FROM FRANKENSTEIN TO IOTOYS: EDUCATING BETWEEN CONTROL AND AUTONOMY IN THE AGE OF DATAFICATION

Silvestro Malara
Università Mediterranea degli Studi di Reggio Calabria
silvestro.malara@unirc.it

Fabiana Milardi
Università Mediterranea degli Studi di Reggio Calabria
mlrfbn02b44h224q@studenti.unirc.it

Double Blind Peer Review

Citation
Malara S & Milardi F., From frankenstein to iotoys: educating between control and autonomy in the age of datafication, *Italian Journal of Health Education, Sports and Inclusive Didactics, 10*(4).

Doi: https://doi.org/10.32043/gsd.v1i4.1882

Copyright notice:
© 2023 this is an open access, peer-reviewed article published by Open Journal System and distributed under the terms of the Creative Commons Attribution 4.0 International, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

gsdjournal.it
ISSN: 3103-5744

ABSTRACT
The tension between control and autonomy encourages educational models oriented toward constructing the "perfect child," evoking the figure of the teacher as creator and the risk of a pedagogy of fabrication (Shelley, 2018; Meirieu, 2017; Biesta, 2013). Therefore, *IoToys* emerge as devices that, through processes of datafication, enable personalization and care in learning, while sustaining a fantasy of control grounded in monitoring and optimization of behaviour (Mascheroni & Holloway, 2019; Floridi, 2022). Embedded in datafied educational environments – interconnected "non-places" – they reshape play and expose it to dynamics of surveillance and normalization (Bonaiuti et al., 2017; Lancini & Cirillo, 2022). The paper examines technophobic resistance and proposes teacher training models promoting technology domestication, prioritizing pedagogical intentionality over technical functionality (Tisseron, 2018; Marangi, 2023; Rivoltella & Rossi, 2019), ultimately arguing for a pedagogy that, in governing the Technium, fosters agency, ethical awareness, and educational freedom (Cambi & Pinto Minerva, 2023).

KEYWORDS
IoToys; datafication; Frankenstein complex.

Received 09-07-2026
Accepted 26-09-2026
Published 30-10-2026

1. Introduction

Contemporary childhood unfolds within environments in which play, learning, and interaction with technology are increasingly intertwined. The spread of the Internet of Toys (*IoToys*) represents one of the most significant expressions of this transformation. Through sensors, continuous connectivity, artificial intelligence systems, and cloud-based platforms, these devices accompany children's play experiences by recording information about their interactions and progressively adapting their own functioning. As a result, play takes place within digital ecosystems that generate knowledge from the data produced during children's activities (Holloway & Green, 2016; Mascheroni & Holloway, 2019).

Literature has devoted increasing attention to this phenomenon, focusing on issues related to privacy, data security, children's profiling, and the personalization of learning (Lupton, 2020; Williamson, 2017; Mascheroni & Holloway, 2019). These studies have highlighted how datafication constitutes a defining feature of contemporary digital culture, revealing the transformation of everyday experiences into information available for algorithmic analysis (Van Dijck, 2014). Yet one question remains largely unexplored, pedagogically: what conception of the child emerges when play also becomes a space for the systematic production of data? This question recalls a longstanding tension within pedagogical thought. In *Frankenstein pédagogue*, Philippe Meirieu (2017) identifies, within the figure of Frankenstein itself, the paradigm of fabrication, recognizing the aspiration to determine the subject as one of the recurring pitfalls of modern education. The strength of this perspective lies in its ability to relocate the debate on technology within a fundamentally pedagogical question: the relationship between educational intentionality, the learner's freedom, and educability.

The growing diffusion of *IoToys* makes this reflection particularly timely, as these devices introduce unprecedented ways of observing, describing, and interpreting childhood.

This article adopts *IoToys* as a paradigmatic case through which to reinterpret Meirieu's thought in the age of datafication. It argues that these devices contribute to transforming the ways in which the child is known within the educational relationship. To interpret this shift, the article introduces the concept of pedagogical legibility, understood as the progressive construction of representations upon the learner, through data, indicators, and correlations that accompany the educational experience without exhausting its meaning. Drawing on Meirieu's interpretation of *Frankenstein*, the article explores the pedagogical implications of *IoToys* through the concepts of fabrication, educational mediation, and childhood datafication. It concludes by arguing that pedagogy should critically govern the relationship between the subject, data, and technology while preserving educability as a fundamental and non-negotiable principle of education.

