy-makers. A consistent body of critical literature highlights how current uses of Artificial intelligence in education (Aied) fundamentally reinforce what Biesta (2015) has conceptualized as the learnification of education. Biesta refers to learnification as the process by which all things related to education are relocated in the semantic field of learning. Here, education overlaps with the provision of learning experiences which have to be designed, managed, monitored and controlled for the sake of continuous improvement and optimization, re-assembling education as a consumerist, behaviourist and transactional activity. While sharing these concerns, in this article, we point out a potential deadlock in the tendency, within those critical debates, to understand Aied as moving from an «artificial division between consciousness and nonconscious cognition» (Hayles 2017) and the assumption of the existence of a total exteriority between technology and the human (DeLanda 2019). This creates the condition for a one-sided critique of Aied as a means to intensify the subjection of the learner to the desires of a functionalist understanding of education, which in turn reinforces an already established tendency in the wider field of education to retreat from any use of Aied and/or to refuse to adopt any experimental attitude towards its potentially valuable educational uses.

Dismissing this as a short-sighted approach, in this article we argue for an experimental and constructive attitude towards Aied in educational communities, which fundamentally reconsiders the conceptual frameworks that are commonly employed to think about education, Ai, and their relations. To qualify this experimental and constructive attitude, in this article we draw on the works of Geert Biesta, Katherine Hayles and Luciana Parisi to highlight three fundamental epistemic and educational shifts.

First, we contend that it is crucial to de-naturalize the idea of education and recognize that education has always been artificial (Hunter 1994). This means fully assuming the embeddedness of education in cognitive technical environments, but also to enlarge the idea of cognition to include non-conscious activities. Out of any dichotomic thinking, this brings with it the acknowledgement that cognition is distributed across socio-technical assem-

blages, agency is exercised through networks of heterogeneous actors, and the interpenetrations of human and technical cognitions work at specific sites (Parisi 2016). Such an epistemic posture invites us to acknowledge that Ai as a form of nonconscious cognition is in fact crucial to human cognition, but it also challenges any simplistic desire to control the trajectories of those cognitive assemblages (Hayles 2017). Moreover, it invites us to conceptualize Aied entanglements adopting a perspective which is sensitive to the complexity and openness of human-non-human assemblages in education (Gulson *et al.* 2022).

Second, we critically discuss the dangers involved in a conceptualization of Aied and its desirable uses that does not distance itself from the current trends in the learnification of education and the related desire to control the most minute aspects of the educational experience for the sake of continuous improvement and optimization (Perrotta and Selwyn 2020). In our reading, this is what produces the mainstream tendency to design forms and uses of Aied that eradicate the possibility for the human being and Ai itself of being addressed, interrupted and put into question by the other. In contrast, we experiment with an understanding of education as a weak effort, that is a radically open and undetermined process and hence a process always in construction (Biesta 2015). We claim that a valuable way for staying with Aied comes from turning down the hubris of control, searching instead for those forms of Aied which unlock the concrete utopian potential of a weak education: i.e., that intervene in education introducing inflection points and opening up for any Aied cognitive assemblage a crossroads where different directions become possible.

Finally, we emphasize how reconceptualizing Aied within the context of education as a weak effort can help us understand how education as human conscious activity, human nonconscious cognition, and technical cognition can act together. Working together in recursive cycles, they can expand their reach and significance beyond what each can accomplish alone (Parisi 2019). This could favour the «coming into the world of free subjects» who «are-together-in-plurality», to paraphrase Hannah Arendt. Putting Ai into conversation with the concrete utopia of a weak education and its pedagogy of the event can free the potential of Aied-human assemblages from functionalist reductionism, hence nurturing the richness and unpredictability of education as a process of subjectivation.

Our overall argument is that the combination between those epistemic and educational moves can offer us a promising way to engage with the relationship between the coming into the world of Ai and contemporary educational practice and policy.

## 2. Education has always been artificial

The first point we make is that if we want to promote an experimental, critical and constructive attitude towards Aied in educational communities, we need to acknowledge that education has always been artificial (Hunter 1994). This epistemic move, as we will argue, is a condition for such an attitude and allows a significant reframing of the ways in which we commonly think about, envision and engage with the relations between education and Ai, both in educational practices and policies.

Current policy debates and the mainstream literature on Aied are informed by two underlying positivist dichotomies:

- the one between education as an uncontested and inherently human activity and technology as artificial. Accordingly, education has to do with human agency, cognition, and affectivity, while technology is implicitly conceived as the material result of an act of human making which conveys – by design – functions and goals, possibilities for adaptation, and ethical imperatives (Simon 1969);
- the one between analogical forms of education (understood, alternatively, as obsolete and outdated or, conversely, as authentic and genuine) and digitally-mediated ones (seen as innovative, cutting-edge, hyper-efficient or, depending on the perspective, impoverished and depersonalised).

