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Neuroplasticity and Inclusive Education: Neuroscientific Foundations and Evidence-Based Practices within the Italian Regulatory Framework

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Abstract:
Background: *Neuroplasticity, understood as the capacity of the central nervous system to reorganize its structure and functional connections in response to experience, today constitutes the main biological foundation of educational and rehabilitative interventions aimed at students with neurodevelopmental disorders (SLD, ADHD, autism spectrum disorder, intellectual disability). Despite the growing body of neuroscientific evidence, a gap persists between basic research and everyday teaching practice, and the Italian literature rarely integrates the three dimensions – neuroscientific, pedagogical-methodological, and normative – within a unified framework useful to special education and mainstream teachers.*
Materials and Methods: *A scoping review was conducted following the methodological framework of Arksey and O'Malley, supplemented by the PRISMA-ScR criteria, with the aim of mapping the literature relating to: (1) the neuroplastic mechanisms relevant to learning; (2) evidence-based teaching practices applicable to students with neurodevelopmental disorders; (3) the Italian regulatory framework on school inclusion and its operational translation into the Individualized Education Plan (IEP). Experimental studies, systematic reviews, meta-analyses, and normative sources published predominantly between 2014 and 2026 were consulted.*
Results: *The analysis showed that the teaching practices most clearly traceable to an explicit neuroplastic principle – Universal Design for Learning, Feuerstein's mediated learning, structured peer tutoring, and cooperative learning – share common mechanisms of intentional repetition, multimodal activation, and motivational regulation. The Italian regulatory framework, in particular Legislative Decree 66/2017, Ministerial Decree 182/2020, and the recent Legislative Decree 62/2024, offers operational tools (the IEP, reasonable accommodation, the individual life project) consistent with these principles, aspects that must increasingly become constitutive elements of teachers' professional profile.*
Conclusions: *The paper finally proposes an operational matrix linking neuroplastic principles, educational needs, evidence-based practices, and components of the Individualized Education Plan.*
Keywords: *neuroplasticity; inclusive education; neurodevelopmental disorders; evidence-based education; Individualized Education Plan.*

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I. Introduction – Salvatore Vitiello[1]

Inclusive education requires holding together two inseparable needs: understanding the variability of learning profiles and designing contexts capable of reducing barriers to participation. Within this scenario, neuroplasticity constitutes a scientifically relevant concept because it describes the capacity of the nervous system to modify its structural and functional organization in relation to experience. Hebb's classic formulation [1] laid the foundations for interpreting learning as a process associated with changes in connectivity between neurons; subsequent research has shown that plasticity depends on the interaction between experience, age, the state of the nervous system, the intensity and quality of activity, and context [2,3]. Recent studies further indicate that learning involves both transient and sustained cellular mechanisms, confirming the dynamic nature of brain change [4].

The pedagogical relevance of this evidence must be interpreted with caution. It is not scientifically correct to infer from a neurobiological principle that a specific teaching technique directly and predictably "creates new neural connections". The passage from neuroscience to teaching requires an intermediate level made up of cognitive psychology, research on intervention effectiveness, and the analysis of educational contexts. Neuroplasticity should therefore be understood as a property of the nervous system that makes change possible, while the quality of the educational intervention determines which learning opportunities are offered, how frequently, and through which forms of support [2,3].

Within the Italian pedagogical landscape, a theoretical-operational reference point regarding the relationship between the observation of functioning and the design of intervention is represented by the clinical pedagogy developed by Piero Crispiani [5]. This approach places pedagogical diagnostics at its centre, understood as the functional observation of learning processes aimed not at labelling the student, but at designing individualized, dynamic, and progressively adjustable interventions. From this perspective, knowledge of the subject's characteristics does not constitute the final endpoint of assessment, but the starting point for defining the most appropriate educational conditions.

The relationship between clinical pedagogy and the neuroscience of plasticity, however, requires an epistemological clarification. This does not mean assuming the Crispiani Method to be a direct application of neuroscientific evidence, nor attributing to its procedures specific, directly demonstrated neurobiological effects. Rather, a convergence can be identified at the level of operational principles: intensity and repetition of experience; attention to individual variability; integration between cognitive and motor dimensions; progression of difficulty; mediation; continuous monitoring of outcomes. This convergence makes clinical pedagogy a theoretical-operational tradition relevant to the present analysis, provided that its position is kept distinct from that of practices supported by international experimental evidence in the strict sense.

This distinction is particularly important for students with neurodevelopmental disorders, in whom cognitive and executive profiles are heterogeneous and may include difficulties with attention, working memory, planning, flexibility, self-regulation, generalization, and social participation [6–11]. Variability should not be translated into a reduction of educational expectations, but into greater precision in planning: observable objectives, graduated mediation, distributed practice, feedback, opportunities for choice, and monitoring of outcomes.

