UNIVERSITÀ
DEGLI STUDI
DI TRIESTE

UNIVERSITÀ DEGLI STUDI DI TRIESTE

XXXVIII CICLO DEL DOTTORATO DI RICERCA IN

NEUROSCIENZE E SCIENZE COGNITIVE

Finanziato dall'Unione europea - NextGenerationEU
Funded by the European Union - NextGenerationEU

SPECIFIC LEARNING DISABILITIES AS THE TARGET OF AN ADVANCED UNVERSITY TUTORING SERVICE: A PILOT PROJECT

Settore scientifico-disciplinare: **PSIC 02/A PSICOLOGIA DELLO SVILUPPO E PSICOLOGIA DELL'EDUCAZIONE**

DOTTORANDA
GIORGIA MOROSINI

COORDINATORE
PROF. ANDREA CARNAGHI

SUPERVISORE DI TESI
PROF. SANDRA PELLIZZONI

ANNO ACCADEMICO 2024/2025

Finanziato dall'Unione europea NextGenerationEU
Ministero dell'Università e della Ricerca
Italiadomani PIANO NAZIONALE DI RIPRESA E RESILIENZA
UNIVERSITÀ DEGLI STUDI DI TRIESTE

ABSTRACT

Specific Learning Disabilities or Specific Learning Disorders (SLDs) are neurodevelopmental conditions that persist into adulthood and can significantly affect students' educational and professional trajectories. In recent years, the number of university students with SLDs has steadily increased, raising the need to better understand the cognitive and non-cognitive factors shaping their academic experience and to design evidence-based support strategies. While research on SLDs has largely focused on developmental populations, much less is known about how these disorders manifest during higher education, particularly in the Italian context. The present dissertation therefore aimed to provide an integrated account of instrumental abilities, neurocognitive functions, and motivational–emotional dimensions in university students with SLDs.

Across five empirical studies, this dissertation examined multiple aspects of the university experience.

The **first study** addressed the urgent need to better understand the real academic experience of university students with SLDs, a population still largely underrepresented in the literature. Using an ad hoc questionnaire, the study provided a detailed picture of compensatory strategies and academic supports, as well as of the social, institutional, and psychological aspects shaping the university experience of students with SLDs. Furthermore it investigate frequency and type of compensatory tools actually used during studying and examinations, students' perceptions of the adequacy of university support services and faculty preparedness regarding SLD-related issues, the perceived emotional impact of these tools, and the potential use of new technologies in supporting learning.

Two studies (the second and the third) focus mainly on instrumental and neurocognitive abilities providing and update insight on these aspects. In particular t**he second study** offered a comprehensive profile, showing persistent deficits in reading and arithmetic facts, weaknesses in verbal working memory, and reduced use of advanced metacognitive strategies, alongside strengths in visuospatial abilities and relatively preserved study goals. **The third study** explored heterogeneity within the instrumental and neurocognitive domain, examining differences associated with diagnostic subtypes of SLD and academic enrolment (STEM vs. non-STEM).

Other two studies (the fourth and the fifth) investigate aspects related to emotional and motivational aspects. In particular, **the fourth study** investigated predictors of self-regulated learning, highlighting the central role of academic self-efficacy and learning goals, while also revealing that academic anxiety interacted with gender, exerting a stronger negative effect among female students. Academic resilience showed only an indirect influence, mediated by motivational factors. Finally, **the fifth study focused** on non-cognitive factors over time, showing stable difficulties in self-regulated learning and a temporal dynamic in motivational-emotional dimensions: as students progressed in their studies, mastery goals weakened and academic anxiety increased, whereas self-efficacy and resilience remained stable.

Overall, the findings confirm that SLDs highly influence the instrumental abilities during adulthood and highlight the multifaceted nature of students' profiles, where enduring instrumental and neurocognitive difficulties coexist with motivational factors and emotional challenges. Data indicates that focusing exclusively on cognitive abilities is insufficient to ensure an equitable and successful university experience. Instead, a multidimensional approach is required, combining interventions on cognitive

skills and compensatory strategies with programs that strengthen self-regulation, foster motivation, and address academic anxiety.

These results provide actionable guidance for universities, emphasizing the need for structured support services, ad hoc intervention, and accessible teaching practices that respond to students' heterogeneous profiles. Moreover, strengthening metacognitive and motivational resources through targeted programs emerges as a crucial strategy to promote academic success and long-term well-being.

Summary

1. GENERAL INTRODUCTION

Specific Learning Disorders (SLDs) are classified among neurodevelopmental disorders and are characterized by persistent and circumscribed difficulties in acquiring and using reading, writing, and mathematical skills, despite adequate intellectual functioning and appropriate educational opportunities (World Health Organization, 2019).

The international scientific community has updated the classification criteria for learning disorders. The DSM-5 (American Psychiatric Association, 2013) introduced a unified category of Specific Learning Disorder (code 315.00), moving beyond the traditional distinction among dyslexia, dysgraphia, dysorthography, and dyscalculia. Within this framework, specifiers are used to identify the predominant area of difficulty (e.g., reading, written expression, mathematics). This approach reflects an etiological perspective centred on neurobiological underpinnings and the persistence of the disorder over time. By contrast, the ICD-11 (World Health Organization, 2019) retained a distinct classification of the various forms of learning disorders, grouped under the category Developmental Learning Disorder (code 6A03). However, it remains anchored to the discrepancy criterion between general cognitive abilities and academic performance, without explicitly incorporating the concept of resistance to intervention, which represents a central criterion in the DSM-5 (Tannock, 2013; Cornoldi, 2023).

The international scientific debate and the evolution of classification systems have underscored the need to update clinical practices and national guidelines. In Italy, between 2021 and 2022, a new Consensus Conference produced documents and recommendations that led the Italian National Institute of Health to publish the

2022 Guidelines. These broadened the scope of attention to previously underexplored issues, such as SLDs in adulthood, diagnosis in bilingual and migrant populations, and difficulties related to reading comprehension (Aquino, 2022a, 2022b).