This is, of course, particularly evident in the case of digital technologies and Aied as the latest hype in the field. Here, we witness a proliferation of policy documents, frameworks and guidelines, which assume a total exteriority between Ai, educational processes and the human. The same tendency can be detected in a growing body of literature that borrows such an epistemic trait and addresses what is labelled as the continuous artificialisation of contemporary education (Luckin *et al.* 2016; Timotheu *et al.* 2023), linking it to the increasingly intense and widespread use of sophisticated «artificial» technologies.

Those dichotomies are particularly influential in framing the broader and contested debates in the field of Aied about the «values» of education, and what it means to be educated when an Ai-architecture – and its grammars of action and kinds of thinking – inhabits the practice of learning and/or teaching. On the one hand, Aied enthusiasts look at the interaction between Ai-based technologies and education discussing its potential in terms of learning and pedagogical enhancement. What is emphasized here is the capacity

of Ai-based technologies and computation to enlarge both the possibilities for rational decision-making and the understanding of the causal relations between the variables intervening in the learning process and its outcomes (Perrotta 2021). On the other hand, the construction of those dichotomies paves the way for a resistant attitude towards Aied, legitimated by the willingness to oppose any form of artificialisation of education for the sake of its «human nature».

In relation to this last point, as educational researchers who are committed to a democratic, just and emancipatory education, we fully acknowledge many of the ethical concerns surrounding Aied in the contemporary policy and academic debate. However, while we distance ourselves from techno-solutionist enthusiasm, we also see the short-sighted character of any approach resulting in the refusal to engage experimentally with Ai-based technologies in education. To escape from this deadlock, it is essential to de-naturalize the terms of such a dichotomic framing of the Aied debate, reconceptualizing how we see education, Aied and their relations.

Against the anthropocentric idea of education as something which has inherently to do with human agency, cognition and affectivity, we argue that education could be better understood as a set of practices which are culturally, historically, politically, and technically (re)constructed and (re)fabricated. Hence, something which is ontologically artificial and heterogeneous (Perrotta 2021). Drawing on Hunter (2020, 3), we emphasise a conception of education and its institutional components (school and schooling) as an «improvised reality, assembled from the available moral and governmental technologies», a contingent constellation of social and material influences, produced by historical, cultural, and political circumstances. Interestingly, when the ethical aspects of education are in focus, such a perspective moves away from seeing education as something inherently subordinated to a «transcendental» logic of human development. Rather, it shifts the attention from an a priori definition of education's «ideals» or functions towards the recognition of its unprincipled constitution and emergent values (Hunter 2020).

Adopting a perspective which sheds light on the unprincipled and emergent fabrication of education, we bring to the fore its multilayered constitution. This means shifting our attention to the heterogeneity of human, technical and discursive elements that (co)produce education. Such a heterogeneity includes the ways of thinking and questioning, seeing and perceiving, acting and intervening, and forming subjects which are distinctive of specific modes of doing education (Dean 2010; Grimaldi 2019). In relation to that, for instance, in his influential book «Rethinking the School», Hunter (2020) has successfully shown how the modern school is an artificial historical assemblage of humans

and educational technologies. Therefore, it can be understood as an instance of a rationalised form of government whose objects were the security and prosperity of the state itself, and which identified the welfare of the citizens with the achievement of these ends. Deconstructing and recomposing education as something artificial means assuming a socio-material and relational mode of thinking that focuses on the ways in which these technologies, among other entities, frame the possibilities of acting, thinking and being (Dean 2010).

But how can we conceptualize Aied as part of the historical assemblage of education if we want to remain consistent with such a relational mode of thinking? How can we escape from the strictures of the educational/artificial dichotomy and any related essentialist and deterministic perspective? We argue that our first move, the shift towards understanding education as artificial assemblage, has consequences for the ways in which we think of and engage with Aied.

### 3. Artificial education, Aied and cognitive assemblages

In relation to Aied, adopting such a perspective brings with it the acknowledgement that education is a domain of institutionalised practices where cognition is distributed across socio-technical assemblages (DeLanda 2016), agency is exercised through networks of heterogeneous actors (Parisi 2016), and the interpenetrations of human and technical cognitions work in many diverse and distinctive ways at specific sites (Hayles 2017).

Aied, through this lens, could be conceived as a variegated set of entities contributing to a «detailed organisation of the school as a purpose-built pedagogical environment assembled from a mix of physical and moral elements: special architectures, devices for organising space and time, body techniques, practices of surveillance and supervision, pedagogical relationships, procedures of administration and examination» (Hunter 2013, 147). In such complex assemblages, Aied solutions as non-human entities are all but fixed and neutral. Albeit in a non-deterministic way, they participate in the making of educational processes but are at the same time made through a participation.