In the Italian context, school inclusion is supported by a consolidated regulatory system, founded on Law 104/1992 [12] and developed by Legislative Decree 66/2017 [13], amended by Legislative Decree 96/2019, as well as by the national Individualized Education Plan (IEP) models introduced by Ministerial Decree 182/2020 [14] and corrected by Ministerial Decree 153/2023. The IEP takes on a planning and collegial function, linking the observation of functioning, objectives, interventions, assessments, and the participation of the family and other parties involved. Legislative Decree 62/2024 [15], within the framework of the disability reform, has also introduced a revision of the procedures for assessing disability status and the life project, with a transitional phase and a deferral to 2027 of some operational provisions.

The aim of this article is threefold: (1) to summarize the main evidence on neuroplasticity relevant to learning; (2) to analyse evidence-based teaching strategies applicable to the inclusion of students with neurodevelopmental disorders; (3) to translate this evidence into operational guidance consistent with the IEP and with the Italian regulatory framework. The central thesis is that genuinely neuro-inclusive teaching does not coincide with "neuroscientific teaching", but with educational design that responsibly uses knowledge of cognitive functioning and integrates it with evidence of pedagogical effectiveness and with the educational rights enshrined in the legal system.

II. Material and Methods – Valentina Della Volpe[2]

Given the cross-cutting nature of the topic addressed, a scoping review was adopted, aimed at mapping concepts, evidence, and operational implications at the intersection of neuroplasticity, neurodevelopmental disorders, inclusive teaching, and Italian school legislation. The choice of a scoping review is consistent with the aim of integrating literature of different kinds — neuroscientific studies, systematic reviews, meta-analyses, special-education texts, and normative sources — without claiming to produce an overall quantitative estimate of intervention effects. The procedure was structured on the basis of the Arksey and O'Malley framework [16] – identifying the research question, identifying relevant studies, study selection, charting the data, and collating, summarizing, and reporting the results – supplemented by the PRISMA-ScR recommendations [17]. The main bibliographic databases were consulted (PubMed, Scopus, ERIC, Google Scholar) using combinations of the terms «neuroplasticity», «neuroplasticità», «inclusive education», «didattica inclusiva», «neurodevelopmental disorders», «executive function», «Universal Design for Learning», «IEP», supplemented by Italian normative sources retrieved via Normattiva and the Gazzetta Ufficiale. The search was largely limited to contributions published between 2014 and 2026, including foundational historical references (e.g., Hebb, 1949) when conceptually indispensable. The following were included: (a) experimental studies, systematic reviews, and meta-analyses concerning the neuroplastic mechanisms involved in learning; (b) effectiveness studies concerning teaching strategies for students with neurodevelopmental disorders (autism spectrum disorder, Attention deficit hyperactivity disorder - ADHD, intellectual disability); (c) Italian normative texts currently in force on school inclusion. Contributions lacking direct relevance to the three dimensions indicated, or not available in Italian or English, were excluded. Studies focused exclusively on Specific Learning Disorders in the absence of a disabling comorbidity were also excluded, as they fall outside the scope of the IEP adopted here; these profiles, governed by the Personalized Learning Plan (PDP) under Law 170/2010, will be the subject of a dedicated contribution.

The selected content was organized according to a thematic mapping cutting across the three dimensions, in order to answer the following questions.

- Which principles of neuroplasticity are most relevant to learning and instructional design?
- Which characteristics of the neurocognitive profiles of ADHD, intellectual disability, and other neurodevelopmental disorders are most relevant to school practice?
- Which inclusive strategies have empirical support consistent with the goal of improving learning, participation, and self-regulation?
- How can this evidence be translated into objectives, strategies, adaptations, and assessments within the IEP?

The corpus comprises 28 references: foundational works on plasticity [1–4], epidemiological studies and reviews on neurodevelopmental disorders [6–11], contributions on inclusive strategies [18–27], and Italian normative sources [12–15]. The synthesis was carried out by thematic category and organized around four axes: neurobiological foundations; neurocognitive profiles; effectiveness and implementation conditions of teaching strategies; normative and operational translation into the IEP.

Given the scoping-review nature of the study, no level of causality is attributed to the associations reported in the studies, nor is a meta-analysis presented. The operational indications are formulated as controlled pedagogical inferences: they derive from the integration of empirical findings and educational aims and should not be interpreted as directly demonstrated neurobiological effects for each individual practice.