The identification of SLDs in childhood and adolescence is often complex, as clinical manifestations may vary considerably. As noted by Vio and Lo Presti (2014), these disorders pertain to domain-specific skills, yet in clinical practice comorbidity is the rule rather than the exception (Willcutt et al., 2013). Diagnosis therefore requires the use of standardized and updated tools capable of assessing both accuracy and processing speed. Performances below the 5th percentile, or significantly delayed (more than two standard deviations from the mean), are considered clinically relevant; however, scores around the 10th percentile also become significant when associated with school adaptation difficulties (Peterson & Pennington, 2012).

It is equally important to consider exclusionary factors, such as intellectual disability, sensory impairments, neurological conditions, disadvantaged environmental factors, or limited language proficiency, in order to avoid misdiagnoses and ensure appropriate interventions (American Psychiatric Association, 2013; WHO, 2019).

1.1 Dyslexia

Developmental dyslexia refers to a specific and persistent difficulty in acquiring reading skills in individuals with average intellectual functioning, regular schooling, and no sensory or neurological deficits. According to the ICD-11, developmental dyslexia is included within the category of Developmental Learning Disorder with impairment in reading and is defined as a persistent and significant difficulty in learning to read accurately and fluently that cannot be explained by intellectual disability, sensory

impairment, or inadequate educational opportunities (World Health Organization, 2019). Similarly, in the DSM-5 dyslexia is not classified as an independent diagnostic category but is described as a specific pattern of difficulties within Specific Learning Disorder, characterized by problems with accurate or fluent word recognition, poor decoding, and poor spelling abilities (American Psychiatric Association, 2013).It differs from acquired dyslexia, in which previously developed skills are compromised due to brain injury or trauma (Cornoldi, 2023; World Health Organization [WHO], 2019). In line with international classification systems, diagnosis requires evidence of persistent difficulties despite targeted interventions, with a clinically significant impact on reading accuracy and/or fluency (American Psychiatric Association [APA], 2013; WHO, 2019).

At the familial level, dyslexia shows high recurrence and a genetic risk basis consistent with the literature (Erbeli et al.,2021;Becker et al., 2017). The term “dyslexia” refers specifically to decoding processes (automatization and accuracy), in line with international diagnostic systems (APA, 2013; WHO, 2019). However, although reading comprehension difficulties are not part of the diagnostic core of dyslexia in DSM-5 and ICD-11, recent Italian National Guidelines (Istituto Superiore di Sanità, 2022; Aquino, 2022a, 2022b) explicitly emphasize the need to systematically assess reading comprehension as a distinct yet functionally relevant domain. Indeed, comprehension difficulties may co-occur with decoding impairments or emerge independently, and they have substantial ecological implications for academic functioning at both school and university levels (Snowling et al., 2020).

In Italy, diagnostic cut-off thresholds are commonly set at below the 5th percentile or below –2 standard deviations (SD) for speed (syllables/second), and below the 5th percentile for accuracy. The DSM-5 instead proposes ≤ –1.5 SD (approximately the 7th percentile), to be interpreted in conjunction with evidence of

persistence and interference with academic achievement (APA, 2013). Clinical documentation should include at least two tasks among text, word, and pseudoword reading for a reliable profile characterization (Cornoldi, 2023).

In transparent orthographies such as Italian, decoding tends to be relatively accurate from the early stages, while difficulties manifest more prominently in speed (automatization), consistent with the orthographic depth hypothesis (Seymour et al., 2003; Ziegler & Goswami, 2005).

Dyslexia persists across the lifespan, although it may present with heterogeneous compensatory outcomes: reading slowness and phonological deficits generally remain evident, while some adults develop alternative strategies (e.g., vocabulary expansion, visual supports, technological tools) (Montesano et al., 2020; Snowling & Hulme, 2012). In university settings, pseudo word reading and lexical decision tasks remain sensitive measures for detecting persistent decoding difficulties (Montesano et al., 2020).

1.2 Dysortography

Dysortographia involves the linguistic component of writing and manifests as frequent and systematic spelling errors (e.g., phoneme–grapheme conversion, orthographic rules), often accompanied by slow execution. It reflects dysfunctions in central processes of orthographic and phonological encoding (Berninger & Amtmann, 2003; Cornoldi, 2023; WHO, 2019). According to the ICD-11, developmental learning disorder with impairment in written expression includes persistent and significant difficulties in spelling accuracy and written expression that cannot be explained by intellectual disability, sensory impairment, or inadequate educational opportunities (World Health Organization, 2019). Similarly, in the DSM-5 spelling difficulties are not

classified as an independent diagnostic category but are described within Specific Learning Disorder, characterized by persistent problems with spelling accuracy, letter omissions, substitutions, or additions, despite adequate instruction (American Psychiatric Association, 2013). Comorbidity with dyslexia is common, though relatively "isolated" profiles are possible, particularly in languages with different orthographic constraints (Landerl et al., 2019; Moll et al., 2014; Peterson & Pennington, 2015).Experimental evidence links spelling disorder to specific vulnerabilities in working memory. In "isolated" forms, the phonological loop (short-term phonological storage) is often impaired, while in comorbidity with dyslexia central executive inefficiencies are more frequently observed (Peng et al., 2018; Swanson et al., 2019). Some studies also report weaknesses in dynamic visuospatial working memory, with potential consequences for the sequential management of written information (Mammarella et al., 2015; Mammarella et al., 2018; Cornoldi, 2023). Spelling disorder persists beyond school age and tends to emerge under conditions of high cognitive load (e.g., timed writing, multitasking), where the likelihood of errors increases due to reduced executive control of orthographic processes (Berninger & Amtmann, 2003; Montesano et al., 2020). Italian studies report frequent phonological errors and confusion between phonetically similar words, with increased error rates under articulatory suppression, suggesting poor automatization of transcription processes (Montesano et al., 2020).