In other words, this perspective allows us to see education as a sociotechnical assemblage and Aied as part of it. Speaking in terms of assemblage entails a fundamentally relational way of thinking that also accounts for heterogeneity and shared agency. If the education assemblage is understood as a relational entity – an arrangement of diverse and entangled elements – the ontological status of the assemblage ensures a generalised symmetry between human and

non-human actors, recognising their generative attachments. Thus, such an epistemic posture invites us to make a second key move to distance ourselves from the positivist dichotomies which inform the debate on Aied: challenging the traditional anthropocentric assumption that cognition is a prerogative of human thinking and acknowledging that Ai can and should be conceived as a form of nonconscious cognition, in education as in other domains of practice.

To develop this second epistemic move, we build on Hayles (2017) and consider cognition as a capacity that extends far beyond consciousness, permeating complex technical systems. Cognition is intended here as «a process of interpreting information in contexts that connect it with meaning» (Hayles 2016, 32). It is thus «a dynamic unfolding within an environment in which its activity makes a difference» (Hayles 2017, 25). Adopting this understanding of cognition foregrounds interpretation, choice, and decision-making, expanding cognition beyond human to processes occurring across multiple layers within technical systems (Hayles 2016).

In automated technical systems, non-conscious cognition is increasingly embedded in complex architectures where low-level interpretative processes interact with diverse sensors, feeding into higher-level systems that use recursive loops to perform sophisticated cognitive activities. These activities include inferences, developing proclivities, and making decisions that forward into actuators, which perform actions in the world (Parisi 2019a). Hayles (2017) reconceives the tension between automation and thinking as a tripartite system involving conscious thinking, non-conscious cognition, and material processes. This entanglement can be described as a «cognitive assemblage», whose constitutive elements are «the flow of information through a system and the choices and decisions that create, modify, and interpret the flow» (Hayles 2017, 116). Within cognitive assemblages, human and technical «cognizers» interact. Both of them can be understood as important mediators (Latour 2005) that «transform temporary and shifting configurations into durable, robust and reproducible structures capable of creating, solidifying, and wielding power» (Hayles 2017, 116).

Today, there are many examples of cognitive assemblages in education. A prominent one is represented by the many forms of Ai-powered automatic teaching/learning assistance or tutoring tools which are currently employed by teachers and/or students in classrooms and beyond. Those Ai technologies are complex architectures made of material devices, sensors, software and algorithms, data flows and connectivity. They interact with humans in activities with multiple purposes, including designing and planning lessons, assisting with homework or delivering personalised learning, also in response to special or personalized educational needs. Taking advantage of massive storage

space in the cloud, fast processing speed, and computational intensity of data manipulation, they become more and more capable of accessing information from a variety of sources and integrating different flows of information into a streamlined decision-making process. Importantly, they are partly constituted by learning cognizers, such as ML algorithms, sensors and data streams, whose capacities evolve through data scraping and correlation, web reading, geolocation, users interactions, and real-life queries in the interaction with human-operated activities. Interpreting the gathered or retrieved information in contexts and connecting it with meaning through sophisticated statistical modelling, those cognizers are able to provide contextualized tutoring and real-time feedback, to adjust lesson contents based on individual student performance or teachers' queries, or to tailor interventions. As such, these connective technologies form «flexible assemblages that constantly mutate as information is gathered, processed, communicated, stored, and used for additional learning» (Hayles 2016, 34), for both the humans and the technical cognizers themselves.

Through their mobilization, conscious thinking, non-conscious cognition, and material processes interact in a variety of ways. Technical cognizers, in particular, interpret sensory signals and respond to conscious and non-conscious stimuli and/or queries, influencing human cognition, behaviour, movement and responses, and affecting minds, bodies and the configuration of the educational milieu. As programmed technologies and learning automata, they can align with both individual and daily educational needs (e.g. addressing learning gaps or designing a tailored lesson) and broader goals (e.g. promoting specific educational curricula, pedagogies and modes of evaluation). Thus, Ai teaching or learning assistants or tutors can be considered as flexible, adaptive and evolutionary entanglements among human conscious decisions (made by tools designers and programmers, teachers, students, policy makers and/or administrators), human non-conscious actions (such as students and teachers habitual behaviours) and technical cognitive nonconscious operations (processes of data collection and analysis performed by sensors and computer algorithms). In other words, a living, emergent example of cognitive assemblage.