Table 1. Map of sources, levels of evidence, and function in the synthesis

Area	References	Predominant type	Function in the synthesis
Neuroplasticity and learning	[1–4]	Foundational and neuroscientific studies	Definition of the plasticity processes and the general conditions of modifiability associated with experience
Neurocognitive profiles	[6–11]	Epidemiological studies, systematic reviews, and meta-analyses	Analysis of functioning profiles, executive functions, and individual variability in neurodevelopmental disorders.
Teaching strategies and inclusive practices	[18,21–27]	Systematic reviews, meta-analyses, and applied studies	Identification of the effectiveness conditions of UDL, cooperative learning, peer tutoring, explicit teaching, and cognitive mediation.
Clinical pedagogy and modifiability of learning	[5,30–33]	Theoretical-pedagogical model and applied corpus	Analysis of functional observation, individualization, intentional exercise, progression, and outcome monitoring.
Functioning, individualized planning, and the IEP	[12–15,34]	Normative sources and international classifications	Translation of evidence and pedagogical principles into objectives, facilitators, strategies, progression, and assessment.

III. Neuroplasticity: from biological principle to educational design

3.1 Neuroscientific foundations of neuroplasticity – Salvatore Vitiello[1]

Neuroplasticity does not represent a single mechanism, but a set of processes through which the nervous system modifies its organization in response to experience. The Hebbian perspective [1] helped describe the strengthening of connections associated with repeated and correlated activity; contemporary literature, however, emphasizes that plasticity is dynamic, state-dependent, and subject to biological and environmental constraints [2,3]. Learning can thus be considered a process in which experience progressively modifies functional networks, but the direction and stability of these modifications depend on the characteristics of the experience itself. The neuroscientific literature distinguishes at least three levels of plasticity: synaptic (changes in the efficacy of existing connections), structural (formation of new synapses or elimination of unused ones), and functional (reorganization of the networks involved in a task) [2,3]. Plasticity is neither a linear nor a uniform process: it is maximal during specific developmental windows but persists, albeit in attenuated form, throughout the lifespan, and is strongly sensitive to variables that can be modulated by the educational context, such as selective attention, intrinsic motivation, and the temporal distribution of the learning experience [3,4]. At the cognitive level, an area of particular interest for inclusion concerns executive functions (working memory, inhibition, cognitive flexibility), which are frequently impaired — albeit with differentiated profiles — in both autism spectrum disorder and ADHD [8–10].

An important instructional implication is that repetition alone is not sufficient. To be functional for learning, practice must be meaningful, graduated, and accompanied by informative feedback. Research on the cellular processes of learning reinforces the idea that educational experience has a temporal component: some changes are rapid and transient, while others require repeated exposure and consolidation [4].

This leads to a first design rule: inclusive intervention should include a sequence of exposure, guided practice, independent practice, feedback, review, and generalization. This sequence is more consistent with a dynamic conception of learning than with teaching centred exclusively on the presentation of information.

Table 2. Neuroplastic principles and instructional implications

Principle	Educational meaning	Design condition	Operational translation
Experience and activity	Change is associated with experiences in which the student actively participates in the task.	Active engagement and relevance of the experience.	Authentic tasks, active participation, production and functional use of skills.
Repetition and consolidation	The stabilization of learning requires repeated exposure and retrieval over time.	Intensity and distribution of practice.	Distributed practice, intentional exercise, active retrieval, and scheduled review.
Specificity	Learning is influenced by the characteristics of the activity and the context in which it is practised.	Coherence between objective, activity, and context of use.	Training the skill under the conditions in which it will need to be used.
Feedback	Information about the outcome allows performance to be progressively regulated.	Informative feedback and monitoring.	Timely and specific feedback, self-correction, progress tracking.
Progression	The complexity of learning requires gradual modulation of demands.	Task grading and fading of supports.	Sequencing from simple to complex, guided practice, and progressive reduction of aids.
Individual variability	The response to learning experiences is not uniform across students.	Individualization based on observation.	Adaptation of pace, complexity, supports, environment, and response mode.
Generalization	Generalization	An acquired skill does not automatically transfer to different contexts.	Intentional planning for transfer.
Mediation and action-cognition integration	Learning can be supported by structuring experience and integrating cognitive processes with action.	Graduated mediation and functional observation.	Modelling, scaffolding, sequential exercise, and outcome verification.

Note. The associations between plasticity principles and design conditions do not indicate a direct causal relationship between a specific teaching practice and a given neurobiological change. The table proposes an interdisciplinary translation oriented toward educational design.

3.2 Neurodevelopmental disorders and profile variability – Valentina Della Volpe[1]

ADHD shows a significant prevalence in the developmental-age population and constitutes a heterogeneous disorder, in which difficulties may involve attention, inhibition, working memory, planning, and self-regulation [6]. Reviews on executive functions show that the profile cannot be reduced to a single deficit: performance varies across domains, individuals, and contexts [8–10]. Consequently, effective planning should not be limited to "getting the student to pay attention", but should modify the conditions that support self-regulation: clarity of instructions, task segmentation, external cues, realistic timeframes, feedback, and the progressive internalization of strategies.

