

A cura di  
CATIA GIACONI E NOEMI DEL BIANCO

# E-HAND. EMPOWERING CHILDHOOD HANDWRITING



TRAIETT**O**RIE  
INCLUSIVE

**FrancoAngeli** 



# TRAJETTORIE INCLUSIVE

COLLANA DIRETTA DA  
**CATIA GIACONI, NOEMI DEL BIANCO  
SIMONE APARECIDA CAPELLINI**

La collana “Traiettorie Inclusive” vuole dare voce alle diverse proposte di ricerca che si articolano intorno ai paradigmi dell’inclusione e della personalizzazione, per approfondire i temi relativi alle disabilità, ai Bisogni Educativi Speciali, alle forme di disagio e di devianza. Si ritiene, infatti, che inclusione e personalizzazione reifichino una prospettiva efficace per affrontare la complessa situazione socio-culturale attuale, garantendo un dialogo tra le diversità.

I contesti in cui tale tematica è declinata sono quelli della scuola, dell’università e del mondo del lavoro. Contemporaneamente sono esplorati i vari domini della qualità della vita prendendo in esame anche le problematiche connesse con la vita familiare, con le dinamiche affettive e con il tempo libero. Una particolare attenzione inoltre sarà rivolta alle comunità educative e alle esperienze che stanno tracciando nuove piste nell’ottica dell’inclusione sociale e della qualità della vita.

La collana presenta due tipologie di testi. Gli “*Approfondimenti*” permetteranno di mettere a fuoco i nodi concettuali oggi al centro del dibattito della comunità scientifica sia nazionale, sia internazionale.

I “*Quaderni Operativi*”, invece, documenteranno esperienze, progetti e buone prassi e forniranno strumenti di lavoro per professionisti e operatori del settore.

La collana si rivolge a tutti i professionisti che, a diversi livelli, si occupano di processi inclusivi e formativi.

## DIREZIONE

*Catia Giaconi* (Università di Macerata)

*Noemi Del Bianco* (Università di Macerata)

*Simone Aparecida Capellini* (Università San Paolo Brasile)

## COMITATO SCIENTIFICO

*Paola Aiello* (Università di Salerno)

*Gianluca Amatori* (Università Europea, Roma)

*Fabio Bocci* (Università Roma3)

*Lucia Borsini* (Università della Campania Luigi Vanvitelli)

*Elena Bortolotti* (Università di Trieste)

*Gerard Buckley* (Rochester Institute of Technology)

*Roberta Caldin* (Università di Bologna)

*Aldo Caldarelli* (Università Niccolò Cusano)

*Lucio Cottini* (Università di Udine)

*Ilaria D'Angelo* (Università di Macerata)

*Filippo Dettori* (Università di Sassari)

*Donatella Fantozzi* (Università di Pisa)

*Daniele Fedeli* (Università di Udine)

*Laura Fedeli* (Università di Macerata)

*Andrea Fiorucci* (Università del Salento)

*Cristina Gaggioli* (Università per Stranieri di Perugia)

*Amanda Kraus* (University of Arizona)

*Elena Malaguti* (Università di Bologna)

*Gabrielle E. Miller* (University of Arizona)

*Linda A. Myers* (Johns Hopkins University)

*Pasquale Moliterni* (Università di Roma-Foro Italico)

*Annalisa Morganti* (Università di Perugia)

*Salvatore Patera* (Università degli Studi Internazionali di Roma)

*Valentina Pennazio* (Università di Genova)

*Loredana Perla* (Università di Bari)

*Vanessa M. Perry* (University of Arizona)

*Maria Beatriz Rodrigues* (Università Porto Alegre, Brasile)

*Francesco Paolo Romeo* (Università e-Campus)

*Piergiuseppe Rossi* (già Università di Macerata)

*Tommaso Santilli* (Università di Macerata)

*Karrie A. Shogren* (University of Kansas)

*Maurizio Sibilio* (Università di Salerno)

*Arianna Taddei* (Università di Macerata)

*Andrea Traverso* (Università di Genova)

*Tamara Zappaterra* (Università di Ferrara)

*Antioco Luigi Zurru* (Università di Cagliari)

*Ogni volume è sottoposto a referaggio "doppio cieco".*

A cura di  
CATIA GIACONI E NOEMI DEL BIANCO

# E-HAND. EMPOWERING CHILDHOOD HANDWRITING



TRAJETTORIE  
INCLUSIVE

**FrancoAngeli** 

We acknowledge financial support under the National Recovery and Resilience Plan (NRRP), Mission 4, Component 2, Investment 1.1, Call for tender No. 104 published on 02/02/2022 by the Italian Ministry of University and Research (MUR), funded by the European Union – NextGenerationEU– Project Title “EHand. Empowering middle childhood Handwriting” n. 2022AWATR2 – CUP D53D23012830006 - Grant Assignment Decree No. 1060 adopted on 17/07/2023. by the Italian Ministry of University and Research (MUR).

Isbn digitale: 9788835179665

Copyright © 2025 by FrancoAngeli s.r.l., Milano, Italy.

Publicato con licenza *Creative Commons*  
*Attribuzione-Non Commerciale-Non opere derivate 4.0 Internazionale*  
(CC-BY-NC-ND 4.0).

Sono riservati i diritti per Text and Data Mining (TDM), AI training e tutte le tecnologie simili.

*L'opera, comprese tutte le sue parti, è tutelata dalla legge sul diritto d'autore.*  
*L'Utente nel momento in cui effettua il download dell'opera accetta tutte le condizioni*  
*della licenza d'uso dell'opera previste e comunicate sul sito*  
<https://creativecommons.org/licenses/by-nc-nd/4.0/deed.it>

# Indice

|                                                                                                                                  |      |     |
|----------------------------------------------------------------------------------------------------------------------------------|------|-----|
| <b>Introduction</b> , by <i>Noemi Del Bianco, Catia Giaconi, Lucia Borsini, Ilaria D'Angelo, Aldo Caldarelli</i>                 | Pag. | 7   |
| <b>1. Specific Learning Disorders: state of the art and pedagogical implications</b> , by <i>Catia Giaconi and Lucia Borsini</i> | »    | 11  |
| <b>2. Dysgraphia: lines of research and perspectives for prevention and pedagogical intervention</b> , by <i>Lucia Borsini</i>   | »    | 47  |
| <b>3. Assessment and training of grapho-motor skills: the E-Hand project</b> , by <i>Ilaria D'Angelo and Aldo Caldarelli</i>     | »    | 81  |
| <b>Conclusions and inclusive trajectories</b> , by <i>Noemi Del Bianco</i>                                                       | »    | 105 |
| <b>Authors</b>                                                                                                                   | »    | 111 |

# 1. Specific Learning Disorders: state of art and pedagogical implications

by *Catia Giaconi* and *Lucia Borsini*

## 1. Introduction

Specific Learning Disorders (SpLDs) are an important topic in today's scientific and pedagogical discussions (Berninger & Wolf, 2009; Bara & Gentaz, 2011; Coffin & Gentaz, 2011; James & Engelhardt, 2012; Overvelde & Hulstijn, 2011, Ceccacci *et al.*, 2024). These disorders encompass a diverse range of difficulties that disrupt specific academic skills, such as reading, writing, and math, becoming central to an interdisciplinary debate that includes neuroscience, special education, psychology, and educational sciences. For instance, this chapter aims not only to define the characteristics of SpLDs but also to foster critical reflections on educational implications, intervention strategies, and the significance of prevention. This contribution will explore key conceptual issues related to SpLDs, providing a comprehensive and critical overview of the main topics currently under discussion. It will begin by addressing the definition and classification of these disorders, emphasising the necessity of an integrated and interdisciplinary approach to fully understand them. The complex nature of SpLDs requires an analysis that transcends a personal limit to capture the various ways these disorders manifest in different learning and developmental contexts.

This first chapter aims to serve as a foundation for the entire volume, acting as a bridge to the subsequent chapters. For these

reasons, we start with a general overview and a broad reconstruction of SpLDs. A significant focus will be placed on the normative frameworks and evolving terminology that have shaped the history of studying SpLDs, tracing the journey from early definitions to the latest educational and pedagogical perspectives. In this context, special attention will be given to the importance of prevention, a critical area for educational research and intervention. Investigating its trends and developments emphasises the necessity of adopting early and systematic approaches to identify and address difficulties before they become entrenched, thus promoting harmonious and inclusive growth for every student. It is clear that the prevention of SpLDs does not end with preventing the onset of the disorder but aims to create a broader educational and inclusive context that can foster the full development of each pupil's potential, while reducing the risk of failure and dropping out of school.

In summary, the synergy that is fostered by the adoption of evidence-based tools for the early detection of disorders, combined with the ability to provide timely and targeted educational responses, is the foundation for a truly inclusive school.