1.3 Dyscalculia

According to the ICD-11, developmental learning disorder with impairment in mathematics is defined as a persistent and significant difficulty in learning and using numerical concepts, arithmetic facts, or calculation procedures that is not attributable

to intellectual disability, sensory impairment, or inadequate educational opportunities (World Health Organization, 2019). Similarly, in the DSM-5 dyscalculia is included within Specific Learning Disorder and refers to difficulties in number sense, memorization of arithmetic facts, accurate or fluent calculation, and mathematical reasoning (American Psychiatric Association, 2013).The literature identifies complementary explanatory models: (a) deficits in the “number sense” module, with impaired representation of non-symbolic quantities and their relations; (b) difficulties in transcoding between non-symbolic quantities and the symbolic Arabic system; (c) working memory impairments (verbal, for mental calculation; visuospatial, for alignment and number line representation); and (d) inefficiencies in executive functions such as inhibition and attentional control (Butterworth et al., 2011; De Smedt et al., 2013; Mammarella et al., 2019; von Aster & Shalev, 2007).

Recent operational guidelines discourage rigid subtype classifications in favor of functional profiling, which is more useful for tailoring interventions (AIRIPA–AID, Joint Document). In Italy, diagnosis is generally not considered before the end of third grade in primary school; however, early screening allows for the identification of risk profiles and the prompt implementation of targeted interventions (Cornoldi, 2023; Istituto Superiore di Sanità [ISS], Consensus Conference)

Dyscalculia persists into adulthood, although this area remains relatively underexplored. Adults typically show less precise numerical representations, slower procedures, difficulty retrieving arithmetic facts, and lower efficiency in mental calculation. Comorbidity with other SLDs is high (Butterworth et al., 2011; Montesano et al., 2020). From an ecological perspective, the most visible symptom is slow execution, often accompanied by errors even in elementary tasks and by difficulties in

mathematical reasoning under conditions of high cognitive demand (Montesano et al., 2020).

1.4 Dysgraphia

Dysgraphia affects the motor/executive component of handwriting, compromising the formal quality and fluency of writing (e.g., allograph selection, size and speed programming, muscular regulation). Handwriting is often slow and poorly legible, with irregularities in form, size, alignment, and spacing (Berninger, 2009; Cornoldi, 2023; Feder & Majnemer, 2007). For the the ICD-11, handwriting difficulties are not classified as a distinct learning disorder but may be described within developmental learning disorder with impairment in written expression or, when primarily motor in nature, within disorders of motor coordination (World Health Organization, 2019). Similarly, in the DSM-5 dysgraphia is not recognized as an independent diagnostic category; handwriting difficulties are discussed either as part of Specific Learning Disorder with impairment in written expression or in relation to Developmental Coordination Disorder, when motor execution deficits are predominant (American Psychiatric Association, 2013).

Clinical assessment integrates indicators of execution speed (graphemes per minute) and legibility, using standardized paper-and-pencil tasks in the subject's habitual writing mode (e.g., cursive, print). In Italy, batteries assessing orthographic and graphomotor competence are widely used (e.g., BVSCO-3), along with tracing pattern tasks and copy tasks. Neuropsychological assessment may include the VMI, TPV, Rey–Osterrieth Complex Figure, and NEPSY-II sensorimotor subtests. National recommendations advise diagnostic caution during the first two years of primary

school, with greater reliability from the end of third grade (Cornoldi, 2023; ISS, Consensus Conference). Dysgraphia is common in Developmental Coordination Disorder (DCD), which is classified among neurodevelopmental disorders in the DSM-5 (APA, 2013; Feder & Majnemer, 2007).

The literature on dysgraphia in adolescence and adulthood indicate slowness, reduced legibility, and discomfort during writing activities compared to peers, with consequences for academic tasks requiring accuracy and time management (Montesano et al., 2020; Rosenblum et al., 2003). Italian studies report a high prevalence of dysgraphic features among high school students with dyslexia (e.g., irregular stroke, alternation between cursive and print), suggesting persistence trajectories in subgroups even beyond compulsory education (Bindelli et al., 2009).

1.5 Prevalence of SLD from Childhood to University Students

1.5.1 Childhood and Adolescence.

In the 2019/2020 and 2020/2021 school years, the proportion of students certified with Specific Learning Disorders (SLDs) from third grade of primary school through the final year of upper secondary school was 5.3% and 5.4% of total enrolment, respectively. The highest percentages were observed in lower and upper secondary education. Public schools reported rates of 5.16% (2019/2020) and 5.30% (2020/2021), while private/parochial schools recorded slightly higher (Italian Ministry of Education, 2022).

At the territorial level, Northwestern Italy showed the highest prevalence (7.9% in 2020/2021), while Southern Italy had the lowest (2.8%). Among regions, Valle d'Aosta and Liguria consistently reported the highest rates (approximately 8–8.4%), whereas Campania and Calabria were below 2%. Dyslexia was the most frequent

subtype (37.8% of diagnoses in 2020/2021), followed by dysorthography (22.5%), dyscalculia (20.7%), and dysgraphia (19%). These data are drawn from the Ministry of Education (now MIM) *Focus on Students with SLD*, updated for the two school years indicated (Italian Ministry of Education, 2022).

A specific section of the report also quantified “students at risk for SLD” (preschool and the first two grades of primary school), identified by schools based on pre-diagnoses from health services: 5,572 children in 2019/2020 (0.23% of the relevant cohort) and 5,091 in 2020/2021 (0.22%) (Italian Ministry of Education, 2022)

From a historical perspective, since the introduction of Law 170/2010, there has been a progressive increase in certifications: from 0.9% (2010/2011) to 5.4% (2020/2021) of total enrolment. This trend is likely due to greater awareness, the consolidation of diagnostic pathways, and the diffusion of compensatory and dispensatory measures in schools (Italian Ministry of Education, 2022).

For international comparison, the DSM-5 estimates the prevalence of SLDs among school-aged children at 5–15%, depending on the definitions and assessment tools adopted (APA, 2013).

1.5.2 University Students

Reliable data on the true prevalence of SLDs in adulthood in Italy remain limited. Summary documents suggest estimates around 4% in the adult population, consistent with the clinical literature and APA guidelines. However, these figures reflect different phenomena (e.g., previous diagnoses, self-report, disclosure) and may not coincide with the proportion of university students who declare an SLD.