As this example makes it clear, our point is that this notion can be used to read the ecology of Aied as composed of both human and technical cognition which, in order to function, do not rely on enforcing a hierarchical control scheme but rather on embracing such flexible patterns of distributed cognition and agency. Once we move beyond the perception that humans are the sole bearers of cognition, a new set of questions and considerations emerges, prompting us to rethink the relationships between human biological cogni-

tion and technical cognition in education, assuming that their interactions are recursive and complex, and the interpenetrations of human and technical cognitions work at specific sites.

This move further enriches our understanding of education as inherently artificial, since it invites us to recognize that in the making of this artificiality we should include the whole set of social and cultural mediations, which are constitutive of technical cognizers like Llms, Machine learning algorithms (Mla) and other computational functions (Parisi 2016), including the theories of reason and intelligence which they embody or the sociotechnical meanings assigned to them.

Such an epistemic posture sheds light on the evidence that Ai as a form of nonconscious cognition, far from being fundamentally alien to how humans think, is crucial to human cognition. At the same time, it also challenges any simplistic desire to control the trajectories of those cognitive assemblages (Hayles 2017). A crucial implication of the distributed agency of the cognitive assemblage is that humans have no full control over the contexts and levels at which technical systems are able to generate meaning. These are sometimes imperceptible to humans, for example, because of their speed. If therefore Ai systems learn, adapt and interpret, we need to be open to randomness and uncertainty (Parisi 2019a).

In this regard, we argue that rejecting the will of a complete human control over this new form of nonconscious cognition (Parisi 2019b) opens new possibilities for us for problematising the possible mobilizations of Aied in education escaping from the double trap of both human prometheanism and instrumentalist technosolutionism. Speaking about education and its human component as something artificial is a way of indicating its «fragility», instability, «rarity» and contingency (Hunter 2013). Similarly, it involves understanding the relationship between Aied and education as cognitive assemblage and recognizing that it constitutes a multiplicity of uncertain realities that could be contextually (re)made and (re)built. Finally, it clears the ground from the pretension to (and the desire of) total control on Aied cognitive assemblages, while inviting us to engage with the exploration of what Biesta (2015) describes as the weak dimensions of education and its «beautiful risk». This is, in sum, an invitation to opt for a non-dichotomous posture and open us up to the «making [of the educational experience] with» Aied cognitive assemblages (Haraway 2016).

## 4. A weak Aied for a strong education

We have argued so far that recognising the inherently artificial character of education, its assembled nature, and the composite character of education-Aied entanglements as cognitive assemblages brings our attention to the fact that those entanglements could be contextually (re)made and (re)built. We have also emphasized how Aied solutions, as a multiplicity of uncertain realities, are not fixed and neutral. If they embody distinctive technological rationalities, they are also made within relational assemblages. This last point invites us to focus on the ways in which current uses of Aied are shaped through, coupled with, and reinforce specific modes of doing, thinking, questioning, seeing, perceiving, acting and intervening on education, and forming its subjects.

An overview of a body of recent systematic reviews on the uses of Aied in education (Kim and Bennekin, 2016; Zawacki-Richter, *et al.* 2019; Crompton and Burke, 2023; Batista *et al.* 2024; Yusuf *et al.* 2024; Lee and Moore 2024) shows how Aied is systematically related to a peculiar repertoire of educational tools, practices and expectations:

- *Teaching enhancement applications*, such as those aimed at generating and organizing teaching materials, assisting with curriculum design, as well as systems for grading automation and automatic assessment. The latter includes, besides the evaluation of academic achievement, the detection and the estimation of other factors, such as affect and emotions, which are collected and analysed with the goal of increasing students' engagement.
- *Precision assessment and performance prediction applications*, where Ai models are more specifically designed and adopted to identify individual and collective trends drawing on a big and varied amount of data, in order to forecast students' performance, as well as to infer about the overall future of education.
- *Personalized tutoring and individual automatic learning assistance applications*, which for instance offer multimodal support to students, detecting students' individual academic abilities, preferences, and gaps, in order to design tailored strategies to address these. Advocates of personalized learning frame Aied solutions as allowing to match learning to students' personal interests, so that they can «work faster, become disengaged less often, learn more and gain new engaging learning experiences» (Baker 2021).
- *Tools for self-regulated learning*, centred on personalized learning and more specifically on self-evaluation and organization, which of-

fer adaptive content and customized feedback, and aim at making students' learning flexible and autonomous.

- *Tools for administrative support*, which are intended to streamline administrative processes through chatbots and data management.