Therefore, in light of what has emerged, it should be emphasised that at the basis of effective prevention is the need to promote an inclusive culture which is able to give centrality to the training of educational staff and the active involvement of families. From a pedagogical point of view, the entire prevention framework is structured around two main operational guidelines: teacher training through inclusive educational approaches and the school-family relationship, capable of integrating preventive action with systematic attention to the child's needs (Giacconi & Capellini, 2015).

## **2. Terminological and regulatory developments**

The Consensus Conference (2009, p. 19) identified several key issues that have generated considerable debate within the scientific community regarding Specific Learning Disorders (SpLDs). These issues include, for example, the necessity for clear definitions, a comprehensive understanding of epidemiology and aetiology, and



the establishment of robust diagnostic criteria and evaluation procedures. Additionally, attention must be directed towards detecting early indicators, understanding the developmental trajectories of people with SpLDs, and addressing comorbidities and prognostic outcomes. For these reasons, the Consensus Conference represents the turning point for numerous studies that have addressed, over the years, the topic of SpLDs, revealing a diverse array of perspectives on various related issues, including the interpretation of these Disorders (Cornoldi *et al.*, 2010; Giaconi & Capellini, 2015; Toffalini, Gioffrè & Cornoldi, 2017; Giaconi *et al.*, 2019; Del Bianco & Mason, 2021; Murdaca, 2022; Giaconi *et al.*, 2023; Giaconi *et al.*, 2024). The field of SpLDs is inherently broad and complex and, as we explore this area, we encounter multiple theoretical positions and approaches that only sometimes align with their understanding of the phenomenon or their intervention strategies (Ginieri-Coccossis *et al.*, 2013; Kavkler, KoÅ & Magajna, 2015; Minolin, Meena & Karthikeyan, 2020). Given this heterogeneity and the latest scientific findings, certain conceptual domains and phenomena necessitate further exploration and detailed investigation (Giaconi & Capellini, 2015; Woodcock & Hitches, 2017; Ceccacci *et al.*, 2024).

For these reasons, we consider both the reference terminology, recognised nationally<sup>1</sup> (Giaconi & Capellini, 2015) and internationally (Consensus Conference, 2009), and the legislative references that established a legal framework in Italy to ensure the rights of people with these Disorders.

Starting from a terminological reconstruction, the definition of SpLDs is the cornerstone for understanding the complexities of this phenomenon (Giaconi & Capellini, 2015; Kunhoth *et al.*, 2024). Establishing a shared definition is essential, as uncertainties regarding the criteria for diagnosing and recognising these disorders

<sup>1</sup>The main national regulatory sources on the subject: Law 170 of 2010: “New regulations on specific learning disorders in schools”, Guidelines for the right to study of pupils and students with specific learning disorders issued in 2011 by the Ministry of Education, Universities and Research (MIUR), and the 2022 Guidelines: Management of Specific Learning Disorders issued by the National Institute of Health.

hinder the ability to compare research findings and assess their prevalence and impact. SpLDs are not to be confused with general learning difficulties; they refer to disorders that significantly impair specific skill domains – reading, writing and arithmetic – while leaving general intellectual functioning intact. The term ‘specific’ is central to this classification, highlighting the circumscribed nature of the impairments, which, despite their significant effects, do not compromise overall intellectual abilities. This delineation is supported by the notion of ‘discrepancy’, which is critical for diagnosis. Discrepancy refers to the gap between an individual’s performance in the affected domain (reading, writing, or arithmetic) and their general intellectual abilities, as defined in the 2009 Consensus Conference.

Specifically, SpLDs, which include dyslexia, dysgraphia/dysorthographia and dyscalculia, are lifelong conditions that can significantly affect an individual’s ability to function in academic, occupational, and social contexts. Despite their neurobiological origins, these disorders do not indicate reduced intelligence but rather reflect specific neurocognitive differences that persist over time.

Their impact – as we are going to see – underscores the importance of early prevention, targeted interventions, and ongoing support tailored to the evolving needs of people throughout their development into adulthood.

Considering the legislative reform specific to the Italian context, a salient moment in the field of SpLDs is certainly enshrined by the enactment of Law no. 170 of 8 October 2010, ‘New regulations on Specific Learning Disorders in schools’, and the subsequent Decree 5669 of 12 July 2011, ‘Guidelines for the right to study of pupils and students with Specific Learning Disorders’.

Law no. 170/2010 identifies dyslexia, dysgraphia and dyscalculia as Specific Learning Disorders and mandates schools to adopt personalised educational approaches. In this respect, there are several salient passages to be explored in line with the profound motivations behind this discussion. The law, from its very first provisions, recognises SpLDs as primary and specific conditions, not secondary to inadequate cognitive abilities, neurological pathologies, or sensory

disabilities (Art. 1(1)). In particular, SpLDs are distinguished according to specific characteristics that include difficulties in reading accuracy and speed (dyslexia), in graphic production (dysgraphia), in the linguistic processes of transcription (dysorthography) and in the automatisms related to calculation and number management (dyscalculia) (Art. 1(2-5)). The law also specifies that these disorders may occur singly or in combination, highlighting the heterogeneity and complexity of clinical manifestations and individual functioning profiles (Art. 1(6)).

The aims outlined in the law (Art. 2) are clear and articulated: to ensure the right to education in schools of all levels, to promote the scholastic success of students with SpLD, to enhance their individual potential and to foster general emotional and relational well-being. Law no. 170 also aims to guarantee equal opportunities for the development of personal capacities, not only in the school environment, but also in social and professional contexts, thus contributing to the construction of an inclusive future oriented towards the full realisation of each individual's potential (Art. 2(1)(h)).

A further central aspect that is highlighted concerns diagnosis, which is entrusted to the National Health Institute and accredited facilities, with the aim of guaranteeing both a timely and accurate diagnostic process and early educational interventions that can mitigate the impact of the difficulties on school and personal life (Art. 3(1)). In this perspective, the importance of specific and targeted training for teachers at all levels is emphasised in order to equip them with the necessary tools to identify early signs of risk and to adopt appropriate educational and teaching measures (Art. 4). This training should cover the main strategies for recognising risk profiles and implementing timely interventions while promoting close collaboration with families and health professionals. The latter, in fact, are responsible for diagnostic assessment and rehabilitative treatment while actively contributing to the design of customised educational approaches, emphasising an integrated and participative approach (Art. 5).

On a pedagogical level, Law no. 170 represents a fundamental point of reference, highlighting certain educational and didactic

emergencies that require focused and structured action. Prominent among these is the need to promote comprehensive care for students with SpLD, coupled with ongoing training for school and education personnel. The perspective outlined by the law is clearly systemic and longitudinal, as it aims to consider the child or young person with SpLD in their development, both in school contexts and in everyday life, emphasising the need to guarantee the full right to education for all students.

In line with these assumptions, the introduction of the Personalised Educational Plan, regulated by Ministerial Decree no. 5669 of 2011 and the Guidelines<sup>2</sup> annexed thereto, makes it possible to finalise the learning and scholastic success of students with SpLD during primary and secondary school. Article no. 5 of Ministerial Decree no. 5669, of 2011 in fact states: «The school specifically guarantees individualised and personalised educational interventions for pupils and students with SpLD, also through the development of Personalised Educational Plans (PEP), indicating the compensatory tools and dispensatory measures adopted» (Art. 5, Ministerial Decree no. 5669/2011). Note how the conjunction ‘also’ reiterates the non-compulsory nature of developing Personalised Educational Plans but presupposes the wording of a document that adheres to what is set out in the article itself. This is the reason why there is no standardised model of such a document that is the same for all educational institutions. However, in order to reduce the school’s margins of discretion, the Guidelines, published by the Ministry of Education in 2011 and annexed to the reference decree, identify precise characteristics that must be present in each PEP, including the methods, contents and timing for drafting this planning document. In any case, the term PEP is the most widespread and used by schools (Fogarolo, 2013).

The school’s collaboration with the family, reiterated in the 2011 Guidelines, is of fundamental importance: «In the preparation of the documentation in question, it is essential to liaise with the family, which can communicate to the school any observations on experiences developed by the student independently or through

<sup>2</sup> “Guidelines for the right to study of pupils and students with Specific Learning Disorders”.

extracurricular pathways» (Ministry of Education Guidelines, 2011, p. 8). The PEP thus assumes the function of providing the families with documentation of the planned intervention strategies, thereby strengthening a relationship of sharing a work plan geared towards enhancing the student's educational success.

In summary, numerous ministerial documents (Ministerial Decree of 27.12.2012; Note no. 2563 of 22 November 2013, Ministerial Circular no. 8/2013, Departmental Decree no. 1061 of 15.10.2015, Legislative Decree no. 66/2017, Legislative Decree no. 96/2019) have recognised over time the Personalised Educational Plan (PEP) as the preferred tool for the activation of an individualised and personalised approach that has «the purpose of defining, monitoring and documenting – according to a collegial, co-responsible and participatory elaboration – the most suitable intervention strategies and learning assessment criteria» (Ministerial Circular no. 8/2013, p. 2). From this perspective, the PEP represents the operational document in which didactic-educational planning, programmatic interventions of a didactic-instrumental nature, dispensatory measures and compensatory tools can be included. The main methodological directions of the ministerial documents can be traced back to a vision of the PEP as a shared and participated approach, both inside and outside the school context, and the preferred tool for educational and didactic flexibility, capable of bringing the individualised and customised approach closer to its broader inclusive process.

