

THE EUROPEAN LICENSE OF COMPENSATORY TOOLS

Introduction

1.1 SPECIFIC LEARNING DISORDERS NO MORE!

1.2 DISCLAIMER

The partners of the project called *LEAD! - specific LEArning Disorders no more!* have prepared the document for the in-depth study of the subjects relating to the training path that involves students (9-14 years) with Specific Learning Disorders so that it is possible to certify the skills on the use of compensatory tools useful for school learning and in other contexts of life.

This is a basic knowledge based on the Community standards and references in force on the subject. Given the complexity and breadth of the topic, the LEAD! cannot be held responsible for any errors, omissions, damage or improper use of the tools by or incorrect instructions or advice contained in the publication and possibly used by third parties.

The partners of LEAD! they reserve the right to make any changes or corrections that they deem necessary at their discretion, at any time and without any notification.

The recipient user is required to acquire periodic information on this by visiting the areas of the myskillslead.eu online platform dedicated to the Program.

1.3 abstract of “LEAD! - specific LEArning Disorders no more!”

The LEAD! Project, specific LEArning Disorders no more! focuses on the learning difficulties of a small (but significant) group of students attending European schools of all levels.

With the acronym SLD (Specific Learning Disorders) we mean a diagnostic category, related to Specific Developmental Learning Disorders belonging to Neurodevelopment Disorders, which concerns the disorders of school skills: Dyslexia, Dystography, Dysgraphia and Dyscalculia .

Based on the functional deficit, the following clinical conditions are used:

- Dyslexia, is a disturbance in reading (intended as a text decoding ability);
- Dysorthography, is a disturbance in writing (understood as phonographic coding skills and spelling skills);
- Dysgraphia, it is a disturbance in handwriting (understood as a graphic-motor skill);
- Dyscalculia is a disturbance in number and calculation skills (understood as the ability to understand and work with numbers).

In the Italian Consensus Conference on SLD, the criteria useful for the definition of Specific Learning Disorders are cited. They Are: the "evolutionary" character of these disorders; the different expressiveness of the disorder in the different evolutionary phases of the competence in question; the almost constant association with other disorders (comorbidities); the neurobiological character of the procedural anomalies that characterize specific learning disorders.

Specific Learning Disorders have a biological origin which is the basis of cognitive anomalies that are associated with behavioral symptoms of the disorder and which includes an interaction of genetic, epigenetic and environmental factors that affect the brain's ability to perceive or process verbal or non-verbal information efficiently and accurately (DSM-5, 2013).

The Consensus Conference of the Istituto Superiore di Sanità defines Specific Learning Disorders "Disorders that involve a specific skill

domain, leaving the general intellectual functioning intact. In fact, they affect the instrumental skills of school learning. "

It is important to emphasize that children with specific learning disorders have intelligence within the norm and / or above the norm. They easily manage to have an overview, to perceive an image as a whole. They are able to grasp the fundamental elements of a discourse or a situation, reasoning dynamically and creating unusual connections that others are difficult to develop.

In addition, they easily learn from experience and remember facts more not in an abstract way but as life experiences, stories and examples. They think above all by images, displaying words and concepts in a three-dimensional way, for this reason they memorize much more easily by images. They are able to see things from different perspectives and process information globally rather than sequentially.

The main characteristics that distinguish Specific Learning Disorders concern:

- The unexpected and important difficulties in reading-writing and / or in numbers and in calculation
- Difficulties in phonological awareness (difficulty in recognizing how many, which and in what order are the sounds of a word)
- The slowness in automating different skills

Some children with Specific Learning Disorders may also have coordination difficulties, fine motor skills, organization and sequence skills and difficulties in acquiring timelines (hours, days, seasons, etc.). From the analysis of the literature, the disorders that are most frequently found in comorbidity with Specific Learning Disorders are: attention deficit hyperactivity disorder (ADHD) and Specific Language Disorders (DSL). The 2007 Consensus Conference highlighted that in clinical practice there is a high presence of comorbidity both between the Specific Learning Disorders themselves, and between Specific Learning Disorders and other disorders (dyspraxia, behavior and mood disorders, anxiety disorders, etc.). The high comorbidity determines the marked heterogeneity of the functional and expressive profiles with which the Specific Learning Disorders manifest themselves and entails significant effects on the side of the diagnostic investigation.

Although school learning difficulties concern 10-20% of the population in age school age, the prevalence of specific learning disorders

(dyslexia, dysgraphia and dysorthography, dyscalculia) is placed by the majority of authors between 2 and 5%.

In Europe there are about 35.67 million students with this type of condition, 13.88 million in primary school and 21.70 million in secondary school (EPALE 2017).

Rehabilitation best practices are not enough if these are not combined with socio-pedagogical solutions that make the child and adolescent (but also the adult) with SLD more autonomous in acquiring and using multidisciplinary knowledge, skills and basic notions.

In Italy Law no. 170/2010 concerning the "New rules on specific learning disorders in the school environment", as well as defining the recognition of SLDs, the diagnostic path and the importance of training for teachers:

1. RECOGNIZES THE IMPORTANCE OF DISPENSATIVE MEASURES (exemption of pupils with LSD from carrying out activities that are not essential for the quality of the concepts to be learned);
2. AND COMPENSATORY INSTRUMENTS (introduction of tools capable of enhancing performance for learning and performing tasks).

According to the World Health Organization, each individual must be able to take advantage of all types of facilitators in order to stem any form of limitation of activities and restriction of social participation . These facilitators are among the environmental factors which, through their absence or presence, IMPROVE OPERATION AND REDUCE DISABILITY. They include aspects such as an accessible physical environment, the availability of relevant assistive technology or assistive devices and people's positive attitudes towards disability, and also include services, systems and policies that are aimed at increasing the involvement of all people with disabilities. a health condition in all areas of life. Facilitators improve the performance of an action, despite the ability problem of the same person .

The European strategy, EUROPE2020, aims to reduce the number of students who drop out of school prematurely to less than 10% in EUROPE. According to EUROSTAT (Disability statistics - access to education and training), 1 out of 4 young people who have difficulty doing basic activities (BASIC ACTIVITY DIFFICULTIES) leaving school before their peers.