Looking at this repertoire from a technological point of view, three things are worth noting. First, all Aied tools described above are forms of weak Ai. As is well known, with strong Ai we commonly understand the (hypothetical) mechanical replication of all intellectual human functions, whereas the notion of weak Ai is used to indicate any system employing domain-specific algorithms running tasks that would be considered intelligent if carried out by humans (Gunkel 2012). Second, all the envisaged uses (or expected uses) of those Aied tools are based on Learning analytics (La), also known as educational data mining (Sghir *et al.* 2022), which attempt to exploit the availability of data about students and learning activities to understand them better and make more accurate and forwarding inferences (Clow 2013). Key applications of La include estimating students' knowledge, predicting low achievement and school dropouts, or even identifying factors that cause learners' poor engagement (Baker and Siemens 2014). La also enables Intelligence augmentation systems (Ias), which, for example, may be used to support teachers in decision-making. Notably, rather than using raw data, Ias distil them through machine-learning models into predictions or recommendations (Baker 2021), providing timely insights for enhancing students' reasoning. Similarly, La fuel Intelligent tutoring systems (Its), which collect, store, and analyse students' characteristics and needs, providing them with immediate and customized instruction or feedback (Mousavinasab *et al.* 2021). Finally, a distinctive «technological» rationality underpins the way in which these tools produce what is uncontestedly regarded as reliable education knowledge, a rationality that Parisi (2016) describes as «automation of automation». In fact, the automation embedded in those forms of Ai-based data mining emerges from a peculiar computational logic, whose aim is to discover the algorithm that produces a desired output, rather than deducing an output from a given algorithm. Here Ai does not work as a mere mechanical execution of rules – a rigid series of input-output procedures – but as an abductive mode of artificial thinking. Its «performative activity is afforded by [its] capacity to compress large quantities of information and thus transform outputs into new inputs, involving a new synthesis of reasoning and calculation» (Parisi 2019a, 94) and its aim is to infer «certain facts and hypotheses to plausibly explain some situations» (Parisi 2016, 474).

If we change the perspective and address the Aied repertoire from an educational point of view, equally interesting considerations can be made.

First, uses of Aied are regularly presented as a way to enhance and advance learning in all its aspects (Górriz *et al.* 2020). Interestingly, when the notions of enhancement and advancement are conceptually developed, what emerges is a developmentalist, functionalist and utilitarian vision of learning, as in the case of Technology enhanced learning (Tel) (Hayes 2015). Second, Aied's actual and envisaged uses address education, and the learner, as something that can and should be atomized into smaller elements to be constantly captured, meticulously observed, and translated into measurable values to be «objectively» judged. On the one hand, the identification of engagement, affect, and emotions is supported by a behaviourist rationality, which flattens the nuances of interactions within educational assemblages into predefined and limited options. On the other hand, the drive toward prediction reinforces both a developmentalist perspective and an underlying impulse toward control.

In sum, current trends in Aied seem to be the result of the encounter between a discourse which promotes computation and automation of automation as a new legitimate mode of producing advanced knowledge on education and a specific set of educational rationalities, which are alternatively centred on personalization, functional development, behavioural nudging or cognitive optimization. These traits are what Biesta (2013; 2015) labelled as a strong understanding of education, inspired by a culture of learnification, i.e. the re-location of all things related to education in the semantic field of learning. In this framework, learning itself is translated into a consumerist, behaviourist and transactional activity, and redefined as a commodity to be packaged and offered to the autonomous, self-directed learner by teachers, institutions and other learning providers, including EdTech (Williamson and Komljenovic 2023). In such a strong understanding of education, the ultimate desire is to control and direct learning through modulation with the ultimate aim to optimize it.

Trends in learnification are a key part of the set of social and cultural mediations which are constitutive of Ai technical cognizers like Llm, Mla and other computational functions in the field of education (Knox *et al.* 2020). Hence, they play a significant role in the formation of the sociotechnical meanings assigned to them and the definition of their desirable uses. In fact, consistently with such a strong understanding of education, the primary urge behind the discourses surrounding Aied today seems to be fixing education's inherent risk (Biesta 2013), recalling the risk-free narrative underlying most of contemporary Ai policies<sup>1</sup>. The vision of the relation between Ai and educa-

<sup>1</sup> <https://www.europarl.europa.eu/topics/en/article/20230601STO93804/eu-ai-act-first-regulation-on-artificial-intelligence#ai-act-different-rules-for-different-risk-levels-6>.

tion as a strong effort seems to be grounded in the belief that learning is an input-output process that can be objectively predicted and fully governed. In this view, Ai can serve as a technical (and thus manageable and in full control of the human) tool to optimize learning.

It is in the complexities of those encounters that the educational aims, purposes, and modalities of existence of Aied are shaped and, in turn, contribute to sustain the epistemologies of learnification and to enact its pedagogies. We label this trend as the emergence of «a weak Aied for a strong education» and we suggest that the development of an experimental and symmetric attitude towards Aied requires its careful critique.