In light of these definitions and the normative references, it seems appropriate – from our point of view – to move forward with an informed look at the pedagogical emergencies that they call into question, moving towards a critical analysis of the main challenges that professionals and parents are called upon to face during the longitudinal care of persons with SpLDs. Before proceeding in that direction, a brief identification of Specific Learning Disorders follows.

## **2.1 The reading, writing and calculation Specific Disorder: a brief overview**

In this section, we concentrate on conceptual frameworks that are widely accepted by the scientific community, as well as on research trajectories that warrant thorough exploration. The aim is to provide foundational elements for professionals in the educational sector to enhance their understanding of SpLDs and to identify key concepts deserving of investigation in their professional practice (Giacconi & Capellini, 2015).

While not entering into the specific framework and in order to highlight the variety and heterogeneity of individual profiles, the main identifications attributable to dyslexia, dysgraphia, dysorthographia and dyscalculic frameworks will be outlined.

### **2.1.1. Dyslexia**

The Specific Reading Disorder, commonly referred to as dyslexia, significantly affects the instrumental skill of reading, with impairments in reading fluency and correctness, without an impairment in general intellectual functioning (Consensus Conference, 2009, p. 37).

Dyslexia, in fact, is characterised by difficulties in the correct sequence of reading (from left to right, in changing lines) and in decoding skills, which result from a disorder of the phonological component of language. It is also characterised by impairment in language processes, especially in the phonological process of speech and later in the phonological process required for reading (Temple *et al.*, 2000).

A person with dyslexia presents various manifestations, representing a complex syndromic picture of specific, primary symptoms of the disorder, which persist even in the presence of exposure to continuous, highly stimulating and motivating reading exercises. Among the main ones, the literature (Etchepareborda,

2002; Shaywitz, 2006; Capellini, 2009; Giaconi & Capellini, 2015) identifies the following:

- difficulty recognising and analysing the alphabetical signs of a word in the correct sequence;
- disorientation when confronted with graphic signs differently oriented in space (d-b, p-q, p-d, q-b, u-n, a-e, ecc.) and alphabetical signs corresponding to similar sounds;
- omissions of graphemes and syllables;
- omissions of words on the line to be read;
- inversions of graphemes and syllables;
- addition or repetition of syllables;
- difficulty in finding one's way around the line to be read and loss of the line in the action of going to the end of the line;
- invention of words, keeping the first part of the written word;
- poor reading fluency compared to classmates;
- difficulty in retrieving words or phrases to be used for the expression of facts or ideas;
- difficulty understanding speech or reading;
- difficulty understanding the use of grammar in forming sentences;
- difficulty remembering numbers, letter sequence, directions, ecc;
- difficulties in organising and planning tasks to be performed.

In the same vein, investigations have looked into aspects closely related to slowness, the tendency to tire easily, the propensity for low self-esteem and a low sense of self-efficacy (Capellini *et al.*, 2009). In particular, the relationships between poor reading fluency and other components related to reading in the broader sense have also been studied. First of all, a child, tending to 'read well' and decipher the words of a sentence, invests all their energy in this action, therefore, they have no more resources to use for understanding what they are reading.

Secondly, the perception of inadequacy and sense of uncertainty increase over time and the feeling of not being able to read is amplified. This inevitably leads to a tendency to reduce spontaneous reading, to avoid reading the text aloud or to avoid the task itself.

### 2.1.2 Dysgraphia and dysorthographia

As we will see in detail in the next chapter, the terminologies most commonly used to identify Specific Writing Disorder can be traced back to the terms ‘dysgraphias’ and ‘dysorthographias’ (Giaconi & Capellini, 2015; Kunhoth *et al.*, 2024; Giaconi *et al.*, 2024). The plurality refers to a broad correlation of such a Disorder, both in reference to the motor component of the act of writing, i.e. the execution one in terms of legibility, fluidity and accuracy, related to dysgraphia (Capellini & Souza, 2008; Capellini, Coppede & Valle, 2010; Okuda *et al.*, 2011; Kunhoth *et al.*, 2024), and in the merit of the orthographic component, proper to textual production, defined by some as dysorthographia (Fletcher *et al.*, 2018; Giaconi & Capellini, 2015).

In the case of dysgraphia the main difficulties are related to an uncertain assumption of the motor sequence underlying the coordination of movements and the organisation of action, poor skills in fine manual dexterity, inadequately acquired lateral dominance or difficulties in eye-hand coordination, as well as difficulties in sequential visual recognition or memorisation (Engel-Yeger, Nagauker-Yanuv & Rosenblum, 2009; Gvion & Friedmann, 2009; Pollock *et al.*, 2008; Lousada *et al.*, 2009; Giaconi *et al.*, 2024). Whereas dysorthographia involves various aspects of language and thinking, which call into question ideas in linguistic representations that need to be organised, stored and, later, retrieved from memory (Zucoloto & Sisto, 2002; Galaburda & Cestinick, 2003; Cervéra-Mérida & Ygual-Fernández, 2006; Manzano *et al.*, 2008; Giaconi, & Capellini, 2015).

There are several characteristics of this syndromic picture. The main ones that Giaconi and Capellini (2015) identify include:

- incorrect handling of the writing instrument;
- alteration of writing size;
- variation of pressure on the sheet (weak or excessive);
- poor organisation in the space of the writing sheet, with a tendency to observe a lack of alignment of the writing with the left margin on pages;
- writing lines with irregular patterns;



- tendency to stick words together and not keep the right space between words (irregular spacing between the letters of a word and between words in a text);
- tendency to rewrite and redo what has already been written, with the presence of elongated links between graphic signs and between words;
- tendency to overlap graphic strokes or leave closed forms open (e.g. ‘o’);
- irregular in shape and size, and not very stable;
- illegible and incomprehensible handwriting;
- substitutions, omissions, inversions of graphemes;
- alterations in word segmentation;
- inversion, transposition and substitution of letters;
- inaccuracies in letter-to-sound conversion;
- alteration of the order of syllables;
- slowness in visual perception;
- slowness in the execution of writing and fatigue.

A person with dysgraphia and/or dysorthographia, by investing all their cognitive and energy resources to improve their handwriting, ends up not having enough residual energy to devote to other fundamental actions such as articulation and organisation of concepts, textual enrichment, revision and self-correction. Such an excessive effort, prolonged over time, generates a sense of inadequacy both in the act of writing and in written production, leading to significant fatigue and general demotivation. All this contributes, on the whole, to progressively reducing the inclination towards writing or avoiding it altogether.

### *2.1.3. Profiles of dyscalculia*

When the Specific Learning Disorder pertains to the specific domain of the ability to calculate, one speaks of dyscalculia. Specifically, it refers to the impairment of written calculation in terms of number manipulation, mental calculation and retrieval of arithmetic facts.

Again, the characteristic feature of the Disorder is specificity, in other words, performance is below what is expected for age in a condition of adequate intellectual functioning, relevant level of schooling and absence of sensory or neuropsychiatric disability profiles. Longitudinal studies conducted by Jordan and Montani (1997) with 7-year-old children with disorders in the calculating process examined up to the age of 9 show how the disorder persists despite the presence of maturity in the calculating cognitive system and the administration of stimulating exercises. We are therefore dealing with a disorder that persists over time, i.e. one that is not characterised by transient difficulties related to the process of acquiring written calculation procedures.

The Consensus Conference (2009) classifies two frameworks of dyscalculia: the first is profound, the second procedural.

Profound dyscalculia is characterised by an impairment in the processing of numerical parts. The most significant errors that can be observed are:

- in the semantic processes of numerical cognition;
- in the immediate recognition of small quantities, hence that process we called, in the section on the physiology of computation, subitising;
- in the breakdown and re-composition of quantities;
- in serialisation and comparison.

Procedural dyscalculia, on the other hand, relates to procedural aspects of the calculation process and is the more frequent form than the one just described. The most frequent errors in this case include:

- in syntactic and lexical processes;
- in reading and writing numbers (e.g. instead of writing 107, the child writes 1007);
- in the positional value of the digits;
- in the ordering and positioning of numbers;
- in recognising the sign of the operation (e.g. performs a '+' addition instead of an '×' multiplication);
- in written calculation procedures;
- in the mental calculation (in terms of applying the procedure and maintaining and retaining it);

- in the remainder and carry-over;
- in the retrieval of arithmetical facts.