In intellectual disability, cognitive and adaptive functioning is characterized by high variability and may include difficulties with working memory, learning new procedures, generalization, and autonomy [11,20,28]. Educational intervention must therefore link curricular learning to functional and meaningful skills, use explicit mediation, and provide opportunities for practice across different contexts. The perspective of self-determination [19,29] adds a decisive dimension: inclusion cannot be measured solely in terms of skill acquisition, but also in terms of participation, choice, and personal control.

Specific Learning Disorders (dyslexia, dysgraphia, dysorthographia, dyscalculia) present a distinct neurocognitive profile, mainly attributable to difficulties in phonological processing and in the automatization of reading, writing, and calculation skills. In the absence of a comorbidity entailing certification of disability under Law 104/1992, these students do not fall within the IEP but within the Personalized Learning Plan (PDP) provided for by Law 170/2010: their treatment requires a regulatory and design framework distinct from the one adopted here and is therefore deferred to a dedicated contribution. The present work refers to Specific Learning Disorders (SLD) only in cases of comorbidity with another certified condition, for which the IEP pathway described in the following sections remains valid.

It is also necessary to avoid a deterministic reading of diagnosis. The presence of a neurodevelopmental condition does not by itself predict school outcomes. Functional profiles are influenced by the interaction between individual characteristics, task demands, and context. It is precisely in this interaction that instructional design can intervene: reducing barriers, increasing opportunities for response, making strategies explicit, and building conditions for progressive success.

Table 3. Neurocognitive profiles and instructional priorities

Profile/condition	Areas of possible vulnerability	Priority functional observation	Design priorities

ADHD	Attention, inhibition, working memory, planning, and self-regulation [6,8–10].	Identifying the conditions under which inattention, impulsivity, and task-completion difficulties increase or decrease.	Segmentation; brief instructions; external cues; time management; feedback; self-monitoring and progressive reduction of supports.
Autism spectrum disorder	Differentiated profiles in executive functions, flexibility, social communication, and management of contextual variability [8–10].	Analysing environmental demands, the predictability of routines, communication modes, and the conditions that promote participation and regulation.	Structuring and predictability; visual supports; making requests explicit; gradual variation; mediation and generalization.
Intellectual disability	Learning new procedures, working memory, generalization, autonomy, and adaptive behaviour [11,20,28].	Identifying the level of assistance needed, the most effective learning modes, and the conditions for skill transfer.	Explicit teaching; modelling; guided and repeated practice; visual supports; exercise in different contexts; progressive autonomy.
Comorbidity	Overlap of cognitive, executive, communicative, and adaptive difficulties; non-uniform course [8–10].	Defining functional priorities while avoiding the indiscriminate summing of diagnostic categories.	Selection of a few priority objectives; coordination between interventions; shared monitoring; progressive adaptation of strategies.
Individual variability	Significant differences between students with the same diagnosis and across different contexts.	Observing the relationship between student characteristics, task demands, barriers, and facilitators.	Personalization of pace, complexity, supports, environment, and response mode; ongoing verification of outcomes.

Note. The pedagogical-clinical model is included for the consistency of its operational principles with individualized planning, without attributing to it the same level of empirical evidence as strategies supported by systematic reviews or meta-analyses.

3.3 Evidence-based teaching strategies for inclusion – Valentina Della Volpe[2]

The teaching practices with the strongest empirical evidence share certain operational conditions consistent with the general learning processes associated with plasticity: intentional and distributed practice, active engagement, feedback, progression of difficulty, motivational regulation, and opportunities for generalization. This convergence does not, however, allow each practice to be directly attributed a specific neurobiological change; teaching strategies must therefore be selected on the basis of evidence regarding their educational outcomes, and not on a presumed, directly demonstrated capacity to "activate" specific brain mechanisms. Among these, Universal Design for Learning (UDL) is the most cross-cutting framework, with evidence of effectiveness both for students with intellectual disability and, more generally, for heterogeneous school populations [18,26,27]. The Instrumental Enrichment Program developed by Feuerstein, based on the concept of mediated learning, shows positive results especially with students with intellectual disability [11,22,23]. Structured peer tutoring and cooperative learning, finally, act mainly through the social and motivational dimension of learning, with documented benefits both academically and in terms of relational inclusion [21,24,25]. Table 4 summarizes these strategies in relation to the neuroplastic mechanism predominantly involved.

Alongside practices supported by systematic reviews and meta-analyses, the Italian pedagogical context offers further intervention traditions oriented toward the modifiability of learning processes. Among these, the Crispiani Method and clinical pedagogy [5,30] propose a functional reading of difficulties and organize intervention through ecological-dynamic practices, sequential actions, intentional exercise, and the integration of cognitive and motor components. The point of greatest interest for the present synthesis concerns its convergence with certain general principles of learning: individualization based on observation, intensity, meaningful repetition, progression of complexity, mediation, and outcome monitoring.