In our view, there are significant dangerous implications involved in a conceptualization of Aied and its uses which does not distance itself from the current trends in the learnification of education:

- designs and uses of Aied inspired by the culture of learnification risk reinforcing the dominance of a rationality of measurement in education that reduces students' and teachers' lifeworlds to sets of data to be managed (Perrotta and Selwyn 2020), obliterating both all relevant educational knowledge which cannot be formalised into numbers and all information which cannot be measured;
- they also convey the danger of computational reductionism, that is the generalisation of a computational understanding of education as a set of machine-like processes of input-feedback-output which can be optimized through mechanisms of cybernetic control (Parisi 2019a);
- computational reductionism and the «dream» of a cybernetic government of education bring with them the framing of uncertainty and unpredictability as problems to be tackled and the will to eradicate the unexpected and the error from the educational experience;
- relatedly, «a weak Aied for a strong education» acts as a vehicle for the intensification of the processes of standardisation in education, via the reduction of education to a predictable process whose aim is to reach predefined outcomes;
- the combination of those forms of reductionism risks to reinforce or radicalize the present anthropocentric trend in education which assumes that education has to do only with the human as a failing subject to be disciplined, moulded or controlled.

In our reading the mainstream tendency to design forms and uses of Aied which are epistemically synergic with the trends towards learnification favours

an instrumental understanding of the relationship between Ai and education and reinforces all the risks described above. More importantly, «a weak Aied for a strong education» narrows down possible modes of engagement of Ais and humans within educational cognitive assemblages and eradicates the possibility for the human being and Ai itself of being addressed, interrupted and put into question by the other, failing to recognize the impossibility of any simplistic desire to control the trajectories of those complex cognitive assemblages which includes Ai technologies (Hayles 2017).

## 5. Staying with Ai for an education as a weak effort

In the remaining sections of this article, we discuss the possibility of interrupting this nexus. More specifically, we argue that such an interruption requires, first and foremost, experimenting with an understanding of «education as a weak effort» (Biesta, 2015). Relatedly, we claim that a valuable way for staying with Aied comes from turning down the hubris of control, searching instead for those forms of Aied which unlock the concrete utopian<sup>2</sup> potential of a weak education. Let us unpack our argument.

Conceptualizing education as a weak effort means, in the perspective we advocate here, understanding it as a radically open and undetermined process and hence a process that is always in construction. Modern education has historically been asked to operate in three overlapping domains, what Biesta (2015, 4) describes as qualification, socialization and subjectivation. If qualification refers to the acquisition of knowledge, skills, values, and dispositions, and socialization to the ways in which, «through education, we take part to existing traditions and ways of doing and being», the third domain, subjectification, concerns the role that education is called to play in the making of the «subject-ness» of those who are educated. To put it differently, this third domain relates to the role that education can and is asked to play in creating the conditions for the emancipation and freedom of the subject, and in clearing the responsibility that comes with such freedom.

The discourse of learnification (and the materialization of an Aied-enhanced learnification) produces an overemphasis on education as qualification and socialization, subordinating the making of the subject-ness to the acqui-

<sup>2</sup> We use Lefebvre's notion of concrete utopias here to refer to an attitude, an utopian disposition which moves from knowing and criticizing the real, explores its possibilities, and relies on such a work to imagine proposals for another «world». Such a form of utopianism does not deny social, spatial or historical realities but takes them into consideration – deal with them – in order to explore its possibilities.

tion of knowledge, skills, values and standardized ways of doing and being. In contrast, understanding education as a weak effort means to bring to the fore the subjectification component of education, acknowledging with Biesta (2015, 4) that «education is not just about the reproduction of what we already know or of what already exists, but is genuinely interested in the ways in which new beginnings and new beginners can [engage with, and thus] come into, the world». Education as a weak effort privileges «a pedagogy of the event, [...] that favours existence over essence, weakness over strength, praxis over poiesis» (Biesta 2015, 9). Conceiving education as the opening of spaces for emancipation and freedom involves some key relevant changes in the perspective that often inspires Aied-enhanced modes of educating.

First, it acknowledges that educational processes and practices do not work in a machine-like way and, as a consequence, it is pointless to strive for a perfect match between educational «input» and «output» in any process of teaching and learning. Second, if education isn't a mechanism, then uncertainty and unpredictability have not to be seen as problems to be tackled and reduced, but should rather be understood as the very «dimension» that makes «educational processes and practices educational» (Biesta 2015, x). Third, it accepts the idea that «any engagement in education, teaching or learning always entails a risk», being it the risk of failing, taking different directions with respect to what was planned, exploring the unexpected or coming to uncomfortable conclusions. In sum, embracing an idea of education as a weak effort entails to see the risky nature of education «as something positive that properly belongs to all education worthy of the name» (Biesta 2015, xi). Fourth, it forces us to abandon any anthropocentric assumption in education. In line with the theoretical traditions that we have discussed in the first part of this article, it recognizes that the unfolding of plurality and difference is the condition for any event of subjectivity. Consistently, it acknowledges that education cannot be conceived primarily as a disciplining or controlling practice directed towards the «individual», but on the contrary should mainly address the making and the maintenance of social spaces in which «freedom can appear» (Biesta 2015, 144).