Having special educational needs and / or disabilities represents a very high risk factor for early school leaving (Early School Leaving and Learners with Disabilities and / or Special Educational Needs, European Agency for special needs and inclusive education, 2017). In Europe in particular, the probability of school abandonment is three times higher among people with disabilities than without (Limbach-Reich and Powel, 2016, p.8).

For these reasons, LEAD! specific LEARNING Disorders no more! is an innovative project that aims to increase the social inclusion of students with SLD by encouraging them to acquire new skills to improve their school performance.

LEAD! wants to support access, participation and improve the learning performance of students with SLD diagnosis in order to provide an INNOVATIVE APPROACH and SCHOOL SUCCESS, based on MIXED LEARNING, to decrease disparities and increase the involvement of SLD students through digital technologies in formal and non-formal learning contexts.

To achieve the goal, LEAD! wants to promote ADVANCED KNOWLEDGE with respect to compensatory tools (and their use) and create a path of certification of knowledge of the use of facilitators for students with SLD (aged between 9 and 14 years).

In fact, students with Special Educational Needs (SEN SPECIFIC EDUCATIONAL NEEDS), which includes students with SLD, have a higher probability of leaving school prematurely than students who do not have this disability (Early School Leaving and Learners with Disabilities and / or Special Educational Needs European Agency for special needs and inclusive education, 2017).

LEAD! supports inclusive education and wants to combat early school leaving through:

- 1) the development of training modules regarding compensatory tools and their use;
- 2) the creation of the MY SKILLS platform which houses the training modules, a HELP DESK and a COMMUNITY FOR families, schools and SLD pupils;
- 3) obtaining the EUROPEAN LICENCE OF COMPENSATORY TOOLS validated according to the European guidelines for formal and informal learning.

To achieve this LEAD! He would be able to promote a training course through mixed learning which will be adapted on the MY SKILLS

platform. At the end of the training course, students will have the opportunity to obtain THE EUROPEAN LICENSE OF COMPENSATORY INSTRUMENTS which will support them in acquiring the skills necessary to overcome the difficulties with respect to their DISABILITY, and on the other hand, IT WILL BE A QUALITY GUARANTEE FOR THE TEACHERS on students' ability to use compensatory tools.

1.4 Objectives of LEAD!

The innovative aspect of the project consists in developing a learning path completed by a platform (developed from scratch, during the project) able to offer both offline and online learning paths (mixed learning) on compensatory tools for children 9-14 years with a SLD (Specific Learning Disorders) diagnosis. The training course will be validated according to the European Guidelines of the Validation of non-formal and informal learning (CEDEFOP). At the end of the training course, the European license for compensatory instruments will be issued.

The platform is able to favor the passage of didactic material in digital format opened by the teachers to the students and to establish among them some electronic forms of communication and reception.

In fact, LEAD! supports inclusive education and wants to combat early school leaving through:

- 1) the development of training modules regarding compensatory tools and their use;
- 2) the creation of the platform hosting the training modules, a help desk and a community for families, schools and SLD pupils;
- 3) obtaining the European license of compensatory tools validated according to the European guidelines for formal and informal learning.

The processes put in place will be aimed at improving:

- learning and applying the knowledge acquired;
- problem solving and problem solving;
- communication through language, signs and symbols, including the reception and production of messages also with the specific use of communication tools and techniques;
- carrying out the tasks and actions necessary to engage in education, work and employment;
- knowledge to conduct simple and complex economic transactions.

Therefore giving a young pupil the opportunity to access a recognized training course on compensatory tools does not mean diminishing his skills, but rather giving him the opportunity to learn more easily and easily on how to use all those tools that support him in reading, writing, calculation and study without diminishing the cognitive level of the tasks it carries out. In fact, young SLDs have the competitive disadvantage of being generally slower to process verbal messages, do homework and solve problems. This slowdown is due to the time invested by young people with SLD in decoding messages without having specific intellectual deficiencies. This difficulty in developing these basic activities leads pupils with SLD to need more time than their classmates, generating a decrease in self-esteem and a greater probability of abandoning the educational path.

The basic idea does not concern health rehabilitation treatments (speech therapy, psychological) but a training aimed at acquiring and enriching the child's skills in the use of tools and methods that compensate for their deficits in reading, writing and calculation. In this way, the disabling factors are limited or even canceled by the identified facilitators.

The panel of experts (established at the beginning of the project) will identify the necessary innovative training contents which will then be adapted for "blended" learning on the platform in order to certify the skills acquired by the students and for the release of the European Licence for compensatory tools.

1.5 Project Activities

The project is divided into four macro-actions:

- Transnational Projects Meetings (TM)
- Intellectual Outputs
- Multiplier Events
- Learning, Teaching, Training Activities.

TMs are necessary to conduct, manage, evaluate and monitor project activities. Each of the meetings will be held in each partner's home country.

Intellectual Outputs consist of the activities characterizing the project which in fact entail obtaining the expected results. In the case of LEAD! Intellectual Outputs are:

1) **MY SKILLS PLATFORM** that will offer both online and offline learning paths (mixed learning) with the aim of promoting the passage of

didactic material in digital format opened by teachers to students and establishing electronic communication and reception forms among them . On the lead! Platform A help desk will also be available to support students, parents and teachers and to facilitate learning on the platform. The help desk will be managed by PO-ENFOR.

The MY SKILLS platform will therefore host:

- a) The training material scheduled for students, with a part dedicated to how teachers can use the platform and promote blended learning. In fact, for the training to be effective, it is essential that teachers and family members also know how to adopt such solutions. Therefore, the experimental project includes: a training course for pupils, a training course for trainers / teachers and teachers (SHORT JOIN STAFF TRAINING EVENT) which in turn will train the other students and information material to inform and sensitize parents and other extra educators -schools about LEAD !;
- b) Community, therefore a sharing space where young people and their families with SLD (Specific Learning Disorders) can exchange information, discuss and create a community around what will be the MY SKILLS platform;
- c) Help Desk, to facilitate and offer a service to schools, students, families and all the actors involved in learning, the MY SKILLS platform provides for the creation of a HELP DESK that provides the actors involved with all the information necessary for the use of the platform , for the development of training modules and for the issue of the European Licence. The HELP DESK service will be available in the languages of the countries participating in the project (Italian, Romanian, Spanish and French). After the end of the project, the service will be available in English and Italian.