This approach is not, however, classified in the present article as evidence-based in the strict sense. Although clinical pedagogy has a consolidated theoretical and applied corpus [5,30–33], its empirical base does not currently present the same level of international evidence, indexing, and controlled experimentation available for some of the strategies previously examined. It is therefore methodologically more correct to consider it a pedagogical-clinical model that is theoretically consistent with a dynamic and modifiable conception of learning, whose effectiveness requires further verification through rigorous empirical studies.

Table 4 – Teaching strategies and pedagogical models: operational conditions consistent with the principles of plasticity.

Strategy/model	Relevant operational principles	Population/context	Level of evidence
Universal Design for Learning (UDL)	Redundancy of access channels; multiple means of representation, action, and expression; reinforcement of	Neurodevelopmental disorders in general; heterogeneous school populations	Solid: international meta-analyses and systematic reviews (Capp, 2017; AlRawi & AlKahtani, 2022; Boysen et al., 2025)

Strategy/model	Relevant operational principles	Population/context	Level of evidence
	multiple attentional and executive networks		
Instrumental Enrichment Program (Feuerstein)	Mediated learning; enhancement of basic cognitive functions; guided and progressive repetition	Intellectual disability	Moderate: consolidated applied and theoretical-clinical studies (Feuerstein, 2008; Vannini, 2006)
Structured peer tutoring	Activation of social and motivational networks; frequent response opportunities; close peer feedback	Disability and special educational needs in inclusive settings	Solid: meta-analyses and systematic reviews (Bowman-Perrott et al., 2013; Talbott et al., 2017)
Cooperative learning	Positive interdependence; individual accountability; co-regulation of executive functions through peer scaffolding	Neurodevelopmental disorders	Moderate: recent systematic review (Arjmandnia & Mojaver, 2026)
Pedagogical-clinical model – Crispiani Method	Functional observation; individualization; intentional and sequential exercise; cognitive-motor integration; progression of difficulty; continuous monitoring	SLD, dyspraxia, neurodevelopmental disorders, and learning difficulties	Under consolidation: decades-long theoretical-applied corpus in Italy; controlled international empirical evidence still to be strengthened [5,30–33]

Note. The reference to Specific Learning Disorders (SLD) in this table concerns exclusively cases of comorbidity with a condition certified under Law 104/1992 and falling within the IEP; SLD profiles without comorbidity, to which the PDP (Law 170/2010) applies, fall outside the scope of the present contribution.

UDL proposes designing multiple possibilities for engagement, representation, and action/expression in advance. The literature reviewed considers UDL a solution for reducing design barriers and increasing curriculum accessibility [18,26,27]. Its main contribution consists in shifting attention from individual adaptation alone to the design of the learning environment. UDL does not, however, coincide with the indiscriminate multiplication of materials: options must be functional to the objective and must not unnecessarily increase cognitive load.

The systematic review by Arjmandnia and Mojaver [21] shows favourable results of cooperative learning in students with neurodevelopmental disorders, with outcomes concerning learning, social dimensions, and participation. The elements that make the approach inclusive are the structuring of roles, positive interdependence, and individual accountability. Simple group work is therefore not sufficient: without roles and participation criteria, the group can reproduce exclusion or dependency.

Peer tutoring has a well-established empirical base, including the meta-analysis by Bowman-Perrott et al. [24] and the synthesis by Talbott et al. [25]. Its value lies in the frequency of response opportunities, close feedback, and the active involvement of both tutor and tutee. To avoid paternalistic dynamics, the tutor must be trained and monitored, and the relationship must be designed as reciprocally educational.

For students with executive or generalization difficulties, the explicit structuring of the task plays a central role. The teacher makes the steps visible, models the procedure, guides practice, provides feedback, and progressively reduces support. The Feuerstein method [22,23] belongs to the pedagogical tradition of mediation and cognitive modifiability; in the present contribution it is not automatically superimposed on neuroscientific evidence. Metacognitive strategies complete the process through planning, monitoring, and evaluation.

A similar caution must be adopted with regard to clinical pedagogy and the Crispiani Method [5,30]. The reference to the modifiability of learning and to the centrality of exercise does not authorize an automatic overlap between a pedagogical model and a neurobiological mechanism. The possible connection lies rather in the conditions of the educational experience: intensity, repetition, progression, mediation, integration between action and cognition, and continuous monitoring of outcomes. In this sense, the scientific interest of the model consists mainly in the possibility of subjecting these principles to empirical evaluation within specific educational and individual contexts.

Table 5. Matrix of evidence-based strategies

Strategy	Teaching mechanism	Conditions of effectiveness	Indicators
UDL [18,26,27]	Preventive reduction of barriers; multiple means of access and response.	Clear objectives; relevant options; alignment between means and objectives.	Access, participation, choice, quality of response.
Cooperative learning [21]	Positive interdependence and individual accountability.	Structured groups, roles, shared task, monitoring.	Participation, interaction, learning.