2. The Temptation of Fabrication: Frankenstein as a Pedagogical Paradigm

Modern pedagogical thought has long been shaped by the tension between whether to accompany the growth of a free and irreducibly other subject, or to direct that subject's development towards a predefined model. Educational intentionality cannot renounce its transformative vocation; however, it ceases to be genuinely educational when it claims to determine the outcomes of that transformation in their entirety. To educate necessarily entails pursuing a project, yet what distinguishes education from fabrication is the recognition that such a project can never fully coincide with the subject's destiny.

The educational relationship is grounded precisely in this gap: the awareness that every individual exceeds the image constructed by the educator, retaining a potential that no educational plan can ever fully exhaust (Meirieu, 1991; Cambi, 2006; Biesta, 2013).

Meirieu considers the figure of Frankenstein as the paradigm through which one of the most enduring temptations of modern pedagogy can be understood: the transformation of education into a process of fabrication (Meirieu, 2017). Mary Shelley's monstrous and artificial creature is not merely a literary metaphor; it rather constitutes a pedagogical category capable of revealing a particular educational rationality. Victor Frankenstein should therefore be understood not only as a scientist driven by technological *hybris*, but as an educator who mistakes his project for the fulfilment of another person, if the perfection of his creation depends upon his ability to control both its origin and its development. His tragedy lies not in having artificially created life, but in believing that his task had ended precisely in the moment when the educational relationship should have begun.

This is the crucial insight of Meirieu's interpretation. The Creature does not become monstrous because it is artificial, but because it is deprived of recognition, guidance, and educational mediation. The generative act is severed from formative responsibility; production replaces relationship; the project supplants the encounter. Frankenstein does not expose the failure of technology itself, but rather the failure of an educational conception that seeks to reduce the subject to the outcome of a purely intentional design. Fabrication consists precisely in this reduction: the child is no longer recognised as a free interlocutor but as the expected product of a process governed by the adult (Meirieu, 2017; Meirieu, 2007).

Meirieu's pedagogical reflection can therefore be read as a defence of educability against every claim to predetermination. Educability does not simply denote the capacity to learn; rather, it expresses the impossibility of ever considering the

subject's formative process complete. No description, classification, or prediction can exhaust what a person may become. Authentic education presupposes an act of trust in the other's alterity and in their capacity to escape the images projected upon them. For this reason, Meirieu insists on the constitutive limitation of educational action: to educate means relinquishing the illusion of omnipotent planning and accepting that the subject will always, at least in part, resist the intentions of the educator (Meirieu, 1991).

This perspective finds important resonance in Hans Jonas' work. In *The Imperative of Responsibility*, Jonas (2002) argues that the growing power of technology demands an ethical framework capable of assuming responsibility for the long-term consequences of human action. Responsibility does not consist in exercising absolute control over outcomes, but in recognising that every technological intervention reshapes the conditions of future life. Applied Frankenstein's paradigm, this perspective highlights an additional dimension: the ethical problem lies not in creating something new, but in the moral obligation to accompany its consequences through relationships of care, recognition, and responsibility. Critiquing fabrication thus acquires not only pedagogical, but also anthropological significance.

At the same time, contemporary educational theories have increasingly demonstrated that human formation cannot be understood through deterministic models. From a hermeneutic perspective, personal identity is conceived as an open process, continually reshaped through interpretation and reciprocal recognition (Ricoeur, 2011).

Likewise, critical pedagogy emphasises that education loses its emancipatory meaning whenever it is reduced to adaptation or conformity (Freire, 2018; Cambi, 2006).

Biesta (2013), similarly, understands the educational event as the irruption of the unpredictable, arguing that the quality of education cannot be assessed solely in terms of measurable outcomes, but depends on the possibility for the subject to emerge as an autonomous presence that cannot be fully programmed.

This framework also provides a critical lens through which to interpret the transformations brought about by contemporary technological ecosystems. As Michel Foucault (2017) demonstrated, modern forms of governance operate not only through disciplinary mechanisms but also through the production of knowledge capable of shaping behaviour in advance. In today's digital society, this governmental rationality appears to assume a further configuration: governing subjects increasingly relies on the continuous production of data, their correlation, and the construction of predictive models that precede educational intervention itself. This represents not merely an extension of surveillance, but the emergence of a new epistemology of knowing the subject.

It is precisely at this point that Meirieu's concept of fabrication reveals its remarkable contemporary relevance. The educational ambition no longer consists solely in shaping the child according to a predefined ideal, but increasingly in rendering the child knowable through the systematic production of information concerning behaviour, preferences, and learning patterns. Fabrication thus undergoes a profound epistemological transformation: rather than constructing the subject directly, it progressively constructs the conditions through which the subject becomes knowable.