2) The TRAINING COURSE will involve the issue of the **EUROPEAN Licence OF COMPENSATORY TOOLS**. This will be the fundamental tool to guarantee quality that will allow students with SLD to have a deguated and CERTIFIED training regarding the literacy process on compensatory tools. On the other hand, it will help teachers gain confidence in these tools and introduce them into classes with the guarantee that both the teaching staff and the student can use a single set of reference tools to overcome the learning barriers caused by SLDs - Specific Learning Disorders.

EXPECTED RESULTS on the target group, during and at the project:

- Acquisition of ICT skills thanks to the use of the MY SKYLLS platform and the use of cersionline and the platform itself;
- Support to children (9-14 years) with a complete and certified training path with respect to what are the specific compensatory tools for students with DYSGRAPHY / DYSORTHOGRAPHY; for students with DYSLEXIA; for students with DYSCALCULIA;
- greater involvement in school activities through the promotion of INCLUSIVE training courses that take into consideration those who are pupils with SPECIAL EDUCATIONAL NEEDS;
- Enriching European schools with cutting-edge courses to attract new students, especially all those students who are diagnosed with a SPECIFIC LEARNING DISORDER;
- decrease early school leaving through the provision of extra-curricular training courses that can facilitate learning and use of innovative technologies in order to create INTEGRATION AND INCLUSION starting from schools.

In the long term and after the end of the project, the partners compromise to make a SCALING UP to the training path of LEAD !. In fact, the training course will be validated following the GUIDELINES FOR THE VALIDATION of NON-FORMAL and INFORMAL learning developed by the European Union, in collaboration with CEDEFOP (2012). Then, the partners will adapt the training path according to the national formal recognition schemes of the skills acquired through the course. So in the long run the expected results are:

- inclusive education system;
- decrease in early school leaving;
- greater endurance and ease of school placement for all those children with SLD in schools;
- greater respect for diversity and diversity in the classrooms and therefore also in tomorrow's society, where students will be protagonists and citizens in the front line.

Multiplier events will serve to disseminate what has been produced and to deal with the stakeholders of the countries involved.

Learning, Teaching, Training Activities are the activities that characterize the project since professional training, training and

awareness of the use of specific tools are the hard core of the entire project system.

1.6 Target

The DIRECT TARGET GROUP of the project is represented by students aged 9-14 who have a SLD diagnosis (Dyslexia and specific learning disorders).

Taking into consideration the different European structure of primary and secondary compulsory education, in general we can refer to this particular group of students belonging to primary and / or lower secondary school (what we commonly call Lower Middle School in Italy).

Taking into account the young age of the direct interest group, even if the training path of the project is addressed to young students, teachers and parents will be involved to support students in the learning phase.

The INDIRECT TARGET is composed of: primary and lower secondary school teachers, support teachers, principals and associations of professors and principals active in the local and European territory. Teachers and tutors who accompany students in extra-curricular and recovery activities and related associations. In particular, we refer to all those actors involved in the learning process both who work directly with pupils / students with SLD and who may have to deal with SLD cases in the future. In fact, giving the possibility to professors and their associations to have access to the materials developed by the project facilitate the PREVENTION of the phenomenon.

First, the group of experts and the project partners have, through the development of the project itself, the desire to support and involve not only SLD students with these characteristics but also schools and families to deal with a single European response the SLD disorder.

How to support them? Thanks to the initial phase of the project, and in particular of the IO2.A1 creation of a universal language (managed by P4-UVA), a language common to all the ailments (layout, fonts etc.) of the MY SKILLS platform will be created. In addition, the teachers of the schools involved in the project and the researchers from the university (P4) and P0 will support these young people from a psychological point of view and make living the SLD diagnosis as a surmountable obstacle and not an insurmountable obstacle. The

group of experts and the project partners have, through the development of the project itself, the desire to support and involve not only SLD students with these characteristics but also schools and families to deal with a single European response the SLD disorder. The project involves SLD students in PILOTING WITH SCHOOL activities through the CHALLENGE JAM which involves the involvement of min. 5 classes / partners, organized by P1. And also in the MULTIPLIER EVENTS organized at the end of the project itself. Given the tender age of the participants, the presence of parents / teachers / tutors will be required during the phases of the project which involve their involvement.

1.7 Consortium

The partnership is composed by:

- ENFOR - Ente di Formazione e Ricerca, Policoro (Matera), Italy
P0
- Istituto Comprensivo n.2 Giovanni Paolo II, Policoro (Matera), Italy
P1
- Inspectoratul scolar judetean Iasi, Romania
P2
- LifeLong Learning Platform, Bruxelles, Belgium
P3
- Universidad de Valladolid, Spain.
P4

1.8 Specific Learning Disorder: definitions, characteristics, epidemiology and social roles.

1.9 Definition and Characteristics According to WHO ICD-11

Specific Learning Disorder (often referred to as Learning Disorder or Learning Disability, see note on terminology) is a neurodevelopmental disorder that begins during school age and continues throughout the person's life. Learning difficulties refer to ongoing problems in at least one of three areas: reading, writing and math.

Other specific skills that can be affected include the ability to put thoughts into written words, spelling, reading comprehension, math and solving math problems. Such difficulties can cause problems in learning and can have an impact on daily activities.

Learning disabilities, if not recognized and managed (early), can affect the very existence of the person, causing problems throughout life and not only in the school context. The main risks to which one is exposed are: psychological distress; worsening mental well-being; difficulty in looking for and keeping a job; drop out of school due to school failures. From a terminological point of view: the specific learning disorder is a nosographic term used for the preparation of the diagnosis.