Peer tutoring [24,25]	Frequent practice and peer feedback.	Trained tutor; short tasks; supervision.	Responses, accuracy, autonomy, interaction.
Explicit teaching/scaffolding [11,20,22,23,28]	Modelling, guided practice, progressive withdrawal of support.	Clear sequence; repetition; feedback; generalization.	Accuracy, level of assistance, transfer.
Metacognition	Planning, monitoring, and evaluation.	Initial prompts; self-monitoring; fading.	Independent use of strategies, self-correction.

3.4 From neuroplasticity to the IEP: operational translation – Salvatore Vitiello[1]

The passage from evidence to the design of the IEP requires avoiding two opposite errors: reducing the IEP to a clinical description, or transforming it into a list of techniques.

Between these two poles, a functional conception of planning can be placed, consistent both with the International Classification of Functioning, Disability and Health (ICF framework) [34] and with the tradition of pedagogical diagnostics [5]: knowledge of the student's characteristics acquires educational value only when it is translated into verifiable operational hypotheses. The description of functioning must therefore be continuously linked to the definition of barriers, the choice of facilitators, the selection of strategies, and the measurement of outcomes.

The IEP should link functioning, barriers and facilitators, objectives, strategies, resources, and assessment criteria. The national model updated by Ministerial Decree 153/2023 maintains the reference to the four dimensions of the IEP — relationship/interaction/socialization; communication/language; autonomy/orientation; cognitive, neuropsychological, and learning dimension — in relation to the domains of the Functioning Profile [14].

In this logic, neuroplasticity mainly contributes to formulating a design question: which learning experiences, at what frequency, with which supports, and with what progression can increase the likelihood of acquiring and generalizing a skill? The answer must then be verified through observable indicators. For example, instead of generically stating “strengthen attention”, the IEP may specify that the student complete a sequence of three brief activities while maintaining focus for an agreed interval, initially using a visual timer and a checklist, with a progressive reduction of prompts.

Planning must also distinguish between accommodation and teaching. A support that enables access to the task is not necessarily a strategy for building competence. Both may be necessary, but they must be described separately and verified: accommodation reduces a barrier; instructional intervention builds a capacity. This distinction increases the precision of the IEP and makes the relationship between need, intervention, and outcome more legible.

Table 6. Translation matrix into the IEP

Element	Design question	Operational example
Functional observation	Under what conditions does the skill emerge, diminish, or require greater support?	Performance improves with segmented instructions, an initial model, and reduced competing stimuli.
Functioning	Which skill is fragile, and in what context?	Difficulty maintaining a sequence of independent work.
Barrier	What in the context hinders performance?	Long, unsegmented instructions and multiple stimuli.
Facilitator	What makes participation possible?	Checklist, step-by-step instructions, timer, seating with fewer distractions.
Objective	What observable change is intended?	Completing 3 steps with a maximum of 1 prompt within the agreed time.
Strategy	Which evidence-based intervention is used?	Scaffolding + feedback + self-monitoring.
Progression	How is support reduced?	From full guidance to an independent checklist, then gradual withdrawal.
Generalization	Where should the skill be transferred?	Another subject, another teacher, an authentic task.
Verification	What data demonstrates progress?	% of steps completed, number of prompts, time on task.

3.5 Italian Regulatory Framework – Salvatore Vitiello[1]

The Italian system of school inclusion is based on a regulatory framework that has developed in layers over time. Framework Law No. 104/1992 introduced the general principles of the social integration of persons with disabilities [12]; Legislative Decree 66/2017 reorganized school-inclusion procedures in a more operational sense, introducing disability certification for inclusion purposes and redefining the role of the inclusive working groups (Class-level Operational working group - COWG, School-level Working Group - SWG) [13]. Ministerial Decree 182/2020 adopted the national IEP models and the related Guidelines, distinguishing the provisional IEP from the definitive one and organizing its content by developmental domains [14]. More recently, Legislative Decree 62/2024 – as amended by Decree-Law 202/2024, converted into Law 15/2025 – redefined the multidimensional assessment of disability and introduced the individual, personalized, and participatory life project, strengthening the link between functional assessment, reasonable accommodation, and educational planning [15]. This regulatory framework, if known and used to its full extent, already constitutes in itself a framework consistent with the neuroplastic and evidence-based principles described above: the IEP, in particular, lends itself to being conceived not as a mere bureaucratic requirement but as a tool for personalized neuro-instructional design.

Law No. 104 of 5 February 1992 [12] represents the fundamental historical reference for the protection of the rights of persons with disabilities and for school inclusion. Article 12 affirms the right to education and instruction in mainstream sections and classes, laying the foundations for a conception of inclusion as a right rather than as a merely assistential intervention.