With reference to such difficulties, there are numerous studies (Wang *et al.*, 2014; Carey *et al.*, 2016) that highlight how poor performance in mathematics might elicit anxiety about mathematics, especially in children and young people with developmental dyscalculia (Lai *et al.*, 2015; Passolunghi, 2011). Some researchers (Maloney *et al.*, 2011; Passolunghi, 2011) claim that the onset of anxiety about mathematics may be due to difficulties in basic numerical skills, such as numerical cognition, which would lead dyscalculics to develop a negative relationship with mathematics from the earliest years of schooling.

### **3. Pedagogical challenges: early warning, diagnosis and intervention**

Entering into a critical analysis of the main pedagogical challenges involved in caring for people with SpLDs, prevention constitutes a cornerstone of the contemporary pedagogical debate, playing a crucial role in the student's educational success.

This approach takes the form of an articulated set of interventions aimed at reducing the incidence of difficulties and limiting their negative impact on the child's development (Penge, 2010; Capellini & Giaconi, 2015; Giaconi, Taddei, Del Bianco & Capellini, 2018; Isidori & Prosperi, 2019; Capellini *et al.*, 2020; Giaconi *et al.*, 2024).

Specifically, a distinction can be made between primary, secondary and tertiary prevention, depending on the objectives and methods of intervention.

As far as primary prevention is concerned, it focuses on actions to counter the onset of disorders through the strengthening of basic prerequisites, such as language skills, motor coordination and memory capacity. In schools, for example, this approach translates into the implementation of educational activities aimed at promoting the full development of the child's cognitive and relational skills (Penge, 2010; Giaconi & Capellini, 2015).

Secondary prevention, on the other hand, focuses on early detection of signs of risk. In this respect, the adoption of screening tools is effective, through which it is possible to identify children who, as early as the last year of pre-school or the first two years of primary school, manifest difficulties in the development of reading, writing and calculation processes. This type of intervention, which is not limited to detecting individual difficulties but involves the entire class group in inclusive reinforcement approaches, is based on scientifically validated observational protocols. Early identification enables the early activation of targeted educational approaches, preventing difficulties from structuring into established disorders and facilitating more effective functional recovery (Giaconi & Capellini, 2015).

Finally, tertiary prevention targets children who have already manifested the disorder, with the aim of preventing its worsening and reducing the onset of secondary comorbidities. This approach involves targeted interventions, including the use of compensatory tools and the design of customised educational paths aimed at ensuring the person's overall well-being (Giaconi & Capellini, 2015).

In such a framework, the central element of prevention is early diagnosis, i.e. observation protocols aimed at the early identification of groups of children who, as early as the last year of preschool and the first two years of primary school, may present a set of difficulties in the development of the precursors and processes of reading, writing and calculation. Between the end of preschool and the beginning of primary school is, in fact, a crucial moment in the progressive refinement and consolidation of the requirements of reading, writing and calculation. The two most important developmental periods concern precisely the 5 to 6-year-olds (high precocity) and 6 to 7-year-olds (low precocity) ranges, thus confirming the need to detect risk predictors with reference to possible SpLD frameworks already during these 'developmental windows' (Stella & Gallo, 2005; Ianes *et al.*, 2007; Giaconi & Capellini, 2015). It is at this stage that early recognition of signals, such as the failure to develop phonological skills or difficulty in

understanding logical sequences, can prevent an increase in complications.

In this regard, several knots still need to be unravelled in the area of prevention.

Firstly, scientific research attempts to demonstrate the real opportunity to prevent a disorder, i.e. the possibility of early detection of reliable indicators, which occur before the disorder appears. Secondly, the scientific community is seeking to ascertain whether specific work aimed at reducing these risk indices actually leads to a reduction in the likelihood of the occurrence of SpLD.

Let's examine the substance of these two issues.

Indicators or risk factors are identified as «personal and social elements whose presence increases the likelihood that an individual will manifest a given disorder over time» (Penge, 2010, p. 39) and which, therefore, could become central in prevention projects as early as preschool. What needs to be clarified is that the presence of a risk threshold in the context of SpLD is connected with 'an increased likelihood of developing the disorder' (Penge., p. 40) over time and not with an unequivocal identification of people who will definitely have an SpLD condition. The scientific literature (Penge, 2010; Capellini & Giaconi, 2015; Giaconi, Taddei, Del Bianco & Capellini, 2018; Isidori & Prosperi, 2019; Capellini *et al.*, 2020; Kunhoth *et al.*, 2024; Giaconi *et al.*, 2024) attempts to trace, with increasingly accurate longitudinal research and interesting documentation through case studies, the presence of a number of risk factors of a potential SpLD framework. These include (Consensus Conference, 2009, p. 49) important critical signs to be identified at an early stage, such as the possible presence of a family history of the disorder, delays in the acquisition and development of communicative-linguistic, motor-praxic, auditory and visual-spatial skills at pre-school age. The result that emerges is, therefore, that of a plurality of definitions referring to the most likely predictive early signs, a heterogeneity that reflects the diversity of interpretation of the disorders.

As early diagnosis and intervention play a decisive role in the development of the disorder, numerous studies (Baker & Smith, 1999; Morris *et al.*, 2000; Penge, 2010; Giaconi & Capellini, 2013;

Isidori & Prosperi, 2019) have shown how the effectiveness of screening approaches enables the reduction of the extent of SpLD. At the procedural level, however, professional caution is required. A screening process must have several cornerstones to be effective. Prominent among these is the principle of cost-effectiveness, i.e. the protocol must make it possible to observe the SpLD risk group more accurately and with less expenditure of energy and resources. In addition, screening must meet the principle of reliability, i.e. it must use tools that are standardised and validated on a large scale and are based on scientific findings in the field of SpLDs.

Such detection procedures can be designed and conducted by practitioners, but also by trained teachers who, moreover, can make use both of everyday school life for continuous observation over time and of screening as a constant monitoring system. For these reasons, we believe it is of paramount importance to focus not so much on the selection of teams of professionals from outside the school to carry out the screening in the school, but on the training of school staff so that it becomes a shared and stable practice over time.

### ***3.1 The role of professionals in the early warning, diagnosis and empowerment intervention***

Closely related to the above-mentioned evidence is a further aspect of pedagogical relevance concerning the careful and accurate planning of training and refresher courses for school staff of all levels, possibly also to be extended to the families concerned. There are various training courses that should be aimed both at knowledge of the law, but also at an in-depth study of the complex framework of SpLDs, of the different procedures for early identification, of the educational-didactic strategies for reinforcement, of the different and possible compensatory tools, of the most appropriate forms of verification and assessment.

The primary objective in supporting the training of professionals is to ensure access to essential elements and areas of consensus that can effectively guide them through this complex field.

Since «SpLDs [...] constitute a complex phenomenon of vast social proportions that has hitherto been little recognised» (Stella & Savelli, 2011, p. 7), such uncertainties and the plurality of viewpoints can occasionally create confusion (Giaconi & Capellini, 2015).

One key aspect that warrants consideration is the tendency to overlook Specific Learning Disorders or broaden their definition to encompass all educational difficulties. In this case, we face a dual challenge: on one hand, the failure to recognise SpLDs promptly can lead to the loss of critical opportunities for intervention; on the other hand, there exists a tendency to confuse Specific Learning Disorders with ‘general learning difficulties’ (Giaconi & Capellini, 2015, p.14). In this regard, as highlighted by Giaconi and Capellini (2015, p. 14), «those elements highlighted signify critical points from a pedagogical perspective. Firstly, the early identification of difficulties and the implementation of timely habilitative interventions are acknowledged as favourable prognostic factors; this indicates their profound influence on the progression of the disorder. Secondly, it is essential to clearly delineate the conceptual boundary between difficulty and disorder to prevent the misinterpretation of recommendations for clinical practice as indicative of disorders» (Giaconi & Capellini, 2015, p. 14).

This clarification aims to establish a clear distinction for all professionals involved in the educational context, including teachers and educators. It is essential for these professionals to avoid the extremes of either overlooking potential SpLDs by allowing issues to persist unaddressed or assuming that all students facing challenges automatically have an SpLD. Both tendencies can lead to detrimental practices, including a lack of engagement or excessive reliance on diagnostic services, fostering a mindset where difficulties are expected to be resolved on their own or are inaccurately categorised (Giaconi & Capellini, 2015).

Research (Penge, 2010; Capellini & Giaconi, 2015; Giaconi, Taddei, Del Bianco & Capellini, 2018; Isidori & Prosperi, 2019; Capellini *et al.*, 2020; Kunhoth *et al.*, 2024; Giaconi *et al.*, 2024) indicates that learning difficulties can be characterised as general challenges that a student may encounter within the school environment. These difficulties can be transient and may be

effectively addressed through targeted interventions (Dockrell & McShane, 2000; Feder & Majnemer, 2007; Capellini, 2009; Capellini *et al.*, 2009; Ianes, Cisotto & Galvan, 2011; Borean, 2014; Rosenblum & Dror, 2016; Danna *et al.*, 2023; Kunhoth *et al.*, 2024). In contrast, SpLDs pertain to specific impairments that significantly impact a person's ability to adapt in academic, professional, and daily living contexts. SpLDs are recognised for their persistence over time and can be formally diagnosed through a comprehensive assessment process, conducted by professionals.