It is within this shift that we propose the notion of pedagogical legibility. By this expression we do not simply refer to the availability of information about the child, nor to the legitimate practice of educational observation, which remains one of the cornerstones of pedagogical professionalism.

Rather, pedagogical legibility denotes the process through which the developing subject is progressively rendered back to the educator in the form of data, indicators, correlations, and interpretative profiles, thereby transforming the very conditions of the educational relationship. Whereas pedagogical observation remains interpretative, contextual, and open to unpredictability, datafication tends to transform interpretation into a process of continuous correlation, in which data risk assuming the status of an exhaustive account of lived experience.

The issue at stake, therefore, is not simply the introduction of digital technologies into educational contexts, but the reconfiguration of the very conditions through which the child becomes knowable. *IoToys* represent one of the privileged sites in which this transformation becomes visible. They are not merely a new generation of smart toys, but devices that intertwine play, data production, and the construction of interpretative profiles. The tension identified by Meirieu between education and fabrication is therefore not overcome; rather, it re-emerges in a novel form, in which the educational project becomes progressively less concerned with directly shaping the subject and increasingly focused on constructing the conditions of the subject's pedagogical legibility.

3. Human Incompleteness, Neoteny, and the Necessity of Educational Mediation

Meirieu's (2017) critique of the pedagogy of fabrication finds further support in the anthropological understanding of the human being as an inherently incomplete subject. Education is possible precisely because human beings are not born fully formed but require a prolonged process of cultural, symbolic, and relational integration. Human incompleteness, therefore, should not be regarded as a deficiency to be corrected through technical intervention; rather, it constitutes the

original condition that makes learning and transformation possible.

The concept of neoteny refers to the persistence, in adult organisms, of characteristics that are typical of immature stages of development. From an evolutionary perspective, a neotenous species retains into adulthood certain juvenile traits that, in earlier species, would normally disappear during maturation (Gould, 1977). Applied to human beings, neoteny highlights a fundamental peculiarity: humans reach biological maturity while preserving a remarkable openness to further development The human brain does not immediately attain a definitive configuration, but instead retains an extraordinary degree of plasticity, allowing profound modifications through experience, learning, and social interaction (Changeux, 1983).

Brain plasticity thus constitutes the biological foundation of educational possibility. Precisely because individuals are not born with a fully determined form, they require educational processes through which they can progressively construct their relationship with the world.

This perspective also offers a different understanding of childhood dependency. The child's original vulnerability is not merely a biological limitation but the very condition through which language, culture, and sociality develop. Human beings cannot access reality directly; rather, they require mediators that enable them to interpret and transform it.

As Meirieu (2017) argues, education arises precisely from this original distance between the subject and the world. Children do not immediately possess the symbolic, cognitive, and cultural resources necessary to orient themselves within reality; they must therefore encounter mediating devices that make such access possible.

It is adults, language and cultural tools mediate the child's progressive autonomy. Educational mediation therefore assumes a radical significance. It is not merely a teaching method or a pedagogical technique employed by educators; rather, it

constitutes a fundamental dimension of human existence. Human beings live through mediation because they do not coincide immediately with the world. Cultural tools do not stand between the subject and reality as obstacles but rather as means of access and understanding.

Within educational contexts, this perspective is expressed through the concept of didactic mediation, understood as the process through which the educator's intentionality is realised while simultaneously fostering the learner's desire to learn. Educational action therefore unfolds within an intermediate space where the educator creates favourable conditions for the encounter between the learner and knowledge.

This space may be understood as the Pedagogical Third (Terzo Pedagogico): a symbolic and operational dimension that belongs neither exclusively to the educator nor exclusively to the learner, but rather to what is constructed through their relationship. This third element – whether knowledge, a pedagogical device, a text, an experience, or a problem to be addressed – prevents the educational relationship from becoming merely a form of personal influence exerted by the adult over the child. Instead, it introduces the necessary distance that preserves the learner's opportunity to appropriate the world autonomously.

From this perspective, mediation represents the pedagogical alternative to fabrication. Whereas fabrication presupposes a linear process in which the adult determines the outcome, mediation acknowledges the unpredictability of learning and recognises the learner's active role. Educators do not directly construct the person the other will become; rather, they create environments, situations, and encounters through which individuals can construct themselves. This distinction also helps clarify the role of educational technologies. A digital device may function as a meaningful mediator when it expands opportunities for exploration, communication, and knowledge construction. It becomes problematic, however, when it attempts to replace the educational relationship through systems of

behavioural prediction and automated regulation (Rivoltella & Rossi, 2019).