In the Italian university system, a 2020 survey conducted by ANVUR and CNUDD (CINECA questionnaire, July–October 2020; 90 universities responding out of 98) identified 16,084 students with SLDs, representing about 1% of the total university population (1,793,210 students). Subsequent reports indicated further growth, with 19,616 students with SLDs in 2020/2021. These figures reflect students who officially disclosed their SLD to university services and therefore it could not correspond to the actual prevalence in adulthood. The discrepancy compared to epidemiological estimates (e.g., 4%) may be explained by underreporting, late or absent diagnoses, student dropout, and differences between the general and university populations.

At the national level, ANVUR's report also highlighted heterogeneity across regions and universities in terms of policies for student support, access to services, and available accommodations. Such variability influences disclosure rates and the administrative traceability of students with SLDs, with important implications for interpreting system-wide statistics.

The 2022 Guidelines of the Italian National Institute of Health (ISS) reaffirm the persistence of learning difficulties beyond school age and emphasize the need for consistent diagnostic and inclusion pathways across the lifespan, particularly during transitions between school, university, and work. At the international level, this framework aligns with DSM/APA estimates on persistence into adulthood and underscores the need for context-specific accommodations.

1.6 Legislative Framework in Italy: From School to University

Over the past two decades, Italy has progressively strengthened its legislative and institutional framework for including and supporting students with SLDs. This

evolution has paralleled the expansion of scientific research and rising public awareness, culminating in the adoption of measures designed to guarantee the right to education and promote inclusion across all educational levels.

A turning point was the approval of Law 170/2010, which formally recognized dyslexia, dysgraphia, dysorthography and dyscalculia as SLDs and established the right to compensatory tools and dispensatory measures in the school system. The subsequent 2011 Guidelines specified the procedures for identification, educational planning and assessment in primary and secondary education. However, Law 170/2010 operates alongside Law 104/1992 on disability, producing two parallel systems that may fail to capture intermediate or complex learning profiles. To address this gap, the Ministerial Directive of 27 December 2012 expanded the framework to include the broader category of *Special Educational Needs* (BES), extending certain educational measures to students who do not meet the strict criteria for SLD but nonetheless require individualized support.

In the transition to university, important procedural differences emerge. In Italy, access to university support services and accommodations for admission tests requires the presentation of a valid diagnosis of Specific Learning Disorders. According to Law 170/2010 and the State–Regions Agreement of July 24, 2012, a diagnosis issued after the age of 18 is not subject to mandatory updating and is therefore considered valid for the entire university career. The diagnosis must comply with the criteria of the 2011 Consensus Conference, include the explicit diagnostic labels and nosographic codes, and describe the student's cognitive profile, strengths and weaknesses. Diagnoses released after age 18 remain valid throughout the entire academic career; whereas diagnoses produced before age 18 must be updated every three years, as specified by the CNUDD Guidelines 2024.

Regulations for national admission tests (e.g., medicine, healthcare professions) are defined by the Ministerial Decree No. 583/2022, which grants students with SLD: up to 30% extra time; permission to use a non-scientific calculator; video-enlargers; or a human reader supported by university disability/SLD services.

Restrictions also apply: digital devices, dictionaries, formula sheets and concept maps are typically not permitted during admission tests (DM 583/2022). For locally managed entrance tests, such as TOLC exams or programs with local numerus clauses, universities generally apply the same principles, offering additional time and access to the tools allowed under national standards legislation.

Unlike the school system, Italian universities do not implement a formal Individualized Educational Plan (PDP). Instead, support is regulated by the 2011 Guidelines (section 6.7 “Higher Education Institutions”) and the CNUDD Guidelines 2024, which provide recommendations but do not have binding legal status. As Italian Association for Dislexia (AID)notes, the absence of a dedicated implementation decree for Law 170/2010 in higher education leads to substantial variability in practices across universities and even across individual instructors.

During the academic year, students may access compensatory tools, including: digital recorders; computers with spell-checkers; digital textbooks and accessible materials; text-to-speech software; calculators; concept maps or structured summaries; tutoring support, including note-taking assistance; early access to teaching materials (slides, exercises, readings) and dispensatory measures, which may include: splitting an exam into multiple partial tests; prioritizing oral over written assessments; alternative exam formats when multiple-choice tests pose a barrier; reducing the quantity (but not quality) of written tasks; granting up to 30% extra time for written exams; evaluating content over orthographic accuracy.

In practice, students must inform the University Disability/SLD Office of their requests for each exam. While services are expected to mediate between students and professors, anyway many association for the right of these students (e.g., Italian Association for Dyslexia) reports that students often negotiate accommodations directly with faculty members, highlighting persistent implementation gaps. Overall, the Italian university system appears characterized by a high degree of heterogeneity in the implementation of SLD-related measures, with substantial differences not only between institutions but also across departments. Unlike the school system, where training and information on SLDs are disseminated in a more systematic and capillary manner, higher education lacks mandatory and structured professional development on these issues, resulting in uneven awareness and discretionary practices that often place the burden of negotiating accommodations directly on students (Italian Association for Dyslexia [AID], 2023; Conferenza Nazionale Universitaria dei Delegati per la Disabilità e i DSA [CNUDD], 2024).

1.7 Overview of the present dissertation

In general terms, the aim of the present dissertation is to offer updated research evidence towards a comprehensive understanding of the instrumental, instrumental, neurocognitive, motivational, and emotional dimensions characterizing university students with SLDs. As observed in the in introduction, scientific literature about university students with SLDs is still scarce in higher context, particularly in Italy even if the number of university students with SLDs in the last years increases (e.g., Casali et al., 2024; Johnson et al., 2023)

This dissertation adopts an integrative perspective on SLDs in adulthood. Rather than conceptualizing university students with SLDs solely in terms of residual

learning deficits, the present work frames their academic functioning as the outcome of a dynamic interaction between enduring domain-specific vulnerabilities and the contextual demands of higher education. University learning environments require high levels of autonomy, strategic planning, self-monitoring, and emotional regulation, while simultaneously offering fewer standardized supports compared to primary and secondary education. Within this context, even circumscribed difficulties in reading, writing, or calculation may exert cascading effects on study organization, workload management, and academic persistence.