These discussions highlight the need for further clarification of these critical aspects of the subject in order to provide guidance to various professionals involved in training.

### *3.1.1 The pedagogical-didactic dimension in the early warning, diagnosis and empowerment intervention*

Further reflection that emerges in our discussion concerns the frequently overlooked implications of SpLDs on the development of co-identity and their impact throughout a person's lifespan, from early education to adulthood. This encompasses challenges related to academic failure, increased dropout rates, and negative effects on career progression.

Therefore, as a corollary, another major dimension emerges that is closely related to the entire school career of the student with SpLDs: the didactic-pedagogical dimension of planning and personalisation. Inevitably, this issue invokes the very core of didactic action in terms of constructing pathways for the whole class, within which there are different paths for personalisation, in this case, for students with SpLD. This dimension represents, in our opinion, one of the greatest challenges in this regard, i.e. to experiment together, in everyday life and within the different educational proposals, possible approaches for students with SpLD.

In the regulatory framework, while noting the need to activate dispensatory and compensatory measures, the emphasis, in our opinion rightly, is placed on the «use of individualised and personalised teaching, with effective and flexible forms of school



work that also take into account the specific characteristics of the subjects, such as bilingualism, adopting an appropriate methodology and educational strategy» (Law no. 170/2010, Art. 5(2)(b)).

The sustainability of the approaches, however, is the indicator that could make any assumption fail. In fact, it is a matter of experimenting with approaches that are potentially manageable, throughout the school year, by both teachers and students. It is therefore necessary to design customised teaching plans to be used within class groups. The pedagogical-didactical emergency manifests itself in the urgent need to support forms of experimentation aimed at inclusive education. The focus, therefore, becomes polarised not on a generic plan of dispensatory measures and compensatory tools, but on the feasible construction of an integrated system of methodologies and didactic mediators, on the one hand, responsive to the educational needs of children/young people with SpLD, and on the other, context-sensitive and inclusive for all pupils.

We are talking about dispensatory measures<sup>3</sup> related to dysfunctional instrumental skills (e.g. dispensation of reading aloud, copying on the blackboard) and compensatory tools<sup>4</sup> (such as the use

<sup>3</sup> «Dispensatory measures are interventions that allow a student with SpLD not to perform certain tasks that, due to the disorder, are particularly difficult and do not contribute to functional learning. Available studies on the subject recommend estimating the extent to which the specific difficulty penalises them in comparison with peers and calibrating additional time or reduction of work material accordingly while taking into account the student's performance indexes. In the absence of more precise indices, an additional 30% appears to be a reasonable additional time» (Ministry of Education Guidelines, 2011, p. 7). By exempting the pupil from certain tasks, the pupil avoids a feeling of frustration and low self-efficacy, allowing them to manifest their competences (Zappaterra, 2012). The quality of interventions depends on the possibility of experimenting with strategies that allow people to develop forms of control and self-regulation over their own performance (Giacconi & Capellini, 2015).

<sup>4</sup> Compensatory tools are «didactic and technological instruments that replace or facilitate the required performance of the impaired skill» (Guidelines, MIUR 2011, p. 7). In fact, they compensate for the student's specific difficulty by allowing them to use their energy for more effective learning. These tools, which can be low-tech or high-tech, should be evaluated on the basis of the personal needs of each student. Moreover, they do not simplify the execution of the task from a cognitive point of view and do not put the student who uses them in a privileged position with respect to others, but rather allow the student to achieve

of didactic and technological tools) that allow support for performance based on the impaired skill.

It should be pointed out that dispensatory measures relate to dispensing tasks that, given the SpLD, could subject the person to excessive effort with the result of losing the very content of the activity and exposing them to unnecessary frustration. These measures are also carefully designed and timed according to the subject's profile, the structural and temporal characteristics of the activity and the methodologies proposed by the teacher. The line to be pursued, also for homework, is to support ways of working that favour the quality of thinking and not the mechanical execution of a large number of exercises. We reiterate, in fact, that the quality of interventions hinges on the possibility of experimenting with effective strategies and developing forms of control and self-regulation of one's own performance. Change in learning, therefore, is not achieved by repeating numerous exercises, for example, by rewriting sentences several times where the correct spelling rules have not been used.

Whereas compensatory tools are facilitators, with reference to the performance framework that the SpLD condition makes particularly difficult. These tools must be proportional to the length and complexity of the proposed activities. With regard to the use of technological compensatory tools, the initiation and preparation process that can lead the student to the knowledge of the tool and its autonomous use should not be underestimated. Think, for example, of the use of computers. This precludes working on memorising the keyboard in such a way that the subject achieves an adequate writing speed to be able to concentrate not so much on finding letters on the computer keyboard, but on the cognitive task.

In conclusion, the line to be pursued and favoured is, in our opinion, that of choosing the system of devices that is most functional to the participation and autonomy of the individual with SpLD. The choices must be weighed with reference to the specific nature of the profile and the precise space-time dimension in which

the same goals as their classmates, thanks to a customised approach that sees the introduction of such tools aimed at overcoming difficulties due to the disorder (Zappaterra, 2012).

the person lives, in order to achieve real educational gains in terms of future autonomy and skills development, also with reference to the use of compensatory tools and different ways of approaching study which are useful for educational success.

### *3.1.1.1 Evidence of inclusive teaching for empowerment intervention*

From the above considerations, it seems useful to outline some of the main teaching strategies for implementing learning/enhancement pathways in sections and classes where students with SpLD are included.

As mentioned in the preceding paragraphs, school learning is based on a number of key dimensions (e.g. visual and auditory perception, visual-verbal association, phonological memory and awareness, eye-hand coordination), the development of which can be carefully monitored and consequently enhanced already during pre-school age. Enhancement interventions based on these elements have been extensively researched and validated (Cornoldi, 2007; Angeli *et al.*, 2011; Hulme & Snowling, 2011; Coggi & Ricchiardi, 2014; Kaldenberg *et al.*, 2015; d'Alonzo, 2017; Nepi, 2017; Isidori & Prospero, 2019), in order to highlight the strategies that teachers can implement in the classroom with a view to applying inclusive teaching.

Specifically, several studies (Kaldenberg *et al.*, 2015; Isidori & Prospero, 2019) identify a series of exercises considered useful for this developmental group which can be taken into consideration according to the type of strategy to be implemented.

These include exercises useful for visual discrimination, aimed at developing attention, perceptual analysis and executive control. In this regard, exercises in the areas of pairing, reiteration, repetition, coding, semantic organisation, seriation, perceptual highlighting, spatial orientation, etc. can be implemented. For example, recognising and differentiating graphemes from other graphic signs on the basis of their different spatial orientation and shape, without being able to name them; completing simple figures; distinguishing

the figure from the background, discriminating what is larger and what is smaller, and being able to find the differences between similar drawings.

As far as auditory perception is concerned, which enables the perception and differentiation of linguistic sounds belonging to one's own language, teachers can also implement a series of useful exercises for the identification of the minimal components of language. For example, certain rhythms can be associated with larger or smaller images depending on whether they are faster or shorter, or stronger or weaker rhythms. Or specific work can be done on sequential auditory memory and auditory function, perhaps through the ordering of sequences or recognition of a part of a text in the course of the story.

The teacher can also contribute to the facial-auditory integration with the aim of implementing the correspondence between image and sound, in order to facilitate the retrieval of linguistic labels from the verbal lexicon to correctly associate graphemes with phonemes and subsequently name words correctly (Tretti *et al.*, 2002; Grabe & Stoller, 2002). In this regard, exercises in which figures, objects, and symbols must be named and recognised correctly (e.g. puzzles with letters and alphabets) appear useful.

In this age group, phonological memory, which is necessary to train short-term memory to maintain a correct phonological sequence, and metaphonological skills, which enable the recognition and processing of the phonological characteristics of words (Cornoldi, 2007; d'Alonzo, 2017; Neria & Pellegrini, 2017), can also be the subject of specific training. As far as phonological memory is concerned, exercises that allow the identification of individual phonemes that will later be converted into graphemes (during writing) in order to merge them into words (functional for reading) appear useful. Exercises in syllabic metaphonology can be proposed that will allow, with entry into school, better mapping of spelling and better reading. Exercises can focus on the recognition of vowels, flat syllables, complex syllables, spelling digrams/trigrams, closed syllables (Isidori & Prosperi, 2019). With reference to metaphonological skills (or phonological awareness), teachers can implement all those exercises that call into question the ability to

fuse, i.e. to distinguish a word after hearing its phonemes or syllables separately, and the ability to segment, i.e. to break down a word into its constituent sounds (syllables before and phonemes after), without having access to the written code. Examples include: syllable segmentation (e.g. clapping according to how many syllables are in the words); syllable blending (e.g. If I say po-me-gra-na-te what word did I say?); initial syllable identification (e.g. a boatload of words starting with ...WO has arrived); rhyme completion (e.g. rain, rain go away, come again another DAY); word chain identification that allows the identification of words starting with the same syllabic component (e.g. boAt...ATlantIC...ICeland...).