What are the implications of an understanding of education as a weak effort when the relationship between education and Ai is in the spotlight? Many answers could be provided to this question. We will focus here on the more relevant in our view.

If we take seriously the principle of symmetry discussed in the previous sections of this article, the relationship between education and Ai works through weak and unpredictable connections of communication and interpretation, of interruption and response. If this is the case, from the perspective

of a weak education, we should value the generative potential of those weak connections between education and Ai, rather than struggling to reduce them. As Biesta (2015, 4) would argue, «this weakness matters if our educational endeavours are informed by a concern for those we educate to be subjects of their own actions — which is as much about being the author and originator of one's actions as it is about being responsible for what one's actions bring about».

A second relevant answer relates to the need to renounce any desire for control, intended as the desire for anticipating all relevant consequences and using this foreknowledge to determine the future. If education does not work as a mechanism, and is thus an uncertain, unpredictable and risky endeavour, deploying Aied as a means of pervasive control of any educational event seems a counterproductive effort, both in the case in which control assumes the form of disciplining to a norm or modulating towards change and optimization. It is counterproductive in so far as it assumes a mistaken focus (the individual as the categorical entity of education) and goal (mastering a process which is unpredictable, and as such matters). As Hayles observes (2017, 202), the very idea of controlling human-Ai entanglements, «with its historical baggage of human domination and exceptionalism, has come to seem increasingly obsolete, if not outright dangerous». We embrace here her point that, in education as in other domains, any nuanced appreciation of the differences that networked and programmable digital technologies have made in human complex systems can only invite us to abandon any prometheanism and to experiment with the new possibilities that these entanglements open for concrete utopian thinking and acting: «the more control is codified and extended through computational media, the more apparent it becomes that control can never be complete, and the very operations that make control possible also authorize its antithesis, areas where the unknowable rules. The problem, then, is how to use this potential to make real differences in the real world» (Hayles 2017, 203).

Our position, thus, is that a valuable way for staying with Ai in education depends on our willingness to reflect on and experiment with the possibility of attuning our engagement with Ai to the project of a weak education. This means to engage in a search for those forms of Aied which value the generative potential of any weak connections of communication and interpretation, interruption and response between education, the human and Ai and, in doing so, address the making and the maintenance of social spaces in which educational freedom can appear. In this perspective, staying with Ai in education always entails a risk, since it requires dismissing those uses of Ai which eradicate the possibility for the human being and Ai itself of being addressed, «of being interrupted by the other, the risk of being addressed by the other, of being put

into question by the other», whether it is a human or a technical entity (Biesta 2015, 146).

Such an attuning, thus, pushes us towards experimenting with modes of educating with the Ai that introduce inflection points<sup>3</sup> and open up crossroads for Aied-human cognitive assemblages where different directions become possible. This means to compose and decompose Aied-human cognitive assemblages in and through the educational process itself, to make it possible to understand how the interpenetrations of human and technical cognizers work at specific educational sites. It is such a work which allows the emergence of what Hayles (2017, 204) defines as «inflection points», that is, points where it is possible to experience the altering of modes of being, thinking, and acting for both the human and non-human entities involved in a cognitive assemblage. Again, this is first and foremost an educational rather than technological matter, insofar as those alterations can only happen if the Ai-human assemblage is interrogated and questioned closely through educational design, rather than treated as preexisting objective realities. In this perspective, education as subjectivation does not involve merely the making of the subject-ness of the human. Rather, it urges us to fully adopt a relational mode of thinking and to make of education a process where inflection points emerge through a relentless work of educational weak composition and re-composition between the human and the artificial. It assumes the disposition of the human and the non-human to move away from prior commitments to create new trajectories which imagine and explore «more open, just, and sustainable futures» (Hayles 2017, 205).

Staying with Aied for an education as a weak effort means, in sum, working together in recursive cycles, where education as human conscious activity, human nonconscious cognition, and technical cognition can expand their reach and significance beyond what each can accomplish alone (Parisi 2019), favouring the «coming into the world of free [heterogeneous] subjects» who «are-together-in-plurality», to paraphrase Hannah Arendt. Putting Ai into conversation with the concrete utopia of a weak education and its pedagogy of the event can free the potential from functionalist reductionism of Aied-human assemblages to enhance the richness and unpredictability of education as a process of subjectivation.