From the most common classifications (ICD-11 and DSM-5) it is defined as "Specific learning disorder"; while the term "learning disability" is a term used by both the educational and legal systems. Although learning disability is not exactly synonymous with specific learning disability, someone with a diagnosis of specific learning disability can expect to meet the criteria for a learning disability and have legal status to qualify for housing and services school / academic / university. The term "learning difference" is a term that has gained popularity, especially when talking to children about their difficulties, as it does not label them as "messy". (<https://www.psychiatry.org/>)

To carry out a correct **DIAGNOSIS**, the following criteria must be met: have difficulty in at least one of the following areas for at least six months despite targeted help:

1. Difficulty reading (e.g. inaccurate, slow and only with a lot of effort)
2. Difficulty understanding the meaning of what is being read

3. Difficulty with spelling
4. Difficulty with written expression (for example, problems with grammar, punctuation, or organization)
5. Difficulty understanding numerical concepts, numerical facts or calculations
6. Difficulty with mathematical reasoning (for example, applying math concepts or solving math problems)

Having academic skills substantially lower than those expected for the child's age and causing problems at school, at work or in daily activities.

Difficulties begin in school age even though some people do not experience significant problems until adulthood (when academic, work and daily demands are greater).

Learning difficulties are not due to other conditions, such as intellectual disability, impaired vision or hearing, a neurological condition (eg, pediatric stroke), adverse conditions such as economic or environmental disadvantage, lack of education, or difficulty in speak / understand language.

A diagnosis is drawn up after a path made up of observations, interviews, anamnesis and evaluation of academic performance.

Neuropsychological tests can be used to help find the best way to help the individual with a specific learning disorder.

The International Classification of Diseases (ICD), now in its eleventh edition, has set the following definitions regarding SLD.

In this classification, WHO has specify as:

- Developmental learning disorder (6A03):
- Developmental learning disorder with impairment in reading (6A03.0)
- Developmental learning disorder with impairment in written expression (6A03.1)
- Developmental learning disorder with impairment in mathematics (6A03.2)
- Developmental learning disorder with other specified impairment of learning (6A03.3)
- Developmental learning disorder, unspecified (6A03. Z)

ICD-10	ICD-11	DSM-IV-TR	DSM-5
<p>Specific developmental disorders of speech and language (F80): Specific speech articulation disorder (F80.0) Expressive language disorder (F80.1) Receptive language disorder (F80.2) Acquired aphasia with epilepsy <i>Landau-Kleffner syndrome</i> (F80.3) Other developmental disorders of speech and language (F80.8) Developmental disorder of speech and language, unspecified (F80.9)</p>	<p>Developmental Speech & Language Disorders (6A01): Developmental speech sound disorder (6A01.0) Developmental speech fluency disorder (6A01.1) Developmental language disorder (6A01.2) Developmental language disorder with impairment of receptive and expressive language (6A01.20) Developmental language disorder with impairment of mainly expressive language (6A01.21) Developmental language disorder with impairment of mainly pragmatic language (6A01.22) Developmental language disorder, with other specified language impairment (6A01.23) Other specified developmental speech or language disorders (6A01.Y) Developmental speech or language disorders, unspecified (6A01.Z)</p>	<p>Communication disorders: Expressive Language Disorder (315.31) Mixed Receptive-Expressive Language Disorder (315.32) Phonological Disorder (315.39) Stuttering (307.0) Communication Disorder Not Otherwise Specified (307.9)</p>	<p>In the DSM-V, reading and writing disorders are found in the category of SLD. They are distinguished as “SLD with impairment in reading” [315.00 (F81.0)], “SLD with impairment in written expression” [315.2 (F81.81)], as well as “SLD with impairment in mathematics.” The first two subgroups are categorized further as:</p> <ul style="list-style-type: none"> • Specific learning disorder with impairment in reading can vary between problems in word reading accuracy, reading rate, or fluency and reading comprehension. • Specific learning disorder with impairment in written expression is divided into problems with either spelling accuracy, grammar and punctuation accuracy and clarity or organization of written expression. <p>The subgroup “SLD with impairment in mathematics (dyscalculia)”¹, is beyond the scope of this paper and, thus, is not discussed in detail here.</p> <p>The ICD-10 also indicates the category of “developmental disorders of academic skills.” In contrast to the DSM-V, it only differentiates between impairment in reading and writing (F81.0) and isolated impairment in writing (F81.1). A single impairment in reading is not categorized. Furthermore, the ICD-10 names a “disorder in mathematics” (F81.2) and a combined disorder of academic skills that includes a “disorder in mathematic skills, reading and writing.” (F81.3). Finally, F81.3 as “other developmental disorder of academic skills including developmental expressive writing disorder” is classified. Unlike the ICD-10, the DSM-V specifies reading and writing disorders by current severity (mild-moderate-severe).</p>
<p>Specific developmental disorders of scholastic skills (F81):</p>	<p>Developmental learning disorder (6A03): Developmental learning disorder with impairment in reading (6A03.0)</p>	<p>Learning disorders: Reading Disorder (315.0) Mathematics Disorder (315.1)</p>	

Specific disorder (F81.0)	reading	Developmental learning disorder with impairment in written expression (6A03.1)	Disorder of Written Expression (315.2)	
Specific disorder (F81.1)	spelling	Developmental learning disorder with impairment in mathematics (6A03.2)	Learning Disorder Not Otherwise Specified (315.9)	
Specific disorder of arithmetical skills (F81.2)		Developmental learning disorder with other specified impairment of learning (6A03.3)		
Mixed disorder of scholastic skills (F81.3)		Developmental learning disorder, unspecified (6A03.Z)		
Other disorders of scholastic skills (F81.8)				
Developmental disorder of scholastic skills, unspecified (F81.9)				
Specific developmental disorder of motor function (F82)		Developmental motor coordination disorder (6A04)	Motor skills disorders: Developmental coordination disorder (315.4)	
Mixed specific developmental disorder (F83)				

Table 1 Comparison of SLD conditions

1.10 Developmental learning disorder with impairment in reading (6A03.0)

Developmental learning disorder with impairment in reading is characterised by significant and persistent difficulties in learning academic skills related to reading, such as word reading accuracy, reading fluency, and reading comprehension. The individual's performance in reading is markedly below what would be expected for chronological age and level of intellectual functioning and results in significant impairment in the individual's academic or occupational functioning. Developmental learning disorder with impairment in reading is not due to a disorder of intellectual development, sensory impairment (vision or hearing), neurological disorder, lack of availability of education, lack of proficiency in the language of academic instruction, or psychosocial adversity.