Legislative Decree 66/2017 [13], amended by Legislative Decree 96/2019, strengthens the shared responsibility of the school community and organizes the inclusive process around individualized planning, family participation, and the work of the COWG. The most significant pedagogical consequence is the overcoming of a conception of support as an isolated action by the specialized teacher: inclusion concerns the overall functioning of the class and the school environment.

Ministerial Decree 182/2020 [14] adopted the national IEP models and the related Guidelines; Ministerial Decree 153/2023 introduced amendments and corrections to them. The structure of the IEP makes it possible to link the observation of functioning, interventions on the context, objectives, strategies, tools, and assessments. The COWG constitutes the collegial forum in which the plan is discussed, approved, and verified. Ministerial documentation confirms the role of the COWG and the participation of the family [14].

Legislative Decree No. 62 of 3 May 2024 [15] reforms the definition of disability status, basic assessment, and the tools linked to reasonable accommodation and to the individual, personalized, and participatory life project. Subsequent amendments deferred to 1 January 2027 the entry into force of some provisions relating to the new assessment procedure, while the experimental phase was extended during the transitional period. Therefore, in 2026 the framework must be read as an evolving system: the innovations introduced by Legislative Decree 62/2024 are already part of the legal order, but some procedures are subject to deferred entry into force and to experimentation.

For instructional design, this has a methodological consequence: the IEP should not be constructed as a document separate from knowledge of the student's functioning, but as a dynamic tool linking available information, educational objectives, contextual interventions, and monitoring. The perspective of participation and self-determination, also recalled in disability legislation [14,15], further reinforces the need to consider the student as an active subject of their own educational path.

Table 7. Linking regulatory references to inclusive planning

Source	Contribution	Implication for the IEP
Law 104/1992 [12]	Right to education and instruction and principles of inclusion.	Protection of the right and shared educational responsibility.
Legislative Decree 66/2017 [13] + Legislative Decree 96/2019	Organization of inclusion and individualized planning.	IEP as a collegial process and intervention also on the context.
Ministerial Decree 182/2020 [14]	National IEP models and Guidelines.	Common structure for observation, objectives, strategies, and assessment.
Ministerial Decree 153/2023 [14]	Corrections and additions to the IEP models.	Coherence between the Functioning Profile and the dimensions of the IEP.
Legislative Decree 62/2024 [15] and amendments	New regulation of disability, reasonable accommodation, and the life project; procedural transition.	Linking assessment, supports, participation, and the individualized project.

IV. Discussion – Valentina Della Volpe[2]

The main conceptual finding to emerge from the synthesis is the need to keep three levels distinct: neurobiological, cognitive-instructional, and normative. At the first level, neuroplasticity indicates that the brain is modifiable through experience [1–4]. At the second, educational research identifies strategies that can increase the quality and accessibility of learning experiences [18,21,24–27]. At the third, Italian school law establishes the conditions, responsibilities, and tools through which such interventions must be designed and shared [12–15]. The quality of inclusion emerges precisely from their integration, not from their overlap.

A second finding concerns the risk of neuromyths and biological determinism. Claiming that a specific activity “builds neurons”, or that a student with a given diagnosis has a “non-plastic” brain, would be a simplification incompatible with contemporary literature. Neuroplasticity is ubiquitous but not unlimited; it can support recovery and learning, but it does not eliminate individual differences, nor does it guarantee that any intervention will produce improvement. For this reason, the evidence-based category must take precedence over unverified neuro-educational narratives.

This distinction also makes it possible to clarify the different epistemological status of the models referred to in this contribution. Neuroscientific evidence describes general conditions and processes through which experience can contribute to modifying the nervous system; educational research evaluates the effectiveness of specific strategies with respect to given outcomes; pedagogical and clinical-educational models, by contrast, propose interpretive structures and intervention procedures that may present different levels of empirical validation. The conceptual convergence between these levels must not be confused with evidentiary equivalence.

From this perspective, clinical pedagogy and the Crispiani Method [5,30–33] represent a particularly significant case. Their interest, in the present contribution, does not derive from the attribution of a directly demonstrated neurobiological effectiveness, but from the coherence of certain operational principles — functional observation, individualization, intentional exercise, sequentiality, progression, and monitoring — with a conception of learning as a dynamic and modifiable process. Their inclusion in an interdisciplinary synthesis must therefore be accompanied by a distinction between theoretical-operational plausibility and the level of empirical evidence.

A third element concerns the quality of implementation. Cooperative learning, peer tutoring, and UDL are not self-sufficient techniques. Their effectiveness depends on the quality of the design: appropriate tasks, clear roles, success criteria, feedback, monitoring, and the progressive withdrawal of support. In the IEP, a generic formulation — for example, "use cooperative learning" — has limited design value. A more useful formulation specifies the objective, activity, the student's role, support, frequency, success criterion, and method of assessment.