A central assumption underlying this dissertation is that instrumental and neurocognitive difficulties alone are insufficient to fully explain the heterogeneity observed in university outcomes among students with SLDs. Individuals with comparable diagnostic profiles may follow markedly different academic trajectories, suggesting that motivational resources, emotional regulation, and contextual factors play a critical role in shaping adaptation to higher education. Consequently, the present work moves beyond a deficit-based framework and emphasizes the importance of examining protective and risk factors that modulate the impact of SLDs in adulthood.

In line with this perspective, the dissertation integrates multiple levels of analysis. It considers not only performance-based indicators of learning and cognition, but also students' subjective experiences of inclusion, their use of compensatory strategies, and their perceptions of institutional support. Particular attention is devoted to self-regulated learning as a key construct linking cognitive resources to academic behaviour, as well as to motivational beliefs and academic anxiety as factors that may either facilitate or hinder engagement with university demands over time. Another unifying element of the dissertation concerns its attention to developmental change

within adulthood. Rather than treating the university period as a static endpoint, the present work acknowledges that academic demands, motivational orientations, and emotional challenges evolve across the university path.

Finally, this dissertation is explicitly oriented toward translational relevance. By integrating evidence on cognitive functioning, emotional–motivational processes, and institutional practices, the work seeks to inform the design of more inclusive and psychologically informed university policies. The ultimate goal is not only to advance scientific understanding of SLDs in higher education, but also to contribute to the development of support systems that recognize the complexity of students' profiles and promote equitable, sustainable academic trajectories.

Given the complex panorama dissertation was structured to progressively address the main gaps in the literature, moving from the 1) description of students' lived academic experience to 2) an in depth examination of their cognitive and instrumental profiles, and finally 3) to the evaluate emotional and motivational factors during the university path.

The overarching rationale connecting the five studies is therefore twofold: to describe "what persists" from childhood to adulthood in terms of instrumental and neurocognitive characteristics, and to understand "what changes" in the university context, particularly in the motivational, emotional, and regulatory dimensions required for academic success.

References

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). Washington, DC: Author.

American Psychiatric Association. (2022). *Diagnostic and statistical manual of mental disorders* (5th ed., text rev.). Washington, DC: Author.

ANVUR – Agenzia Nazionale di Valutazione del Sistema Universitario e della Ricerca. (2020). *Risultati dell'indagine su studenti con disabilità e DSA nelle università italiane* (indagine ANVUR–CNUDD; luglio–ottobre 2020). https://www.anvur.it

ANVUR. (2023). *Gli studenti con disabilità e DSA nelle Università italiane – Una risorsa da valorizzare* (sezione "Altri Rapporti"). https://www.anvur.it

Associazione Italiana Dislessia (AID). (2023, 24 gennaio). *Quasi ventimila studenti con DSA all'Università: i risultati dell'ultima indagine ANVUR*. https://www.aiditalia.org

Becker, N., Vasconcelos, M., Oliveira, V., Santos, F. C. D., Bizarro, L., Almeida, R. M. D., ... & Carvalho, M. R. S. (2017). Genetic and environmental risk factors for developmental dyslexia in children: Systematic review of the last decade. Developmental neuropsychology, 42(7-8), 423-445.

Berninger, V. W. (2009). Highlights of programmatic, interdisciplinary research on writing. *Learning Disabilities Research & Practice, 24*(2), 69–80.

Berninger, V. W., & Amtmann, D. (2003). Preventing written expression disabilities through early and continuing assessment and intervention for handwriting and/or spelling problems. In H. Swanson, K. R. Harris, & S. Graham (Eds.), *Handbook of learning disabilities* (pp. 323–344). New York, NY: Guilford.

Bindelli, D., Colombo, L., & Tressoldi, P. (2009). *Caratteristiche grafo-motorie in studenti con dislessia*. Padova: CLEUP.

Butterworth, B., Varma, S., & Laurillard, D. (2011). Dyscalculia: From brain to education. *Science, 332*(6033), 1049–1053.

Caravolas, M. (2004). Spelling development in alphabetic writing systems. *European Psychologist, 9*(1), 3–14.

Cornoldi, C. (2023). *I disturbi dell'apprendimento* (2ª ed.). Bologna: Il Mulino.

De Smedt, B., Janssen, R., Bouwens, K., Verschaffel, L., Boets, B., & Ghesquière, P. (2009). Working memory and individual differences in mathematics achievement: A longitudinal study from first grade to second grade. *Journal of experimental child psychology*, *103*(2), 186-201.

Erbeli, F., Rice, M., & Paracchini, S. (2021). Insights into dyslexia genetics research from the last two decades. Brain sciences, 12(1), 27.

Feder, K. P., & Majnemer, A. (2007). Handwriting development, competency, and intervention. *Developmental Medicine & Child Neurology, 49*(4), 312–317.

Gathercole, S. E., Alloway, T. P., Willis, C., & Adams, A.-M. (2006). Working memory in children with reading disabilities. *Journal of Experimental Child Psychology, 93*(3), 265–281.

Istituto Superiore di Sanità (ISS). (2022). *Linea guida sulla gestione dei Disturbi Specifici dell'Apprendimento – Aggiornamento e integrazioni*. https://www.iss.it

Italian Ministry of Education. (2022). Students with Specific Learning Disorders in Italian schools: School years 2019/2020 and 2020/2021. Rome: Ministry of Education.

Landerl, K., Ramus, F., Moll, K., et al. (2019). Predictors of developmental dyslexia across languages. Scientific Studies of Reading, 23, 1–17.

Mammarella, I. C., Caviola, S., Giofrè, D., & Szűcs, D. (2015). The underlying structure of visuospatial working memory. Cognitive Development, 34, 1–15.