1.11 Developmental learning disorder with impairment in written expression (6A03.1)

Developmental learning disorder with impairment in written expression is characterised by significant and persistent difficulties in learning academic skills related to writing, such as spelling accuracy, grammar and punctuation accuracy, and organisation and coherence of ideas in writing. The individual's performance in written expression is markedly below what would be expected for chronological age and level of intellectual functioning and results in significant impairment in the individual's academic or occupational functioning. Developmental learning disorder with impairment in written expression is not due to a disorder of intellectual development, sensory impairment (vision or hearing), a neurological or motor disorder, lack of availability of education, lack of proficiency in the language of academic instruction, or psychosocial adversity.

1.12 Developmental learning disorder with impairment in mathematics (6A03.2)

Developmental learning disorder with impairment in mathematics is characterised by significant and persistent difficulties in learning academic skills related to mathematics or arithmetic, such as number sense, memorization of number facts, accurate calculation, fluent calculation, and accurate mathematic reasoning. The individual's performance in mathematics or arithmetic is markedly below what would be expected for chronological or developmental age and level of intellectual functioning and results in significant impairment in the individual's academic or occupational functioning. Developmental learning disorder with impairment in mathematics is not due to a disorder of intellectual development, sensory impairment (vision or hearing), a neurological disorder, lack of availability of education, lack of proficiency in the language of academic instruction, or psychosocial adversity.

1.13 SLD in DSM5

Another classification tool used in the clinical setting is the Diagnostic and Statistical Manual of Mental Disorders of American Psychiatric Association, now in its fifth edition.

In the DSM5 we find the following wording.

A. Difficulties in learning and in the use of school skills, as indicated by the presence of at least one of the following symptoms that have persisted for at least 6 months, despite the provision of targeted interventions on these difficulties:

1. Inaccurate or slow and tiring word reading (for example, reading single words out loud incorrectly or slowly and hesitantly, often guessing words, pronouncing words with difficulty).
2. Difficulty understanding the meaning of what is being read (for example, may read the texts adequately but does not understand the sequences, relationships, inferences or deeper meanings of what is being read).
3. Difficulty in spelling (for example, can add, omit or replace vowels or consonants).
4. Difficulty with written expression (for example, makes multiple grammatical or punctuation errors within sentences; uses poor paragraph organization; written expression of ideas lacks clarity).

5. Difficulty in mastering the concept of number, numerical data, or calculation (for example, has a poor understanding of numbers, their size and relationships; relies on fingers to add single-digit numbers, rather than remembering the facts mathematicians like his peers do; he gets lost in arithmetic calculations and can change procedures).

6. Difficulty in mathematical reasoning (for example, has severe difficulties in applying mathematical concepts, data or procedures to solve quantitative problems).

B. The school skills affected are significantly and quantifiably below those expected for the chronological age of the individual, and cause significant interference with school or work performance, and with activities of daily living. As confirmed by individually administered standardized measurements of the results achieved and by comprehensive clinical evaluations. For individuals 17 years of age and older, a documented history of disabling learning difficulties can replace the standardized clinical setting.

C. Learning difficulties begin during the school years but may not fully manifest until the demand for these affected academic skills exceeds the individual's limited abilities (for example, as in time trials, reading and writing documents complex and long in a short time, with excessively heavy school loads).

D. Learning difficulties are not better justified by intellectual disabilities, impaired visual and hearing acuity, other mental and neurological disorders, psychosocial adversities, lack of knowledge of the language of schooling or inadequate schooling.

Note: The four diagnostic criteria must be met based on a clinical summary of the individual's history (developmental, medical, family, and educational history), school reports, and psychoeducational assessment.

Coding Note: Specify all educational backgrounds and skills that are compromised. When more than one scope is compromised, each must be individually coded according to the following specifiers.

Specify if:

315.00 (F81.0) With reading impairment:

Accuracy in reading words

Speed or fluency of reading

Text comprehension

Note: Dyslexia is an alternate term used to refer to a pattern of learning difficulties characterized by problems with accurate or fluent recognition of words, with poor decoding and spelling skills. If dyslexia is used to specify this particular pattern of difficulty, it is important to also specify the presence of any additional difficulties, such as difficulties in reading comprehension or mathematical reasoning.

315.2 (F81.81) With impaired written expression:

Accuracy in spelling

Accuracy in grammar and punctuation

Clarity / organization of written expression

315.1 (F81.2) With calculation impairment:

Number concept

Memorization of arithmetic facts

Accurate or fluent calculation

Correct mathematical reasoning

Note: Dyscalculia is an alternative term used to refer to a pattern of difficulty characterized by problems in processing numerical information, learning arithmetic formulas and performing calculations accurately or fluently. If dyscalculia is used to specify this particular pattern of mathematical difficulty, it is important to also specify the presence of any additional difficulties, such as difficulties in mathematical reasoning or in the accuracy of word reasoning.

Specify the current severity:

Mild: some difficulties in learning skills in one or two school settings, but of a sufficiently mild severity to make the individual able to compensate or to function well if provided with appropriate facilities and support services, especially during the school years.

Moderate: marked difficulties in learning skills in one or two school areas, such that the individual can hardly develop skills without intensive and specialized teaching during the school years. Facilitations and support services may be required for at least part of the day at school, in the workplace or at home to complete tasks accurately and efficiently.

Severe: Severe difficulties in learning skills, involving different school settings, such that the individual hardly learns such skills without continuous, intensive, personalized and specialized teaching for most of the school years. Even with a range of facilitation and appropriate services at home, in school and in the workplace, the Individual may not be able to complete all tasks efficiently.

315.00 (F81.0) With reading impairment:

Accuracy in reading words

Speed or fluency of reading

Text comprehension

Note: Dyslexia is an alternate term used to refer to a pattern of learning difficulties characterized by problems with accurate or fluent recognition of words, with poor decoding and spelling skills. If dyslexia is used to specify this particular pattern of difficulty, it is important to also specify the presence of any additional difficulties, such as difficulties in reading comprehension or mathematical reasoning.