Even with regard to the early years of primary school, didactic research has made clear the importance of certain steps that should be made explicit and taken care of in the learning-teaching processes. From the very beginning of the didactic proposal, studies (Stella & Gallo, 2005; Grabe & Stoller, 2002; Berninger & Woolf, 2009; Giaconi, 2013b; Giaconi & Capellini, 2013; 2015; D'Alonzo, 2017; Giaconi *et al.*, 2024) affirm the importance of constructing the lesson in such a way as to lead the student with SpLD to a high degree of both awareness of the learning work they have to undertake, and of control, choice and manipulation of the material to be learned and of the procedures. In this case, recalling a metacognitive approach, as highlighted in previous studies (Giaconi, 2013a; Giaconi & Capellini, 2013), teachers are advised – especially in the presence of a new topic – to proceed with some useful information before starting the lesson: define the field of work (what will be covered in the lesson or assignment); provide indications of the aims and expected competences; estimate the difficulty of the task (highlighting particularly complex concepts); define the operational modes that will be activated during the lesson (e.g. ‘In the first part of the lesson we will do this... then we will do some exercises’); give indications of sources (reference texts and relevant pages, photocopies, etc.); make connections with previously covered topics (either in a sense of continuity or divergence/criticality); and be explicit about the assessment methods. In this regard, it is of considerable importance that the teacher, during the lesson, alternates the oral explanation with moments of graphical punctuation of the

key concepts covered, providing an effective graphic organiser. In the explanations, therefore, it becomes relevant for the learning of students with SpLD to either use ‘visible’ concrete examples ‘close to the children’s experience’, or to guide them to find real or ‘absurd’ ‘mental images’ by following so-called visual learning techniques. Of equal importance is the flexibility and variety of sources that the teacher makes available. Therefore, it becomes important for teachers to offer, in addition to textual sources, other sources that the pupil could consult at home (such as films/documentaries, research on the topic via the Internet).

In line with these reflections are the investigations into cognitive styles and teaching styles (Cornoldi, 1999; Giaconì, 2004; Cornoldi *et al.*, 2020). In fact, there is a tendency of style incongruity between teaching (didactic styles) and learning (cognitive styles), which constitutes a key to the very core of the theoretical and experiential problem of didactics. Taking different subjectivities into account calls for reflection on cognitive and learning styles, on individual differences, on respect, on acceptance, on valuing the person in their uniqueness, and suggests not expecting students to learn everything and always in the same way according to a methodological standard established *a priori*.

The scientific literature (Sternberg, 2003; Giaconì, 2004) emphasises the importance of the so-called ‘personal equation’ effect, which sheds light on how often teachers’ explanations and the guidance they provide in order to acquire a study method reflect their beliefs and previous school experiences. The ‘personal equation’, in fact, emphasises that the teacher sometimes tends to think that pupils are, in the way they think and study, very similar to them. It seems, therefore, evident that the teacher must conduct careful reflection in this respect as awareness of this natural condition can lead to the enhancement of flexible and inclusive teaching. The teacher’s beliefs, i.e. the representations through which they think about their work and which they have developed since attending school as a student, are, therefore, beliefs that should not be underestimated by virtue of their impact on the way they conduct their profession (Giaconì & Capellini, 2013; 2015).

In the vastness of the subject we are dealing with, these are just a few of the strategic approaches that can help us to have an extra key to understanding the complexity of the relationship and teaching-learning processes that are substantiated from the school context to permeate that of the non-school context.

### ***3.2 The importance of school-family partnerships in early warning, diagnosis and intervention***

As mentioned above and also reiterated by the 2011 Guidelines, a fundamental aspect for both the prevention and the subsequent treatment of SpLDs is the active and continuous collaboration that must be established between schools and families as a pivotal element for the success of the student's educational pathway.

Prevention cannot and should not be confined exclusively to the school environment; on the contrary, it implies close cooperation with families who are called upon to become an integral part of the educational process, actively contributing to the early identification of signs of difficulty and the implementation of intervention strategies (Isidori, 2017; Ianes & Cramerotti, 2013).

It is essential that teachers develop effective modes of communication based on transparency and mutual respect. For example, during the phase of early detection of risk signs, it is essential that teachers be able to explain clearly and without alarm the difficulties encountered in a way that is objective and understandable to parents. At the same time, it is necessary to avoid amplifying the problem or drawing premature conclusions that could generate unhelpful anxiety in families. The dialogue between teacher and parent should, therefore, be geared towards raising awareness without alarming, and promoting an awareness that prompts early, albeit reasoned, intervention.

Once the prevention phase, which includes awareness-raising activities, training and early identification of risk signs, is over, it is the responsibility of teachers, adequately trained, to carefully monitor pupils' progress and report any persistent difficulties. Such difficulties, which may manifest themselves in the acquisition and

development of instrumental skills in reading, writing and calculation, may, in fact, persist despite the implementation of targeted interventions. It is important, therefore, that parents be informed about the child's specificities and also guided and supported in understanding the next steps to be taken, such as designing specific interventions that may include, for example, the use of compensatory tools or individualised support. The effectiveness of such collaboration also depends on the ability to establish a support network involving other professionals, such as neuropsychiatrists, speech therapists and educationalists. The creation of a multidisciplinary support network makes it possible to address the dynamics in a synergetic manner, ensuring that the solutions adopted are coordinated and integrated, with the aim of fostering the child's development.

Thus, the awareness process that must be established inevitably presupposes forms of collaboration that allow for an ecological vision of the interventions, which is essential to ensure the effective management of a shared approach that can promote the student's educational success throughout their school career.

From these insights, our attention is focused on the direction of a specific in-depth study on one of the SpLDs, namely dysgraphia. If not adequately recognised and addressed, dysgraphia can adversely affect an individual's education and overall well-being. Therefore, it is crucial to reflect on the most effective intervention strategies and preventive practices, which will be the central themes of the next chapter.

#### **4. To summarise**

Specific Learning Disorders (SpLD) are a major topic in pedagogical and didactic research (Cornoldi, 1999; Giacon, 2004; Cornoldi *et al.*, 2020). These Specific Disorders, including dyslexia, dysgraphia, dysorthographia and dyscalculia, affect specific school skills without affecting general intellectual functioning.

The definition and classification of SpLDs has been the subject of in-depth scientific and regulatory research, culminating in important



references such as the 2009 Consensus Conference and Law no. 170/2010. The latter enshrined the right of students with SpLD to customised education, introducing compensatory and dispensatory measures, as well as support tools such as the Personalised Educational Plan (PEP). The legislation has had a significant impact on school practice, promoting inclusive teaching strategies aimed at the educational success of all students.

A fundamental aspect in the management of SpLD is prevention, articulated at three levels: primary, aimed at enhancing learning prerequisites; secondary, focused on early detection of risk signs; and tertiary, aimed at supporting students already certified, reducing the risk of comorbidity and learning discomfort.

In this context, the role of teachers is crucial in adopting effective teaching strategies and in dialogue with families and professionals to ensure comprehensive support for the student's educational success (Giaconi & Capellini, 2015). For these reasons, teacher training plays a key role in building an inclusive learning environment. It is essential to provide theoretical and operational tools to recognise difficulties at an early stage and implement targeted interventions. Personalised teaching, combined with the use of compensatory tools and the promotion of flexible methodologies, makes it possible to respond to the specific needs of each student, fostering more effective learning and reducing the risk of scholastic failure.

Finally, collaboration between schools and families is an indispensable element for the educational success of students with SpLD. A constructive dialogue between teachers and parents makes it possible to share strategies and support approaches, improving the quality of implemented training (Giaconi & Capellini, 2015). In short, it is through the synergy between training, prevention and personalisation of interventions that it is possible to build a school that can be truly inclusive.