The synthesis thus suggests a circular design model: functional assessment, definition of the objective, choice of the barrier to be reduced, selection of the strategy, implementation, measurement of the outcome, adaptation, generalization. This model is consistent both with a dynamic conception of plasticity and with the procedural nature of the IEP.

Some limitations remain. This contribution does not constitute a systematic review with meta-analysis, does not carry out a quantitative assessment of the risk of bias of the included studies, and integrates sources with different designs and aims. Furthermore, neuroscientific evidence does not allow each teaching practice to be directly attributed a specific brain change. The indications proposed should therefore be understood as an interdisciplinary synthesis oriented toward instructional design, not as proof of neurobiological causality.

V. Implications for teacher training and neuro-inclusive environments – Salvatore Vitiello[1]

Teacher training should develop integrated competence in four areas: understanding of the main mechanisms of learning and plasticity; functional reading of neurocognitive profiles; selection and implementation of evidence-based strategies; the ability to translate analysis into IEP objectives and indicators. Purely theoretical training risks producing knowledge that cannot be transferred; purely technical training, on the other hand, risks turning strategies into decontextualized procedures.

An effective training pathway should alternate case studies, analysis of instructional situations, the design of micro-interventions, the construction of monitoring tools, and collegial review of the IEP. Particular attention should be given to the distinction between facilitation and teaching, the management of fading, generalization, and the collection of simple but reliable data.

Neuro-inclusive environments are not defined by the presence of sophisticated technologies, but by the environment's capacity to make demands predictable, information accessible, and strategies visible. Flexible spaces, the reduction of unnecessary distractions, visual supports, accessible digital tools, routines, and opportunities for individual or collaborative work can function as facilitators. The decisive element, however, is the coherence between environment, objective, and student profile.

VI. Conclusion – Salvatore Vitiello[1]

Neuroplasticity offers an important scientific basis for understanding why educational experience can modify skills over the course of development and beyond the early stages of life [1–4]. Its value for inclusion, however, emerges only when it is linked to rigorous instructional design: clear objectives, distributed practice, feedback, scaffolding, metacognition, opportunities for participation, and generalization.

For students with ADHD, intellectual disability, and other neurodevelopmental disorders, the most effective educational response does not consist in seeking a universal technique, but in building a system of supports proportionate to the functional profile and progressively oriented toward autonomy [6–11]. UDL, cooperative learning, peer tutoring, and explicit teaching can contribute to this process when implemented with structure, monitoring, and effectiveness criteria [18,21,24–27].

Alongside these practices, the Italian tradition of clinical pedagogy [5,30–33] offers a further contribution in terms of functional observation and individualized planning. In particular, the emphasis placed on modifiability, the intensity of exercise, the sequentiality of intervention, and the continuous monitoring of outcomes may constitute a theoretical-operational heritage to be subjected to further empirical verification. Its integration with strategies supported by international evidence may represent a promising direction, provided that a clear distinction is maintained between pedagogical coherence, theoretical plausibility, and empirically demonstrated effectiveness.

In the Italian context, Law 104/1992, Legislative Decree 66/2017, and Ministerial Decree 182/2020, as amended by Ministerial Decree 153/2023, provide the main reference for inclusive planning and for the IEP [12–14]. Legislative Decree 62/2024 also introduces a broader transformation of the disability system, with a

progressive implementation phase [15]. The challenge for schools is therefore twofold: to use scientific evidence responsibly and to translate it into practices consistent with the rights and tools provided for by the legal system.

Inclusive teaching can be defined as evidence-based not when it uses neuroscientific vocabulary, but when it formulates verifiable hypotheses, selects interventions supported by research, monitors outcomes, and modifies its choices on the basis of data. Within this integration of the science of learning, special education, and legislation lies a conception of the IEP as a living planning tool rather than a mere documentary requirement.

The integration of neuroscientific evidence, evidence-based teaching practices, and the Italian regulatory framework constitutes a necessary condition — albeit not yet fully realized — for genuinely inclusive teaching aimed at students with neurodevelopmental disorders. It is proposed that the training of special education teachers explicitly adopt a three-level model – understanding of neuroplastic mechanisms, mastery of an evidence-based methodological repertoire, and competence in the use of regulatory tools (in particular the IEP) – capable of guiding instructional design in a unified way. Future studies should investigate, through experimental designs conducted within the Italian school context, the actual effectiveness of teacher-training pathways built according to this integrated model. A further development concerns Specific Learning Disorders without disabling comorbidity: their planning through the Personalized Learning Plan, although it may draw on the same neuroplastic and evidence-based principles discussed here, requires dedicated regulatory and operational analysis, which will be developed in a subsequent contribution.

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