IoToys exemplify this ambivalence. They may be interpreted as mediating tools capable of enriching children's experiences, but they may also function as devices that reduce the complexity of educational experience to observable data. The pedagogical challenge, therefore, is to ensure that technology remains embedded within a framework of intentional educational mediation, preventing it from assuming the role of a "creator", capable of anticipating and determining the child's development (Mascheroni & Holloway, 2019).

Finally, neoteny theory allows us to reverse the perspective embodied in the Frankenstein complex. If the human being is structurally incomplete, then education cannot aim at bringing the other to definitive completion according to a predetermined model. Incompleteness is not a defect to be eliminated but the very condition of freedom. It is precisely because human beings remain open to transformation that they are able to learn, change, and construct new meanings. Authentic education, therefore, does not seek to produce perfect individuals but to support subjects capable of inhabiting their own incompleteness. In this sense, educational mediation represents the very opposite of fabrication: rather than enclosing possibilities, it makes them accessible to the subject.

4. When Play Produces Data: *IoToys* and the Datafication of Childhood

Pedagogical reflection has traditionally recognised play as one of the privileged spaces of human development. Play constitutes the fundamental mode through which children construct meaning, explore the world, and develop relationships with themselves, with others, and with their environment. Its distinctive quality lies in its capacity to preserve a space of symbolic freedom, where exploration takes precedence over execution, imagination precedes function, and error is understood

not as failure but as a generative possibility. For this reason, play has long been regarded as a constitutive dimension of child development and as one of the primary contexts in which individuals exercise their capacity to make sense of experience (Huizinga, 2002; Winnicott, 2020; Sutton-Smith, 1997).

From Winnicott's (2020) perspective, play emerges within a potential space: an intermediate area between external reality and subjective experience in which children can creatively explore their relationship with the world without being entirely constrained by the demands of reality. It is precisely this suspended dimension that makes play pedagogically fruitful: its purpose is not to produce an outcome but to create an experience through which the child can progressively elaborate their own identity. Similarly, Huizinga (2002) conceptualises play as a culturally foundational practice, characterised by freedom, separation from ordinary life, and the collective construction of rules whose meaning resides within the activity itself. Sutton-Smith (1997), in turn, emphasises the intrinsic ambiguity of play, arguing that it resists any purely functional interpretation precisely because it preserves a plurality of meanings that cannot be reduced to a single explanatory framework.

These perspectives converge in recognising an essential pedagogical quality of play: its capacity to preserve a degree of unpredictability within the educational experience. Children play without every action being immediately oriented towards assessment, measurement, or the production of observable outcomes. The relationship between the child and play is grounded in a dynamic balance between rules and freedom, exploration and discovery, thereby defining that excess of experience which, in the previous section, was identified as the very condition of educability.

The emergence of the Internet of Toys (*IoToys*) introduces a significant discontinuity into this landscape. Unlike traditional electronic toys, *IoToys* integrate sensors, data collection systems, machine learning algorithms,

and cloud-based platforms, enabling continuous communication with other devices and external digital infrastructures (Holloway & Green, 2016; Mascheroni & Holloway, 2019). They do not merely respond to children's actions; rather, they systematically record information about patterns of play, duration of use, preferences, modes of interaction, and, in some cases, users' vocal, motor, or emotional characteristics. Play activity is therefore progressively accompanied by a second, less visible yet structurally inseparable activity: the continuous production of data.

International literature has described this transformation through the concept of datafication, understood as the process through which practices, behaviours, and relationships are converted into digital data that can be processed algorithmically (Van Dijck, 2014; Lupton, 2020; Williamson, 2017). In the context of childhood, datafication concerns not only the growing presence of digital technologies in everyday life but also the ways in which children themselves become known, described, and represented. As Mascheroni and Holloway (2019) argue, smart toys contribute to the construction of an ecosystem in which care, personalisation, and monitoring become deeply intertwined, making it increasingly difficult to distinguish educational practices from practices of data collection and analysis.

From a pedagogical perspective, the central issue concerns the changing conditions under which educational knowledge is produced. Within datafied environments, educational observation is increasingly complemented by automated systems that reconstruct the child through quantitative indicators, behavioural profiles, and predictive models (Williamson, 2017; Lupton, 2020).

It is precisely at this point that the concept of pedagogical legibility acquires interpretative significance. *IoToys* do not merely transform play into a digital practice; they reconfigure the very conditions through which children become knowable. Play continues to retain its educational value while simultaneously being translated into a set of data that fuels new forms of representing and interpreting

the subject. The personalisation of interaction – frequently presented as one of the principal advantages of these devices – is, in fact, grounded in the progressive construction of profiles derived from the analysis of observed behaviours. Children are not simply accompanied during play; they are continuously interpreted through the information that play generates.