315.2 (F81.81) With impaired written expression:

Accuracy in spelling

Accuracy in grammar and punctuation

Clarity / organization of written expression

315.1 (F81.2) With calculation impairment:

Number concept

Memorization of arithmetic facts

Accurate or fluent calculation

Correct mathematical reasoning

Note: Dyscalculia is an alternative term used to refer to a pattern of difficulty characterized by problems in processing numerical information, learning arithmetic formulas and performing calculations accurately or fluently. If dyscalculia is used to specify this particular pattern of mathematical difficulty, it is important to also specify the presence of any additional difficulties, such as difficulties in mathematical reasoning or in the accuracy of word reasoning.

Specify the current severity:

Mild: some difficulties in learning skills in one or two school settings, but of a sufficiently mild severity to make the individual able to compensate or to function well if provided with appropriate facilities and support services, especially during the school years.

Moderate: marked difficulties in learning skills in one or two school areas, such that the individual can hardly develop skills without intensive and specialized teaching during the school years. Facilitations and support services may be required for at least part of the day at school, in the workplace or at home to complete tasks accurately and efficiently.

Severe: Severe difficulties in learning skills, involving different school settings, such that the individual hardly learns such skills without continuous, intensive, personalized and specialized teaching for most of the school years. Even with a range of facilitation and appropriate services at home, in school and in the workplace, the Individual may not be able to complete all tasks efficiently.

Specify if:

315.00 (F81.0) With reading impairment:

Accuracy in reading words

Speed or fluency of reading

Text comprehension

Note: Dyslexia is an alternate term used to refer to a pattern of learning difficulties characterized by problems with accurate or fluent recognition of words, with poor decoding and spelling skills. If dyslexia is used to specify this particular pattern of difficulty, it is important to also specify the presence of any additional difficulties, such as difficulties in reading comprehension or mathematical reasoning.

315.2 (F81.81) With impaired written expression:

Accuracy in spelling

Accuracy in grammar and punctuation

Clarity / organization of written expression

315.1 (F81.2) With calculation impairment:

Number concept

Memorization of arithmetic facts

Accurate or fluent calculation

Correct mathematical reasoning

Note: Dyscalculia is an alternative term used to refer to a pattern of difficulty characterized by problems in processing numerical information, learning arithmetic formulas and performing calculations accurately or fluently. If dyscalculia is used to specify this particular pattern of mathematical difficulty, it is important to also specify the presence of any additional difficulties, such as difficulties in mathematical reasoning or in the accuracy of word reasoning.

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Comorbidities and Predictors of Developmental Dyslexia and Dysgraphia

Assuming that the cognitive and motor requirements for writing differ in some important aspects from those for reading, we will now focus on the existing information about comorbidities and predictors of developmental dyslexia. Moreover, we will discuss the transferability of this knowledge to developmental dysgraphia.

Many studies have highlighted the connection between phonological processing difficulties and reading and writing disabilities. Phonological processing consists of three functions: PA, phonological working memory, and phonological recoding in lexical access (Ramus and Szenkovits, 2008). These three functions work separately but are correlated.

1.14 Comorbidity

1.14.1 Phonological Processing

1.14.1.1 *Phonological Awareness*

It is the ability to work with phonological structure of words like recognizing, segmenting, synthesizing, and manipulating phonemes, syllables and onsets and rhymes. The ability of grapheme-to-phoneme conversion, which is necessary for reading, and the ability of phoneme-to-grapheme conversion, necessary for writing, is part of the PA. Pennington et al. (2012) states that PA is the best single predictor for dyslexia. Written expressions represent the phonological structure of spoken language. As explained above, PGC is much more complex than GPC. To write orthographically correct, i.e., identifying phonemes is indispensable; many orthographic rules can be derived by segmenting words into syllables, for instance. Thus, PA is an important ability not only for reading but also for writing (Moll et al., 2009, 2012).

1.14.1.2 *Phonological Working Memory*

It consists of a passive phonological buffer and an active process of phonological rehearsal which are both combined in the phonological loop (Baddeley, 2003). Based on these two modules, information can be kept in the buffer for a short time. Using the phonological loop and active rehearsal processes, the individual can retain information longer. Consequently, this system keeps phonological representation during the working process complete and in the correct order (Glück, 2000). Repeating an increasing amount of syllables or words in the same order can test working memory (Menghini et al., 2011). To demonstrate the link between reading and working memory, Menghini et al. (2011) compared a group of dyslexics with normal readers. They found out that dyslexic children not only scored worse in phonological components but also in visual-object and visual-spatial working memory than the group of age-matched normal readers.

Even for reading comprehension in early and later elementary school children, phonological working memory plays an important role, because it keeps information active while the persons read phrases or sentences (Seigneuric and Ehrlich, 2005).

These results from the reading domain are at least partly transferable to writing. During writing, working memory has to keep information upon building phoneme-to-grapheme conversion, synthesizing and segmenting phonemes to words. Furthermore working memory is important for building up orthographical representation and for linking these representations with phonological and semantic information (Winkes, 2014).

1.14.1.3 Phonological Recoding in Lexical Access

It means the activation of the correct phonological code and meaning in the mental lexicon to a visual stimulus. To test the speed of access from long-term memory to phonological code, rapid automatized naming (RAN) tasks are used (Norton and Wolf, 2012). These tasks consist of naming letters, numbers, colors, and objects as quickly as possible. The connection between deficits in phonological recoding in lexical access was shown in different studies (Mayer, 2008; Pennington and Bishop, 2009; Pennington et al., 2012). Diverse authors describe poor results in RAN and PA as early predictors of reading ability (Norton and Wolf, 2012; van Ermingen-Marbach et al., 2013, 2014; Pape-Neumann et al., 2015). Wolf and Bowers (1999) and Wolf et al. (2000, 2002) describe an effect which combines deficits in PA and NS. In their study, they emphasize four subtypes of readers: (1) children with average skills in PA and NS, (2) children who show poor results in PA but average skills in NS, and (3) children who show poor results in NS but average skills in PA, and (4) children who exhibit deficits in PA as well as in NS. The outcome of the fourth group is called the double-deficit-hypothesis.