## References

- Angeli, A., D'Amore, B., & Di Nunzio, M. (2011). *La matematica dalla scuola dell'infanzia alla scuola primaria*. Bologna: Pitagora.
- Baker, S., & Smith, S. (1999). Starting off on the right foot: The influence of four principles of professional development in improving literacy instruction in two kindergarten programs. *Learning Disabilities Research and Practice*, 14(4), 239-253. [https://doi.org/10.1207/sldrp1404\\_5](https://doi.org/10.1207/sldrp1404_5).
- Bara, F., & Gentaz, E. (2011). Haptics in Teaching Handwriting: The Role of Perceptual and Visuo-Motor Skills. *Human Movement Science*, 30, 745-759. <https://doi.org/10.1016/j.humov.2010.05.015>
- Berninger, V. W., & Wolf, B. J. (2009). *Teaching students with dyslexia and dysgraphia: Lessons from teaching and science*. Paul H. Brookes Publishing Co.
- Borean, M. (2014). La valutazione dei disturbi visuo-percettivi-motori della scrittura. In Bravar L. et al., *Le difficoltà grafomotorie nella scrittura* (pp. 115-58). Trento: Erickson.
- Capellini, S. A. (2009). Distúrbio de aprendizagem versus dyslexia. In Fernandes F. D. M., Mendes B. C. A., Navas A. L. P. G. P. (Eds.), *Tratado de Fonoaudiologia* (pp. 352-362), 2aed, SP. São Paulo: Editora Roca.
- Capellini, S. A., & Souza, A. V. (2008). Avaliação da função motora fina, sensorial e perceptiva em escolares com dislexia do desenvolvimento. In Sennyey A. L., Capovilla F. C., Montiel J. M. (Eds.), *Transtornos de aprendizagem: da avaliação à reabilitação*. São Paulo: Artes Médicas.
- Capellini, S. A., Coppede, A. C., & Valle, T. R. (2010). Fine motor function of school-aged children with dyslexia, learning disability and learning difficulties. *Prò-Fono Revista de Atualizacao Científica*, 22(3), 201-208.
- Capellini, S. A., dos Santos Liporaci, G. F., Metzner I. P., Del Bianco N., D'Angelo, I., Taddei, A., & Giaconi, C. (2020). Speed and pressure of handwriting as critical issues of the contemporary age: A research in Italian students in early literacy. *Education Sciences & Society-Open Access*, 11(1).
- Capellini, S. A., Silva, A. P. C., Silva, C., & Pinheiro, F. H. (2009). Avaliação e diagnóstico fonoaudiológico nos distúrbios de

- aprendizagem e dislexias. In Zorzi J. L. & Capellini S. A., *Dislexia e outros distúrbios da leitura-escrita*. São José dos Campos: Pulso.
- Capellini, S. A. (2023). Il feedback aptico nella pedagogia e didattica speciale: uno studio esplorativo. *Traiettorie Inclusive*, 45, 128-140.
- Carey, E., Hill, F., Devine, A., & Szücs, D. (2016). The chicken or the egg? The direction of the relationship between mathematics anxiety and mathematics performance. *Frontiers in psychology*, 6.
- Ceccacci, S., Taddei, A., Del Bianco, N., Giaconi, C., Forteza Forteza, D., & Moreno-Tallón, F. (2024). Preventing Dysgraphia: Early Observation Protocols and a Technological Framework for Monitoring and Enhancing Graphomotor Skills. *Information*, 15(12), 781. <https://doi.org/10.3390/info15120781>.
- Cervéra-Mérida, J., & Ygual-Fernández, A. (2006). Una propuesta de intervención en trastornos disortográficos atendiendo a la semiología de los errores. *Revista de neurologia*, 42(2), 117-126.
- Coffin, F., & Gentaz, E. (2011). Haptics in teaching handwriting: The role of perceptual and cognitive factors. *Frontiers in Psychology*, 2, 112. <https://doi.org/10.3389/fpsyg.2011.00112>.
- Coggi, C., & Ricchiardi, P. (2014). La «school readiness» e la sua misura: uno strumento di rilevazione per la scuola dell'infanzia. *JOURNAL OF EDUCATIONAL, CULTURAL AND PSYCHOLOGICAL STUDIES*, 9, 283-308. <https://dx.doi.org/10.7358/ecps-2014-009-cogg>.
- Consensus Conference. (2009). *Disturbi Evolutivi Specifici di Apprendimento. Raccomandazioni per la pratica clinica della dislessia, disortografia, disgrafia e dyscalculia*. Trento: Erickson.
- Cornoldi, C. (1999). *Le difficoltà di apprendimento a scuola*. Bologna: il Mulino.
- Cornoldi, C. (2007). (Ed.). *Difficoltà e disturbi dell'apprendimento*. Bologna: il Mulino.
- Cornoldi, C., Mammarella, I. C., & Caviola, S. (2020). *AC-MT-3 6-14 anni. Prove per la clinica. Test di valutazione delle abilità di calcolo e del ragionamento matematico*. Trento: Erikson
- Cornoldi, C., Pra Baldi, A., Friso, G., Giacomini, A., Giofrè, D., & Zaccaria, S. (2010). *Prove avanzate MT di lettura e matematica2 per il biennio della scuola superiore di secondo grado*. Firenze: Giunti O.S.
- d'Alonzo, L. (2017). *La differenziazione didattica per l'inclusione. Metodi, strategie, attività*. Trento: Erickson.

- Danna, J., Puyjarinet, F., & Jolly, C. (2023). Tools and methods for diagnosing developmental dysgraphia in the digital age: a state of the art. *Children*, 10(12).
- Del Bianco, N., & Mason, L. G. (2021). Specific Learning Disorders in Higher Education: The University of Arizona case study. *Education Sciences & Society*, 1, 219-229.
- Dockrell, J., & McShane, J. (2000). *Crianças com dificuldades de aprendizagem: uma abordagem cognitiva*. Porto Alegre: Artmed.
- Engel-Yeger, B., Nagauker-Yanuv, L., & Rosenblum, S. (2009). Handwriting performance, self-reports, and perceived self-efficacy among children with dysgraphia. *American Journal of Occupational Therapy*, 63(2), 182-192.
- Etchepareborda, M. C. (2002). Detección precoz de la dislexia y enfoque terapéutico. *Revista de Neurología*, 34(supl. 1), 13-23.
- Feder, K. P., & Majnemer, A. (2007). Handwriting development, competency and intervention. *Developmental Medicine of Child Neurology*, 49(4), 312-317.
- Fletcher, J. M., Lyon, G. R., Fuchs, L. S., & Barnes, M. A. (2018). *Learning disabilities: From identification to intervention*. New York: Guilford Publications.
- Fogarolo, F. (2013). *Insegnare e imparare con le mappe*. Trento: Erikson.
- Galaburda, A. M., & Cestnick, L. (2003). Dislexia del desarrollo. *Revista de Neurología*, 36(supl. 1), 13-23.
- Giaconi, C. (2013b). Progettare format inclusivi: le rappresentazioni verbali degli insegnanti. In Perla L. (Ed.), *Per una didattica dell'inclusione* (pp. 179-195). Lecce: Pensa MultiMedia.
- Giaconi, C., Taddei, A., Del Bianco, N., Capellini, S. A. (2018). Inclusive University didactics and technological devices: a case study. *Education Sciences and Society*, 1. [http://ojs.francoangeli.it/\\_ojs/index.php/ess/article/view/6248/300](http://ojs.francoangeli.it/_ojs/index.php/ess/article/view/6248/300) 28.03.2020.
- Giaconi, C. (2004). *Didattica e stili cognitive*. Bergamo: Junior.
- Giaconi, C. (2013a). Elementos de didática inclusiva em classes com alunos com Dislexia. In Capellini S. A., *Dislexia*. Brazil: Wak Editora.
- Giaconi, C., & Capellini, S. A. (2013). *Os professores ensina. Alguns alunos não aprendem*. San Paolo: Fundepe.

- Giaconi, C., & Capellini, S. A. (2015). *Conoscere per includere. Riflessioni e linee operative per professionisti in formazione*. Milano: FrancoAngeli.
- Giaconi, C., Capellini, S. A., Del Bianco, N., Taddei, A., & D'Angelo, I. (2019). Study Empowerment for inclusion. *Education Sciences and Society-Open Access*, 9, 166-183.
- Giaconi, C., Del Bianco, N., D'Angelo, I., & Tarsi, P. P. (2024). School prevention as a new frontier for inclusive planning in Kindergarten. *«Qtimes»*, 2, 57-69.
- Ginieri-Coccossis, M., Rotsika, V., Skevington, S., Papaevangelou, S., Malliori, M., Tomaras, V., & Kokkevi, A. (2013). Quality of life in newly diagnosed children with specific learning disabilities (SpLD) and differences from typically developing children: a study of child and parent reports. *Child Care Health Dev*, 39(4), 581-591.
- Grabe, W., & Stoller, F. L. (2002). *Teaching and Researching Reading*. New York: Pearson Education. <https://doi.org/10.4324/9781315833743>.
- Gvion, A., & Friedmann, N. (2009). Letter position dysgraphia. *Cortex*, 46(9). <https://doi.org/10.1016/j.cortex.2009.09.008>.
- Hulme, C., & Snowling, M. J. (2011). Children's reading comprehension difficulties. Nature, causes, and treatments. *Current Directions in Psychological Science*, 20(3), 139-142.
- Ianes, D., & Cramerotti S. (2013). *Alunni con BES - Bisogni Educativi Speciali*. Erickson: Trento.
- Ianes, D., Cisotto, L. & Galvan, N. (2011). *Facciamo il punto su... disgrafia e disortografia. Apprendimento della scrittura e difficoltà*. Trento: Erickson.
- Ianes, D., Cramerotti, S., & Tait, M. (2007). *Facciamo il punto su... la dislessia. Il ruolo della scuola e della famiglia*. Trento: Erickson.
- Isidori, M. V. (2017). *Bisogni Educativi Speciali BES. Ridefinizioni concettuali e operative per una didattica inclusiva. Un'indagine esplorativa*. Milano: FrancoAngeli.
- Isidori, M. V., & Prosperi, M. (2019). Lo screening dei prerequisiti dell'apprendimento e il loro potenziamento. Un'indagine nella scuola dell'infanzia nell'ottica della didattica inclusive. *Italian Journal of Special Education for Inclusion*, 7(1), 172-188. <https://doi.org/10.7346/sipes-01-2019-14>.