From this perspective, the datafication of childhood is not simply synonymous with the digitalisation of play. Rather, it describes the progressive integration of play into ecosystems in which every interaction can be recorded, analysed, and translated into information capable of informing subsequent educational decisions. *IoToys* represent one of the clearest manifestations of this transformation because they make visible the shift from play that generates experience to play that, while continuing to generate experience, simultaneously produces data. It is precisely this dual function that makes it necessary to reconsider the role of educational mediation and the nature of the artefacts involved in processes of human formation.

5. From *The Jungle Book* to *IoToys*: Educating Between Guidance and Control

The tension between guidance and control has long been a central concern of pedagogical thought. To educate is to introduce individuals to the world by providing them with the cultural and symbolic resources needed to navigate reality. Yet this task can easily turn into the presumption of taking the other's place by determining in advance the path they are expected to follow. The distinction between education and domestication lies precisely in the adult's ability to foster autonomy without transforming the educational relationship into a process of conformity.

Hameline (1973) effectively captures this distinction through his pedagogical reading of Rudyard Kipling's *The Jungle Book* (2008). Mowgli's story can be understood as a metaphor for the educational relationship: a *man's cub* grows through encounters with adult figures and within a cultural environment that enables him to acquire language, rules, and the tools necessary to inhabit the world. The role of those who act as his educators throughout the story is not to confine him within a protected and controlled environment but to progressively equip him to face the complexity of reality.

The transition from the *Jungle* to the *Man-Village* therefore represents a process of mediation. Mowgli does not become autonomous because he is left entirely on his own, nor because he is completely shaped by the adults who surround him. His development unfolds through an educational relationship in which adults provide protection and guidance while simultaneously recognising the necessity for the child to undertake his own journey.

This interpretation highlights the distinction between education and domestication. Domestication seeks to produce compliant behaviour through repetition and control, whereas education aims to cultivate the capacity for judgement and autonomous choice. As Meirieu (2017) argues, educators should not attempt to eliminate the learner's otherness; rather, they should create the conditions that enable individuals to encounter the world and develop their own autonomy.

This reading of *The Jungle Book* acquires relevance in today's digital context, where educational environments are increasingly transformed by technological infrastructures capable of collecting, processing, and interpreting information about individuals. Learning spaces are no longer exclusively physical and relational; instead, they have become hybrid ecosystems in which people, devices, and data flows continuously interact (Floridi, 2022).

Within these emerging environments, *IoToys* reshape the traditional relationship between children, play, and technology. A smart toy is no longer merely an object that children manipulate but a system capable of responding, recording information, and adapting its behaviour based on observed interactions. While this transformation opens significant opportunities for personalised education, it also introduces a new form of asymmetry: the device observes the child and constructs knowledge about them through the data it collects (Mascheroni & Holloway, 2019). The pedagogical issue arises when the device is no longer regarded as a mediator but implicitly assumes the role of the privileged interpreter of children's experiences. In such circumstances, technology risks shifting from being a tool that serves the educational relationship to becoming a system that shapes the relationship itself. The logic of personalisation may thus evolve into a logic of normalisation, whereby what is measured and classified progressively comes to define what is considered desirable.

As Bonaiuti et al. (2017) observe, educational technologies possess no intrinsic pedagogical value; their significance depends on the educational model within which they are embedded. A technological device can expand learning opportunities when it promotes exploration, collaboration, and the autonomous construction of knowledge. Conversely, it can impoverish the educational experience when it is used exclusively as an instrument of monitoring and measurement.

The crucial issue therefore concerns the role of mediation. From the perspective of educational mediation, adults do not employ technological tools to replace their own presence but to enrich the relationship between the learner and the world. Digital devices should occupy the space of the Pedagogical Third (Terzo Pedagogico): an intermediary element that facilitates encounters with knowledge without displacing either the learner or the educator.

IoToys may therefore be interpreted in two contrasting ways. On the one hand, they can function as tools capable of supporting more personalised processes of care and learning.

On the other, they may become devices through which a new form of the Frankenstein complex is enacted, one based no longer on the material construction of the child but on the child's progressive translation into data. The fundamental difference lies in how childhood itself is understood. If children are viewed as incomplete beings to be optimised through increasingly precise interventions, technology risks becoming an instrument of fabrication. If, instead, incompleteness is recognised as a constitutive characteristic of the human condition, technology can assume the role of a mediator capable of accompanying development without determining it. The transition from The Jungle Book to *IoToys* thus illustrates a profound transformation.