<sup>3</sup> We adapt from Hayles (2017, 221) the notion of inflection points to our argument on Ai and education. Originally, this notion, which comes from mathematics, refers to a point on a curve where the sign of the curvature changes direction. In our case an educational inflection point is an event and a strategic point at which small differences in the functioning of a composite assemblage can have significant relational effects, altering how an assemblage and the relations among its entities proceeds in their spatial and temporal unfolding.

## 6. Conclusion

We start this short conclusion by coming back to the notion of artificial education. We have already explained why, in our view, education has always been artificial. Yet, as modern human beings, we have repeatedly told ourselves that education is essentially a human effort, made by humans for humans, failing to recognize its historically contingent and assembled character (Hunter 2013). The coming into education of Ai will probably be the historical fold where we will be forced to acknowledge and attune our idea of education to our hybrid modes of being human.

As educators, today, we are probably at a crossroads. On the one hand, we can continue with our established understandings of education which grant prominence to the human and its capacity to master its relations with the world. This assumes that humans are the only ones who have selves, that they have the monopoly on thinking and acting, that technology can be conceived as prostheses of the human, that are keen to serve human will, and finally that it is the human viewpoint which counts the most in determining what education is and means. Such a set of understandings can, paradoxically, produce the curious effect of modulating the human as a subject in a perennial state of deficit and thus in need of a technological enhancement to pursue its perfection. It also brings us towards functionalist and reductionist modes of doing education, by and through technologies like Ai. In our view, to put it in a very simple way, this is the main story that we tell ourselves today when it comes to the potential and dangers of Ai uses in education. On the other hand, we could enter a dangerous pathway, «by enlarging the idea of cognition to include non-conscious activities» and by recognizing that «the cognitive nonconscious also carries on complex acts of interpretation, which syncopate with conscious interpretations in a rich spectrum of possibilities» (Hayles 2017, 213).

In this vein, in this article we have advocated for both a thorough reconceptualization of the entanglements between conscious and nonconscious cognition, in a perspective that strives for a cognitive planetary just ecology for humans and non-humans and a reconceptualization of the Aied-human educational assemblages within the framework of a weak education as a concrete utopia. Those two moves are essential, in our view, if we want to unlock a non-functionalist and non-reductionist potential of Aied-human assemblages, and experiment with other desirable kinds of Ai in and/or education. Such experimentation involves educators, learners, Aied designers and other humans to acknowledge that, as humans, technical devices such as Ai cognize and interpret all the time, interacting with and significantly influencing human interpretations, while being influenced by their conscious and non-conscious

cognition. Any educational practice involving technical devices as Ais, thus, can be conceived as «a rich ecology of collaborating, reinforcing, contesting, and conflicting interpretations» (Hayles 2017, 213), where the search for educational meaning stands as an activity involving many kinds of agents, humans and technical devices, biotic and abiotic. To put it simply, Ai as a form of non-conscious cognition, far from being fundamentally alien to how humans teach and learn, educate and are educated, is already symbiotically part of it and is indeed crucial to human education: «[...] it is now apparent that humans and technical systems are engaged in complex symbiotic relationships, in which each symbiont brings characteristic advantages and limitations to the relationship. The more such symbiosis advances, the more difficult it will be for either symbiont to flourish without the other» (Hayles 2017, 216).

If we embrace this perspective, then the question becomes how Ai-human cognitive assemblages are changing the conditions of education as teaching and learning and how educational ecologies are becoming increasingly interdependent with intelligent technologies. It also becomes a question of how we can stay with the implications of that interdependence, analysing, interpreting, understanding and acting within it to struggle for the kind of education we want.

In this respect, Biesta's idea of education as a weak effort provides a promising pathway to be explored, a mode of relating to Ai where any educational practice with Aied can be conceived and lived as an act of creation and freedom, a radically open and undetermined act of calling being into life, an engagement with the beautiful risk of staying with Ai as difference in education (Biesta 2015, 139). In sharp contrast with the contemporary debates on Aied, this perspective points out that Aied matters in education when it is addressed, appealed, called or singled out by an educational other, whether it is human or not. This is a promising way to engage with the relationship between the coming into the world of Ai and education as the event of subjectivity, or the effort to favour the coming into the world of free subjects.

As we have already emphasized, we are probably living an educational present which urges us to attune to our hybrid modes of being human (Wynter 2001). Within the framework of an understanding of education as a weak effort, we argue that can provide us with the epistemic, educational, ethical and political terrain for addressing some of the key questions for the future of education in contemporary societies. Those questions concern what kind of Ai is desirable in education, the purposes that an education-Ai assemblage should achieve, what scopes we want Ai in education to work for, the extent to which this can be pre-specified and, finally, at which point the desire for Ai and automation becomes uneducational.

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