Mammarella, I. C., Giofrè, D., & Caviola, S. (2018). Visuospatial working memory in learning disorders. Frontiers in Psychology, 9, 1–12.

Mammarella, I. C., Caviola, S., & Cornoldi, C. (2019). The role of working memory in developmental dyscalculia. *Child Neuropsychology, 25*(3), 271–288.

Ministero dell'Istruzione e del Merito (MIM). (2022). *Focus sugli alunni con Disturbi Specifici dell'Apprendimento* (aa.ss. 2019/2020–2020/2021). https://www.mim.gov.it

Milsom, A. (2014). *Specific Learning Disorders* (Practice Brief). American Counseling Association. https://www.counseling.org

Montesano, A., Facoetti, A., & Zorzi, M. (2020). *I Disturbi Specifici dell'Apprendimento in adolescenza e in età adulta*. Trento: Erickson.

Moll, K., Peterson, R. L., & Pennington, B. F. (2014). The comorbidity of reading and spelling disorders. Journal of Learning Disabilities, 47, 1–14.

Peng, P., Barnes, M., Wang, C., et al. (2018). working memory and literacy development. Developmental Psychology, 54, 1–16.

Peterson, R. L., & Pennington, B. F. (2012). Developmental dyslexia. *The Lancet, 379*(9830), 1997–2007.

Peterson, R. L., & Pennington, B. F. (2015). Developmental dyslexia. Annual Review of Clinical Psychology, 11, 283–307.

Rosenblum, S., Weiss, P. L., & Parush, S. (2003). Product and process evaluation of handwriting difficulties. *Educational Psychology Review, 15*(1), 41–81.

Seymour, P. H. K., Aro, M., & Erskine, J. M. (2003). Foundation literacy acquisition in European orthographies. *British Journal of Psychology, 94*(2), 143–174.

Snowling, M. J., & Hulme, C. (2012). Interventions for children's language and literacy difficulties. *International Journal of Language & Communication Disorders, 47*(1), 27–34.

Snowling, M. J., Hulme, C., & Nation, K. (2020). Defining and understanding dyslexia: past, present and future. Oxford Review of Education, 46(4), 501–513. https://doi.org/10.1080/03054985.2020.1765756

Swanson, H. L., Zheng, X., & Jerman, O. (2019). Working memory and spelling difficulties. Journal of Educational Psychology, 111, 1–17.

Tannock, R. (2013). Rethinking ADHD and LD in DSM-5: Proposed changes in diagnostic criteria. *Journal of Learning Disabilities, 46*(1), 5–25.

Vio, C., & Lo Presti, A. (2014). *I disturbi specifici dell'apprendimento. Dalla ricerca all'intervento*. Trento: Erickson.

Von Aster, M., & Shalev, R. (2007). Number development and developmental dyscalculia. *Developmental Medicine & Child Neurology, 49*(11), 868–873.

Willcutt, E. G., Petrill, S. A., Wu, S., Boada, R., DeFries, J. C., Olson, R. K., & Pennington, B. F. (2013). Comorbidity of reading disability and math disability: Concurrent psychopathology, functional impairment, and neuropsychological functioning. *Journal of Learning Disabilities, 46*(6), 500–516.

World Health Organization. (2019). *International classification of diseases for mortality and morbidity statistics* (11th Revision). Geneva: Author.

Ziegler, J. C., & Goswami, U. (2005). Reading acquisition, developmental dyslexia, and skilled reading across languages. *Psychological Bulletin, 131*(1), 3–2

The first study addressed the urgent need to better understand the real academic experience of university students with SLDs, a population still largely underrepresented in the literature. Specifically, this exploratory work aimed to examine key dimensions of students' academic life and support systems. The study investigated the frequency and type of compensatory tools actually used during studying and examinations, students' perceptions of the adequacy of university support services and faculty preparedness regarding SLD-related issues, the perceived emotional impact of these tools, and the potential use of new technologies, particularly artificial intelligence-based tools, in supporting learning. Furthermore, it explored students' overall sense of inclusion within the university context. Using an ad hoc questionnaire, the study provided a detailed picture of compensatory strategies and academic supports, as well as of the social, institutional, and psychological aspects shaping the university experience of students with SLDs. Taken together, the findings highlight both strengths and gaps in current university practices, offering practical insights for developing more inclusive and technologically responsive academic environments.

STUDY 1

Beyond Diagnosis: A Multifactorial Investigation of Academic Performance and University Choices in Students with Specific Learning Disorders

1.Introduction

University students with Specific Learning Disabilities (SLD) face a complex interplay of academic, emotional, and strategic challenges that frequently compromise their academic achievement and growth. These students often report lower levels of academic self-efficacy and a heavier reliance on compensatory strategies (Stagg et al., 2018; Matteucci & Soncini, 2021; Kirby et al., 2008). Despite institutional support, many students struggle in the transition from high school learning to active self-advocacy and independent study, both of which are crucial for success in higher education (Hadley, 2006; Parker & Boutelle, 2009).

As learning becomes more self-directed at the university level, challenges related to executive function, regulation of study, and the ability to manage complex academic demands become more pronounced. Beyond meeting academic expectations, students with SLD frequently experience additional strain due to the psychosocial impact of their learning difficulties. (MacCullagh et al., 2017). Although data indicate a rise in the enrollment of students with SLD in Italian universities, evidence suggests that they face a greater risk of lower academic achievement (Casali et al., 2024; Del Tufo & Earle, 2020; Newman et al., 2011) and an increased likelihood of dropping out or discontinuing their studies at the bachelor's level (ANVUR, 2022).

Yet, despite lower self-efficacy, their overall psychological well-being is often preserved, suggesting that these students develop coping strategies and support systems to navigate their academic path (Matteucci & Soncini, 2021).