Whereas Mowgli's story revolves around how adults accompany children towards autonomy, in the age of datafication the question also concerns how technological environments may either foster or constrain that autonomy.

The contemporary challenge, therefore, is not to reject technology but to govern it pedagogically. As with every educational mediator, digital technologies must ultimately be evaluated through one fundamental question: Do they contribute to expanding the learner's freedom, or do they reinforce the adult desire to predict and control their behaviour?

6. When the Artefact Observes the Child: Educational Mediation in Datafied Ecosystems

The transformation introduced by *IoToys* concerns not only the ways in which play is organised or the information it generates. More fundamentally, it affects the very nature of the educational artefact and, consequently, the forms of mediation it

enables. Pedagogical theory has traditionally regarded educational tools as elements that expand, guide, and support the learner's activity without replacing the educational relationship itself. An artefact does not determine learning; rather, it helps to structure the field of possibilities within which experience unfolds.

Understanding *IoToys* therefore requires us to examine not only their technological features but also the ways in which they redefine the mediation between the child, experience, and knowledge. Pierre Rabardel's (1995) theory of instrumental genesis provides a particularly valuable framework for addressing this issue. By distinguishing between artefact and instrument (*outil* and *instrumentum*), Rabardel argues that a technical object possesses no inherently educational function. An artefact becomes an instrument only through the subject's activity, within a process of appropriation in which patterns of use, meanings, and operational schemes are progressively constructed. An instrument, therefore, does not coincide with the material object itself but with the dynamic relationship established between the subject and the artefact.

However, the emergence of datafied digital ecosystems challenges some of the implicit assumptions underlying Rabardel's theory. The artefact described by Rabardel mediates the subject's activity but does not autonomously construct a representation of the subject. *IoToys*, by contrast, do not merely support children's actions: while mediating their activity, they simultaneously collect information about that activity, store it, correlate it with other data, and return it in the form of interpretable datasets. The artefact remains a site of mediation, but at the same time it becomes a site of observation.

This transformation profoundly reshapes the nature of the educational relationship. Children's activity no longer generates experience alone; it also produces an increasingly detailed description of the very subject engaged in that activity. A smart toy provides more than functional feedback to support interaction: it contributes to constructing a behavioural profile through which the

child becomes progressively more legible within the technological ecosystem. The artefact does not observe in the human sense of the term, nor does it interpret experience as an educator does. Rather, it generates data that are subsequently processed by algorithmic systems and incorporated into processes of classification and personalisation. What changes, therefore, is not the existence of mediation but its epistemological configuration.

Rabardel's distinction therefore remains valid, but must be reconsidered in light of datafication. In *IoToys*, mediation not only connects children with experience but also with systems that continuously collect and process information about their activity.

It is precisely this feature that gives particular significance to the concept of pedagogical legibility introduced in the previous section.

IoToys do not replace educational observation; rather, they contribute to reconfiguring the conditions under which such observation takes place. Knowledge of the child is increasingly complemented by representations constructed through quantitative indicators, usage histories, recurring preferences, and predictive models. These representations are not equivalent to the child, yet they risk acquiring growing authority within educational decision-making processes related to learning, personalisation, and monitoring. The pedagogical issue is not the presence of data itself, but its epistemic status. Educational interpretation remains contextual and dialogical, whereas algorithmic representations rely on statistical correlations. These forms of knowledge are complementary rather than interchangeable. Educational mediation therefore assumes an additional responsibility; educators are called not only to select the most appropriate artefacts, but also to critically interpret the representations of children that these artefacts help to produce. *IoToys* cannot be regarded merely as learning tools; they actively participate in constructing the conditions through which children become knowable within digital environments. Their use requires pedagogical expertise

capable of distinguishing data from interpretation, description from understanding, and correlation from genuine educational encounter.

From this perspective, Rabardel's theory of mediation is not superseded, but gains renewed relevance. If every artefact becomes an instrument only through the subject's activity, then the contemporary pedagogical challenge consists in preserving this centrality of lived experience even when artefacts themselves are capable of producing knowledge about the subject.

It is precisely within this tension that lies the task of pedagogy: preventing the growing legibility of the child from becoming the illusion of complete knowability, while reaffirming the relational, interpretative, and irreducibly open character of every educational process.

7. Governing Legibility: The Role of Pedagogy in Datafied Ecosystems

The increasing diffusion of *IoToys* across educational and family settings makes it clear that the contemporary pedagogical challenge cannot be reduced to a simple opposition between the acceptance and rejection of technology. Such a perspective not only reproduces the now outdated dichotomy between technophilia and technophobia but also obscures the central issue that has emerged throughout the preceding discussion: it is not technological artefacts themselves that redefine education, but the forms of relationship and knowledge they make possible.