Yet do low scores in RAN tasks predict a deficit in writing skills as well? Winkes (2014) compared German speaking six-graders with isolated writing deficits to those with isolated reading deficits. Children who are below average only in writing showed good results in RAN tasks but significant worse results in PA. It seems that results in RAN tasks show different results for German readers and writers.

In recent years, however, the focus on phonological abilities as relevant for reading and writing disorders has somewhat expanded to now include also visual and auditory processing abilities, visual and auditory attention, or automatization (Nicolson et al., 2001; Valdois et al., 2003; Bosse et al., 2007; Nicolson and Fawcett, 2007, 2011; Reid et al., 2007; Pennington and Bishop, 2009).

1.14.2 Auditory Processing

Ramus (2003) summarizes that many studies have already confirmed the link between auditory processing and dyslexia. In his review, he discusses the connection between auditory processing and phonological deficit. He concluded that both a phonological deficit and a deficit in auditory processing can appear independently in dyslexic children. It needs to be kept in mind that a severe auditory impairment nonetheless can have a negative influence on phonological skills and therefore affect reading and writing (Ramus, 2003; Ramus et al., 2003). Steinbrink et al. (2014) tested German dyslexic children with respect to phonological and auditory processing skills (temporal and spectral). Their study also demonstrated that substandard skills in auditory processing may explain deficits in phonological processing and might therefore, in some cases, be regarded as causal for phonological deficits. Importantly, Steinbrink et al. (2014) reported differential deficit profiles in the dyslexic children: some with only temporal processing difficulties, some with only spectral deficits, and one with an isolated phonological deficit. In most cases, however, if one of those three dimensions was affected, the deficit co-occurred with at least one other, or even all deficits. Christmann et al. (2015) found similar results for adult dyslexics with respect to temporal, spectral, or spectrotemporal deficits.

1.14.3 Visual-Phonological Deficits

Mirror writing and kinetic reversals (e.g., /was/ and /saw/, /b/ instead of /d/) were long considered as a main symptom of dyslexia with repetitions in reading and writing as well as the omission of sounds and misspelled letters being handled as secondary symptoms (Orton, 1925). Orton (1937) established the theory that the two sides of the brain code spatial information oppositely. Some mistakes, such as confused consonants, e.g., f/v or g/c could not longer only be regarded as a visual deficit but rather seen as a phonological problem. This phonological aspect in connection with dyslexia led to discussions about multi- and unicausal models (for a comprehensive summary see Corballis and Beale, 1993; Lachmann, 2002) still being discussed today (see the following sections).

1.14.4 Visual-Magnocellular Processing

Until now, many studies have confirmed the further hypothesis in connection with the visual aspect that dyslexia can be based on a deficit in the magnocellular system (cf. Tholen et al., 2011). This theory is based on an impairment of the brain's magnocellular system which supports processing of rapidly moving visual stimuli and, thus, is responsible for saccadic eye movements. An impaired magnocellular system causes blurred visual representation of letters, for example. As a result, letters are more difficult to distinguish. Dyslexics therefore have difficulties with detecting fast movements and misperceive seemingly moving letters (Stein, 2001).

The connection between dysgraphia and an impaired magnocellular system has not been proven until now. But the problem of not clearly seeing letters in their correct orders, as a consequence of a magnocellular deficit (Stein, 2014), can cause individuals to write letters in a wrong order. This error can be transferred to dysgraphic children.

1.14.5 Attention and Attention Deficits

Facoetti et al. (2003) describe the relation between reading disorders and auditory and visual deficits in the orienting spatial attention. Based on this fact, Facoetti suggests a distortion of development of phonological and orthographic representation as an indirect consequence of the deficit in spatial attention that, in turn, impairs a child's learning to read. Since phonological and orthographic representations are also accessed during writing, this implies that attention has an impact on the acquisition of writing skills as well. Indirect evidence for this notion comes from the study by Rosenblum et al. (2004). These authors assessed handwriting of dysgraphic children. They summarize research and describe the problem of dysgraphics having not fully automatized letter production. Therefore, dysgraphics have an increased demand on their memory and attention while writing. Consequently, higher-level cognitive processes are constrained. As a further limitation, these authors describe the fact that children may forget plans held in memory before they are able to write them down on paper because of slow handwriting. This deficit may lead to serious consequences for students' academic process, their emotional well-being and their social function. Rosenblum et al. (2004) confirm the characteristics of dysgraphic writing such as consistently lower quality of individual spatial writing features. This includes inconsistent letter size, acute turns in letters, uneven and unsteady writing as well as sudden changes in size and direction of letter writing.

Finally, Adi-Japha et al. (2007) investigated the connection between clinically relevant attention deficits in patients with ADHD and reading and writing skills. In summary, they determined that clinically relevant attention problems cause problems in writing. They suggested that the deficits in writing do not necessarily have underlying linguistic problems but an impaired graphemic buffer and impairments in kinematic motor production. Compared to children without ADHD, their test subjects with ADHD made a higher amount of spelling errors in the morphological categories (function words, free morphemes, and derivational words). Yet the reading abilities of the ADHD-test subjects were similar to those of the comparison group. Children with ADHD scored worse in letter insertion, substitutions, omissions, and transpositions (graphemic buffer tasks). They changed similarly shaped letters. However, the results in fluency were similar for both groups.

Furthermore, tests on motor kinematic production showed poor time utilization which means that children with ADHD take longer for writing. The test subjects displayed inconsistent and disproportionate handwriting so that their handwriting was difficult to read. A high amount of corrections and writing with high levels of pressure on the pen for subjects with ADHD was pointed out as well (Adi-Japha et al., 2007). These findings refer back again to the Rosenblum et al. (2004) data discussed above.