- James, K. H., & Engelhardt, L. (2012). The effects of handwriting experience on functional brain development in pre-literate children. *Trends Neurosci Educ*, 1(1), 32-42. <https://doi.org/10.1016/j.tine.2012.08.001>.
- Jordan, N., & Montani, T. (1997). Cognitive arithmetic and problem-solving: A comparison of children with specific and general mathematics difficulties. *Journal of Learning Disabilities*, 30(6), 624-634.
- Kaldenberg, E. R., Watt, S. J., & Therrien, W. (2015). Reading Instruction in Science for Students with Learning Disabilities: A Meta-Analysis. *Learning Disability Quarterly*, 38(3), 160-173.
- Kavkler, M., Košak Babuder, M., & Magajna, L. (2015). Inclusive Education for Children with Specific Learning Difficulties: Analysis of Opportunities and Barriers in Inclusive Education in Slovenia. *Center for Educational Policy Studies Journal*, 5(1), 31-52. <https://doi.org/10.26529/cepsj.152>.
- Kunhoth, J., Al-Maadeed, S., Kunhoth, S., Akbari, Y., & Saleh, M. (2024). Automated systems for diagnosis of dysgraphia in children: a survey and novel framework. *International Journal on Document Analysis and Recognition*, 27, 707-735. <https://doi.org/10.1007/s10032-024-00464-z>.
- Lai, Y., Zhu, X., Chen, Y., & Li, Y. (2015). Effects of mathematics anxiety and mathematical metacognition on word problem solving in children with and without mathematical learning difficulties. *PloS one*, 10(6). <https://doi.org/10.1371/journal.pone.0130570>.
- Law No. 170 of 8 October 2010, New regulations on specific learning disorders in schools. <http://www.istruzione.it>.
- Legislative Decree No. 66 of 13 April 2017, Norms for the promotion of school inclusion of students with disabilities.
- Legislative Decree No. 96 of 7 August 2019, Standards for the promotion of school inclusion of students with disabilities, pursuant to Article 1, paragraphs 180 and 181(c) of Law No. 107 of 13 July 2015.
- Lousada, T. M., Santos, L. C. A., Lourencetti, D. M., Padula, N. A. M. R., & Capellini, S. A. (2009). Caracterização do desempenho motor de escolares com dyslexia. *Temas sobre Desenvolvimento*, 17(97), 11-4.
- Maloney, E. A., Ansari, D., & Fugelsang, J. A. (2011). The effect of mathematics anxiety on the processing of numerical magnitude. *Q J Exp Psychol (Hove)*, 64(1), 10-6. <https://doi.org/10.1080/17470218.2010.533278>.

- Manzano, J. L. G., Sanz, M. T., & Chocano, A. J. D. (2008). *Fundamentos para la intervención en el aprendizaje de la ortografía*. Madrid: Editorial CEPE.
- Ministerial Circular No. 8 of 6 March 2013, Intervention tools for pupils with special educational needs.
- Ministry of Education, University and Research. (2011). de Guidelines for the right to study of pupils and students with DSA, annexed to Ministerial Decree number 5669 of 12/07/2011.
- Ministry of Education, University and Research. (2012). Intervention tools for pupils with Special Educational Needs and territorial organisation for school inclusion, Ministerial Decree of 27/12/2012.
- Minolin, M., Meena, B., & Karthikeyan, U. (2020). A study to assess the knowledge, attitude and compliance regarding specific learning disabilities (SPLD) among school teachers. *International Journal of Academic Research and Development*, 5(2), 20-22.
- Morris, D., Tyner, B., & Perney, J. (2000). Early Steps: Replicating the Effects of a First-Grade Reading Intervention Program. *Journal of Educational Psychology*, 92(4), 681-693. <https://doi.org/10.1037/0022-0663.92.4.681>.
- Murdaca, A. M. (2022). Quali coordinate educativo-didattiche per l'insegnante di sostegno nell'ottica di una scuola innovativa? Nuove piste di ricerca educativa per potenziare e valorizzare le complessità esistenziali. *EDUCATION SCIENCES & SOCIETY*, (2), 186-197.
- Nepi, R. (2017). Le lingue al nido e alla scuola dell'infanzia. *Pedagogia Più Didattica*, 3(1), 15-21.
- Neria, A., & Pellegrini, M. (2017). Il ruolo della consapevolezza fonologica per l'apprendimento della lettura: una revisione descrittiva. The role of phonological awareness for learning how to read: an overview. *Form@re - Open Journal per la formazione in rete*, 17(2), 76-88.
- Okuda, P. M. M., Pinheiro, F. H., Germano, G. D., Padula, N. A. M. R., Lourencetti, M. D., Santos, L. C. A., & Capellini, S. A. (2011). Função motora fina, sensorial e perceptiva de escolares com transtorno do déficit de atenção com hiperatividade. Sociedade Brasileira de Fonoaudiologia. *Jornal*, 23, 351-357.
- Overvelde, A., & Hulstijn, W. (2011). Handwriting development in grade 2 and grade 3 primary school children with normal, at risk, or dysgraphic characteristics. *Research in Developmental Disabilities*, 32, 540-548.

- Passolunghi, M. C. (2011). Cognitive and emotional factors in children with mathematical learning disabilities. *International Journal of Disability, Development and Education*, 58(1), 61-73. <https://doi.org/10.1080/1034912X.2011.547351>.
- Penge, R. (2010). Screening, indicatori precoci e fattori di rischio per i DSA. In Simoneschi G. (Ed.), *Annali della pubblica istruzione. La dislessia e i disturbi specifici di apprendimento* (pp. 37-50).
- Pollock, N., Lockhart, J., Farhat, L., Jacobson, J., Bradley, J., & Brunetti, S. (2008). *Hand-writing Assessment Protocol, School of Rehabilitation Science*. Hamilton: McMaster University Press.
- Rosenblum, S., & Dror, G. (2016). Identifying developmental dysgraphia characteristics utilizing handwriting classification methods. *IEEE Transactions on Human-Machine Systems*, 47(2), 293-298.
- Shaywitz, S. (2006). *Entendendo a dislexia: um novo e complete programa para todos os níveis de problemas de leitura*. Porto Alegre: Artmed.
- Stella, G., & Gallo, D. (2005). *Dislessia, scelte scolastiche e formative*. Torino: Omega.
- Stella, G., & Savelli, E. (2011). *Dislessia oggi. Prospettive di diagnosi e intervento in Italia dopo la legge 170*. Trento: Erickson.
- Sternberg, R. (2003). *Stili di Pensiero*. Trento: Erickson.
- Temple, E., Poldrack, R. A., Protopapas, S., Nagarajan, S., Salz, T., Tallal, P. (2000). Disruption of neural response to rapid acoustic stimuli in dyslexia: evidence from functional MRI. *Proceedings of the National Academy of Sciences*, 97(25), 13907-13912.
- Toffalini, E., Giofrè, D., & Cornoldi, C. (2017). Strengths and weaknesses in the intellectual profile of different subtypes of specific learning disorder. *Clinical Psychological Science*, 5(2), 402-409. <https://doi.org/10.1177/2167702616672038>.
- Tretti, M. L., Terreni, A., & Corcella, P. R. (2002). *Materiali IPDA per la prevenzione delle difficoltà di apprendimento: Strategie e interventi*. Trento: Erickson.
- Wang, Z., Hart, S. A., Kovas, Y., Lukowski, S., Soden, B., Thompson, L. A., & Petrill, S. A. (2014). Who is afraid of math? Two sources of genetic variance formathematical anxiety. *Journal of Child Psychology and Psychiatry*, 55(9), 1056-1064.
- Woodcock, S., & Hitches, E. (2017). Potential or problem? An investigation of secondary school teachers' attributions of the



- educational outcomes of students with specific learning difficulties. *Bulletin of the Orton Society*, 67(3), 299–317. <https://doi.org/10.1007/s11881-017-0145-7>.
- Zappaterra, T. (2012). Disabilità e lavoro: costruzione identitaria ed esercizio di cittadinanza. In Falconi, S., Zappaterra, T., Boffo, V. (Eds.), *Per una formazione al lavoro: le sfide della disabilità adulta* (pp. 17-43). Firenze University Press.
- Zucoloto, K. A., & Sisto, F. F. (2002). Dificuldades de aprendizagemem escrita e compreensão em leitura. *Interação em Psicologia*, 6(2), 157-166. <https://doi.org/10.5380/psi.v6i2.3303>.