Pedagogy is therefore called upon to question not merely what technologies do, but how they reconfigure educational experience and the ways in which the learner progressively becomes knowable.

Contemporary digital ecosystems can be understood as environments in which data production permanently accompanies everyday activities. Kelly's (2010) concept of the Technium captures this interconnected technological environment, within

which *IoToys* operate as nodes linking sensors, algorithms, platforms, and educational practices.

In this regard, Bernard Stiegler's (2010) contribution is particularly significant. Stiegler interprets technology as a constitutive dimension of the process of humanisation while simultaneously recognising its fundamentally ambivalent nature, capable of both supporting and impoverishing processes of individuation. The ambivalence of technology derives not from technological objects themselves but from the cultural and pedagogical forms of appropriation through which they are employed. The educational question thus becomes fundamentally political and cultural: not how to limit the presence of technology, but how to create the conditions under which it remains at the service of human development.

Within this framework, the educator's role takes on a different configuration from that envisioned by traditional models of digital literacy. It is no longer sufficient to acquire operational skills in the use of digital devices or merely to understand the technical implications of data collection. Instead, educators must develop an interpretative competence that enables them to critically situate the representations produced by digital ecosystems within the educational relationship. The challenge is not to replace pedagogical judgement with data but to prevent data from being treated as an exhaustive interpretation of the learner. From this perspective, the education and professional development of teachers and educators assume strategic importance. As Marangi (2023) argues, technological innovation acquires educational value only when embedded within coherent pedagogical reflection. The challenge is therefore not simply to adopt intelligent technologies, but to integrate them critically into educational practice. Similarly, Cambi and Pinto Minerva (2023) emphasise pedagogy's critical role in questioning the anthropological and ethical assumptions underlying educational practices, a function that becomes even more necessary in datafied educational environments.

Datafied ecosystems make this critical function even more necessary because they introduce new forms of knowledge about the learner that risk being accepted as neutral simply because of their apparent objectivity.

It is precisely within this context that the concept of pedagogical legibility acquires its fullest significance. The purpose of education is not to increase indefinitely the quantity of information available about the child, but to preserve the distance between the description of the learner and the learner themselves. No dataset, however extensive, can replace the educational encounter, because the pedagogical relationship continues to rest upon the possibility that the child may surprise the educator, continually reshaping the representations constructed about them. When legibility comes to be treated as an exhaustive description of experience, it risks becoming a new form of fabrication in which the educational project is progressively replaced by the management of profiles, indicators, and predictions.

Viewed through Meirieu's pedagogical paradigm, the transformation introduced by *IoToys* therefore appears less as a technological problem than as a genuinely pedagogical one. If fabrication once consisted in attempting to produce a subject who conformed to a predetermined project, datafication now seeks to construct the conditions for that subject's increasing legibility. In both cases, however, the educational challenge remains fundamentally the same: to preserve the learner's educability by recognising their alterity and their capacity to exceed every representation constructed about them. It is precisely within this excess that pedagogy continues to find both its distinctive field of action and its enduring responsibility.

8. Conclusions: Towards a Pedagogy Beyond Fabrication

This article has argued that *IoToys* exemplify a broader transformation in educational relationships under conditions of childhood datafication, reshaping the ways children become knowable within educational contexts.

Pedagogy is called upon to engage critically with datafied ecosystems by developing forms of educational mediation capable of integrating the opportunities offered by technological tools without relinquishing its interpretative responsibility.

To govern these environments pedagogically means recognising the value of data without allowing it to become the sole criterion for understanding the learner, while preserving unpredictability, alterity, and relationality as constitutive conditions of educability.

Reinterpreted through Meirieu's work, the lesson regarding Frankenstein continues to challenge contemporary pedagogy. The issue is not whether increasingly intelligent artefacts can be designed, but rather the temptation to regard the knowledge generated by such artefacts as exhaustive. *IoToys* demonstrate that this temptation no longer takes the form of directly constructing the ideal child; instead, it lies in progressively reducing the complexity of childhood to profiles, indicators, and predictions. Pedagogy therefore retains an essential responsibility: to remind us that education always involves encountering a subject who exceeds what can be known about them.

While datafication seeks to make the child increasingly legible, education continues to recognise them as irreducibly educable.

References

Biesta, G. J. J. (2013). *The beautiful risk of education*. Routledge.