1.14.6 Automatization Deficit

Proficient readers master GPC without problems because of their normally developed basic articulatory and auditory skills. It is assumed that the cerebellum supports the automatization of these basic abilities. Consequently, learning and automatization of, e.g., grapheme-to-phoneme correspondence as well as other PA tasks is complicated with a dysfunctional cerebellum. The cerebellum processes motor skills and coordination as well as linguistic and cognitive skills (Ito, 2008). Nicolson et al. (2001) state that an impairment of motor skills resulting from an impaired cerebellum adversely affects writing skills. That means that a dysfunctional cerebellum can lead to reading as well as writing disorders (Nicolson et al., 2001). Nicolson and Fawcett (2011) developed a possible causal chain of the influence of cerebellar impairment on reading and writing skills. Writing problems, thus, ought to be caused by motor skill difficulties. Reading problems arise from problems in phonology, based on deficient articulatory skills that stem from cerebellar impairment. In addition, spelling problems result from a deficit in skill automatization. The authors point out that the activated regions of the cerebellum differ for each of the three routes. Hence, a dyslexic person may be impaired in writing (motor skill) and/or reading and/or spelling.¹

1.15 Epidemiological Data

Learning problems occur in about 5% of school-aged children. Learning disabilities are specific and life-long but present with different school problems at different ages, depending on such factors as age, medical history, family history, and intelligence quotient. Proper individualized diagnosis and treatment plans are necessary to remediate these problems and to offer adequate coping strategies. Many children who have learning problems can be classified into one of two major categories: the dyslexia group or the nonverbal learning disability group. The role of the medical professional is important to guide parents in the diagnostic and therapeutic process.

¹ Diana Döhla and Stefan Heim (2015) "Developmental Dyslexia and Dysgraphia: What can We Learn from the One About the Other?" *Front Psychol.* 2015; 6: 2045. Published online 2016 Jan 26. doi: 10.3389/fpsyg.2015.02045

The epidemiological data vary for each country according to the complexity of the language, the evaluation tools by the services, the precocity in identifying difficulties.

1.16 Treatment

Although there is no "cure", a specific learning disorder can be successfully managed for life. In fact, having a learning disability does not inevitably mean dropping out of school, limitation in laboratory careers or opportunities for success.

Early intervention remains a key factor. If the difficulties are identified early, the intervention can be more effective and therefore it is possible to avoid psychological stress of all kinds.

The school can meet the needs of the pupil through personalized educational programs following a specific evaluation.

Special educational services may offer services to improve math reading, writing, and learning. These journeys are effective because they involve systematic, intensive and personalized education that can improve learning difficulties and / or help the individual use strategies to compensate for their disorder. Among the most effective pedagogical solutions is multimodal teaching, which involves multiple senses.

Research has shown that the most effective treatments for reading disorder are structured and targeted strategies that address phonological awareness, decoding skills, comprehension and fluency. Treatments for writing problems cover two general areas: the writing process and the process of composing the written expression.

The use of specific tools, defined compensatory, are useful to facilitate the learning processes as they allow to solve writing (for example with the use of the keyboard), reading (with speech synthesizers) or writing (with specific software) .

In addition to compensatory tools, it is important for pupils with SLD that dispensatory measures are provided: additional time for tests and written assignments; exemption from written foreign language tests; etc.

1.17 Role of family and peer group

There are now many studies that explore the genetic causes of dyslexia. The main studies are aimed at demonstrating the genes that lead to dyslexia. (Shulte-Korne et al; 2006). Researchers from the Yale University School of Medicine have identified a gene on human chromosome 6, called DCDC2, which is said to be associated with dyslexia.

The data in the bibliography also agree on the increase in the probability of having problems learning reading for a child who has a parent affected by this disorder: the presence of specific learning disorders in the parents of children with developmental dyslexia reaches about 710 % of cases. Still other studies attest that 45% of first degree relatives of dyslexic subjects, such as grandparents and uncles, are affected by this disorder (Vellar and Tombolato, 2010).

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But the role of the family is indispensable in the following conditions:

- recognize and accept the condition of their child, preferably at an early age;
- use compensatory tools to promote learning even in the home, as well as at school;
- obtain satisfactory compliance with the school;
- consider the network of social and health, pedagogical, social and psychological territorial services;
- refer to national and local legislation on the rights of pupils with SLD and contact an advocacy agency.

The role of the school is equally fundamental because it is in the school environment that the child with SLD manifests his difficulties. Making use of local experts (doctors, psychologists, social workers, speech therapists, neuropsychomotricity therapists, etc.) is essential for correct management and meeting the needs of the pupil as protected by current legislation.

In the school environment, a decisive role for the psychophysical well-being of the pupil with SLD is given by the peer group. Peers can be both a valid support element and a social barrier that prevents inclusion and that accentuates stigma, prejudice and false beliefs.

This is why it is important to support awareness and information actions also for peers, as well as for teachers and parents. A welcoming group promotes self-esteem, self-efficacy and excludes frustration, deviant behavior and school dropout.

The training and professional updating of teachers is fundamental for the use of compensatory instruments and dispesative measures, as required by the legislation in force in the individual countries.

1.18 Emotions, self-esteem and determination for scholastic success

Regular school attendance is generally a factor of protection and growth for children as it allows them to learn social rules and to associate with peers and significant adult figures outside the family.

For those with a specific learning disorder, school attendance represents a risk factor, as it exposes those with this difficulty to a situation of continuous stress even if at low intensity.

Exposure to demands that cannot be met, with pressure from teachers and parents, who often fail to understand why an intelligent boy is unable to do the same things as his seemingly simple and normal classmates, involves severe emotional distress.

This emotional distress usually presents itself initially in the form of demoralization, anxiety, somatization, low self-esteem, a sense of inadequacy and active avoidance of teaching activities.

Later, disturbing behaviors may also occur in the classroom and the child may become the object of mockery or bullying by peers and punitive behavior by teachers and parents.

The recognition of the specific learning disorder and the introduction of dispensatory measures and compensatory tools therefore represents an important preventive intervention from a mental health perspective.

Intervening early with adequate interventions prevents psychological discomfort from evolving towards a real psychopathological disorder at the time of pre-adolescence and adolescence.

Many studies have confirmed that the long-term effects of continuous stress can give rise to lasting psychopathological disorders and negatively affect the personality structure in adulthood.

The risk of depressive disorders, deviant and self-injurious behaviors in adolescence and adulthood appears to be much greater in people who have had a school career characterized by failures and failures.



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