1.1 Inclusive Education and Policy Frameworks for Students with Learning Disorders

In Italy, a major shift occurred with Law 170/2010, which formally recognized SLD and established the right to individualized teaching, the use of compensatory tools, and exemption from non-essential academic tasks. This legislation represented a milestone comparable to earlier policy developments in the United States (e.g., the *Americans with Disabilities Act*, ADA, 1990) and the United Kingdom (*Equality Act*, 2010), which similarly promoted inclusive educational practices and institutional responsibility toward students with learning disabilities. Following the Italian reform, universities began extending services that had previously been available only to students with physical or sensory disabilities, such as academic tutoring, technological support, and orientation programs, to students with SLD as well (Nenzioni & Friso, 2020).

Despite these advances, the implementation of inclusive measures remains uneven, both within Italy and internationally. Several studies highlight persistent disparities in access to accommodations, limited faculty awareness, and social stigma as major barriers to inclusion (Heiman & Precel, 2003; Cameron & Nunkoosing, 2012; Carnovali, 2017). Students frequently report inconsistent recognition of their rights, insufficient knowledge among lecturers, and variability in the quality of institutional support. Similar challenges have been reported in other higher-education contexts, where the lack of training in inclusive pedagogy limits the effective application of reasonable accommodations (Moriña, 2017; Madaus et al., 2021).

At the same time, the literature increasingly emphasizes the importance of assistive and compensatory technologies, such as text-to-speech software, speech recognition systems, note-taking applications, and digital reading tools, as means of promoting autonomy and improving academic outcomes (Draffan et al., 2015; Fichten et al., 2020). Research also indicates that students' engagement and success are linked not only to the availability of these supports but also to their perceived usefulness and the degree of faculty collaboration (Fuller et al., 2009; Trainin & Swanson, 2005).

Moreover, neurocognitive findings reveal that the difficulties associated with SLD often persist into adulthood, particularly in domains such as working memory and processing speed, despite otherwise average reasoning and intellectual functioning (Pizzigallo et al., 2023; Swanson & Hsieh, 2009). These cognitive characteristics can increase the cognitive load required for complex academic tasks, reinforcing the need for targeted compensatory tools and inclusive instructional design in higher education.

In summary, recent policy frameworks in higher education have represented an important step toward promoting inclusion for students with learning disabilities. However, the effective translation of these policies into consistent and equitable academic practices remains a challenge. This gap highlights the need to move beyond legislative intentions and examine how compensatory tools and academic accommodations are actually implemented and experienced by students, and how they influence academic outcomes and well-being. The following section therefore focuses on international evidence regarding the effectiveness and impact of compensatory tools and accommodations in higher education.

1.2 The Role of Compensatory Tools in Higher Education for Students with Specific Learning Disorders

The inclusion of students with SLD in higher education has become a critical issue in contemporary educational research (Dumitru et al., 2024; MacCullagh et al., 2017). Across international contexts, universities have increasingly recognized that supporting students with SLD requires not only diagnostic acknowledgment but also structural and pedagogical change, ensuring access to individualized accommodations, assistive technologies, and inclusive teaching practices (Becker & McGregor, 2016; Troiano et al., 2010).

International evidence highlights that compensatory tools and academic accommodations yield mixed yet promising outcomes. In fact, different studies report that interventions such as tutoring, coaching, and academic support centres are associated with improved grade point averages, retention, and satisfaction (DuPaul et al., 2017; Troiano et al., 2010). Similarly, the use of assistive technologies, such as text-to-speech, speech recognition, and digital note-taking systems, has been correlated with greater academic self-efficacy, study autonomy, and perceived control over learning (Pellegrino et al., 2023; Kuriakose & Amaresha, 2023).

However, the impact of these measures is not universally positive or consistent. Several studies report no significant effects of lecture recordings or generic “reasonable adjustments” on performance outcomes (Nightingale et al., 2019; Crawford et al., 2022), and in some contexts, an excessive reliance on tutorship correlated negatively with credit accumulation (Pellegrino et al., 2023). These inconsistencies suggest that effectiveness depends not merely on tool availability, but on how interventions are integrated within institutional systems and how students are supported in using them strategically.

Qualitative and mixed-method studies provide deeper insight into these dynamics. Students who know better their learning profiles and are capable of self-advocacy tend to experience better academic and emotional adjustment (Heiman & Kariv, 2004; Cole & Cawthon, 2015; Kreider et al., 2018). Conversely, stigma, inconsistent faculty attitudes, and underutilization of services remain persistent barriers (Cawthon & Cole, 2010; Gow et al., 2020). Institutional factors such as faculty training, policy clarity, and cross-service collaboration significantly influence the perceived usefulness and accessibility of accommodations (Dobson-Waters, 2018; Lightfoot et al., 2018).

Psychological variables, including self-efficacy, also emerge as strong predictors of academic adjustment and success (Mana et al., 2020; Hazan-Liran & Walter, 2024). These findings suggest that effective inclusion in higher education is achieved not solely through compensatory technologies or extended exam time, but through a multi-layered approach that integrates cognitive, emotional, and institutional dimensions.

Across studies, underutilization of available services remains a striking trend. Many students with SLD refrain from seeking accommodations, often due to a desire for independence, a lack of awareness of available resources, or fear of stigmatization (Jacobs et al., 2020; Asdaq et al., 2025). Faculty attitudes toward SLD also vary widely, from supportive and flexible to skeptical or dismissive, underscoring the ongoing need for comprehensive professional development in inclusive approach (Moriña, 2017; Kreider et al., 2018).

Overall, the international literature converges on a shared conclusion: compensatory tools are most effective when embedded within a supportive institutional ecosystem, where students are empowered to self-advocate, faculty are

adequately trained, and assistive technologies are seamlessly integrated into teaching and assessment practices (Lombardi et al., 2015; Moriña, 2017). The transition from a purely “accommodative” to a truly inclusive and neurodiversity-oriented framework represents the next step for higher education systems aiming to promote equitable academic success among students with SLD.

1.3 Role of Compensatory strategies to learn: The Use of Artificial Intelligence (AI)

Over the past two decades, there has been a significant increase in studies aimed at understanding the cognitive, emotional, and social implications of human–machine interaction, particularly the use of artificial intelligence within the framework of Large Language Models (LLMs). Within this context, the psychology of learning has emerged as one of the fields most actively engaged in exploring these implications (Rega et al., 2024).