Bonaiuti, G., Calvani, A., Menichetti, L., & Vivanet, G. (2017). *Le tecnologie educative*. Carocci.

Cambi, F. (2006). *Manuale di pedagogia generale* (6ª ed.). Laterza.

Cambi, F., & Pinto Minerva, F. (2023). *Governare l'età della tecnica: Il ruolo chiave della formazione*. Mimesis.

Changeux, J.-P. (1983). *L'uomo neuronale* (M. Malcovati, A cura di; C. Sughi, Trad.). Feltrinelli. (Opera originale pubblicata 1983). [1]

Floridi, L. (2022). *Etica dell'intelligenza artificiale: Sviluppi, opportunità, sfide*. Raffaello Cortina Editore.

Foucault, M. (2017). *Sicurezza, territorio, popolazione: Corso al Collège de France (1977-1978)* (F. Ewald, A. Fontana, & M. Senellart, A cura di; P. Napoli, Trad.). Feltrinelli. (Opera originale pubblicata 2004).

Freire, P. (2018). *Pedagogia degli oppressi* (M. M. Rossi, Trad.). Edizioni Gruppo Abele. (Opera originale pubblicata 1968).

Gould, S. J. (1977). *Ontogeny and phylogeny*. Harvard University Press.

Hameline, D. (1973). *Les maîtres et les élèves*. Gauthier-Villars.

Holloway, D., & Green, L. (2016). The internet of toys. *Communication Research and Practice*, *2*(4), 506–519. doi.org

Huizinga, J. (2002). *Homo ludens* (U. Eco, Introduzione; C. van Schendel, Trad.). Einaudi. (Opera originale pubblicata 1938).

Jonas, H. (2002). *Il principio responsabilità: Un'etica per la civiltà tecnologica* (P. P. Portinaro, A cura di; P. Rinaudo, Trad.). Einaudi. (Opera originale pubblicata 1979).

Kelly, K. (2010). *What technology wants*. Viking.

Kipling, R. (2008). *The jungle book* (W. W. Robson, Ed.). Oxford University Press. (Opera originale pubblicata 1894).

Lancini, M., & Cirillo, L. (2022). *Figli di Internet: Guida per genitori su tecnologia e rete*. Erickson.

Lupton, D. (2020). *Data selves: More-than-human perspectives*. Polity Press.

Marangi, M. (2023). *Addomesticare gli schermi: Il digitale a misura dell'infanzia 0-6* (P. C. Rivoltella, Prefazione). Scholé.

Mascheroni, G., & Holloway, D. (2019). Introducing the internet of toys. In G. Mascheroni & D. Holloway (Eds.), *The Internet of Toys: Practices, affordances and the political economy of children's smart play* (pp. 1–22). Palgrave Macmillan. doi.org

Meirieu, P. (1991). *Le choix d'éduquer: Éthique et pédagogie*. ESF éditeur.

Meirieu, P. (2007). *Pédagogie: Le devoir de résister*. ESF éditeur.

Meirieu, P. (2017). *Frankenstein pédagogue*. ESF éditeur. *(Nota: Prima edizione 1996)*.

Rabardel, P. (1995). *Les hommes et les technologies: Approche cognitive des instruments contemporains*. Armand Colin.

Ricoeur, P. (2011). *Sé come un altro* (D. Iannotta, Trad.). Jaca Book. (Opera originale pubblicata 1990).

Rivoltella, P. C., & Rossi, P. G. (Eds.). (2019). *Il corpo e la macchina: Tecnologia, cultura, educazione*. Scholé. [1]

Shelley, M. (2018). *Frankenstein; or, The modern Prometheus* (C. Johnson, Ed.). Penguin Classics. (Opera originale pubblicata 1818).

Stiegler, B. (2010). *Taking care of youth and the generations* (S. Barker, Trad.). Stanford University Press. (Opera originale pubblicata 2008).

Sutton-Smith, B. (1997). *The ambiguity of play*. Harvard University Press.

Tisseron, S. (2018). *Il giorno in cui il mio robot mi amerà: Verso l'empatia artificiale* (C. A. Marimò, Trad.). FrancoAngeli. (Opera originale pubblicata 2016).

Van Dijck, J. (2014). Datafication, dataism and dataveillance: Big Data between scientific paradigm and ideology. *Surveillance & Society*, *12*(2), 197–208. doi.org

Williamson, B. (2017). *Big data in education: The digital future of learning, policy and practice*. Sage.

Winnicott, D. W. (2020). *Gioco e realtà* (L. Tabanelli, Trad.). Armando Editore. (Opera originale pubblicata 1971).