The rapid development of digital technologies is transforming the educational landscape, offering new forms of communication and learning. These innovations are particularly relevant for students with Specific Learning Disorders (SLD), as they provide valuable compensatory tools that can support areas of difficulty. In this context, AI is emerging as a revolutionary instrument that is redefining both teaching and learning processes. The increasing integration of AI in education can be attributed to its capacity to adapt dynamically to each learner’s needs, enabling large-scale personalization and expanding the boundaries of learning (Spadacini, 2024).

This field, known as Artificial Intelligence in Education (AIEd), is rapidly expanding and draws on multiple disciplines, including psychology, neuroscience, linguistics, sociology, and education. Its primary goal is to develop adaptive learning environments and AI-based tools that are flexible, inclusive, personalized, and effective, while exploring their full pedagogical potential (Zawacki-Richter et al., 2019).

A growing body of literature suggests that AI can serve as an effective tool for early diagnosis, for the rehabilitation of reading and writing skills (Nair, 2023), and for the creation of personalized educational resources, such as concept maps or summaries, aimed at facilitating learning processes (Gaggioli, 2025; Kuerban et al., 2025). The compensatory function of AI lies in its ability to mitigate the executive difficulties associated with SLD, such as decoding in reading supported by text-to-speech synthesis (Fogarolo & Scapin, 2010), provided that such support does not diminish the intrinsic cognitive effort required by the task. In this way, AI helps reduce the cognitive load linked to instrumental skills (reading and writing), allowing students to redirect their cognitive resources toward higher-order processes such as text comprehension and complex written production (Gaggioli, 2025).

AI's multiple functionalities, including the generation of concept maps, outlines, summaries, flashcards, and integrated analyses from multiple sources, as well as the provision of real-time, personalized, and context-sensitive feedback (Billinghurst & Duenser, 2012), can effectively support study organization, particularly for students who face greater challenges. AI can also transform complex materials into more accessible formats, generate concise summaries, and create visual supports (images, videos), thereby optimizing comprehension and memory retention (Luckin & Holmes, 2016).

Despite this potential, it is essential to acknowledge, as noted by Pinnelli (2024), that AI systems are procedural artefacts designed to execute predefined instructions. Their effectiveness and usefulness for a given individual, even these with learning difficulties, are not intrinsic, but rather depend on how well they function within specific educational contexts (Pinnelli, 2024).

It is crucial that technological tools be conceived as supports for the learning process rather than as substitutes for it. Consequently, their implementation should always occur within a personalized educational plan (Gaggioli, 2025). The central goal is twofold: to promote the development of metacognitive awareness, understood as the capacity to monitor and regulate one's cognitive processes, and to enhance the student's autonomy in managing learning activities.

1.4.The present study

As highlighted by the literature described in the above-mentioned paragraphs, there is a notable lack of research focusing on university students with Specific Learning Disorders (SLD). It is therefore essential to deepen the investigation of this population in order to accurately identify their specific needs within the academic environment.

To this end, we conducted an exploratory study aimed at examining several key aspects:

1) The frequency and type of compensatory tools actually used in studying and during examinations;

2) Students' perceptions of the adequacy of university support services and of faculty preparedness regarding SLD-related issues; the perceived emotional impact of compensatory tools;

3) The potential use of new technologies, with particular attention to artificial intelligence-based tools; and the overall experience of inclusion within the university context.

With the present contribution, our goal is to describe the use of compensatory tools while monitoring the broader academic experience of these students. Specifically, we administered an ad hoc questionnaire designed to assess compensatory strategies and academic supports, social and institutional experiences within the university setting, and psychological aspects related to the academic journey and to the use of compensatory tools, including applications of artificial intelligence.

2 Methods

2.1 Participants

A total of 73 (M_{age}=20.07; SD_{age}= 1.85), 25 male and 48 female undergraduate students with a certified diagnosis of SLD initially, took part in the study. The study received ethical approval from both the University of Trieste and the Burlo Garolofo Children's Hospital ethics committees, and it was conducted in accordance with the Declaration of Helsinki and the ethical standards of the Italian Association of Psychology. Informed written consent was obtained from all participants prior to data collection.

In the Italian higher education system, students with a certified SLD are entitled to reasonable accommodations to support their academic participation and success. This is guaranteed by national legislation (Law 170/2010; CNUDD guidelines, September 2024) that promotes the inclusion and academic equity of students with learning disorders. As such, all participants in the present study were eligible for support measures tailored to individual needs, such as extended exam time, assistive

technologies, alternative learning materials, or the use of compensatory tools, depending on institutional policies and personal accommodations plans.

2.2 Procedure

As part of a collaborative effort between Burlo Garofolo Children's Hospital and the university's research team, participants who had previously undergone a diagnostic assessment for Specific Learning Disorders via e-mail, provided with detailed information about the study, and asked whether they would be willing to take part. Data collection was conducted remotely, trough an online questionnaire designed to investigate several dimensions of academic functioning, including the use of compensatory tools and accommodations. Participation was voluntary, and no incentives were provided. All responses were anonymized and stored in compliance with data protection regulations (GDPR 2016/679).

2.3 Materials

The participants, after approximately one year from the diagnostic renewal of the SLD's diagnosis, were asked to complete an online questionnaire aimed at collecting information about their academic progress in university. A self-report questionnaire was created ad hoc for the research in order to explore the university experience of students with SLDs in relation to four different thematic subscales:

1) Compensatory tools and academic support (assessed through 5 items)

2) Social and institutional experiences in the academic context (assessed through 5 items)

3) Psychological aspects (assessed through 2 items)

4) Academic performance (GPA)

The questionnaire first investigated the frequency of use of compensatory and dispensatory tools, asking participants to specify which ones were most commonly used (e.g. “At university, what kind of compensatory and/or dispensatory tools did you use during classes and for studying?”); in addition, two items were dedicated to the use of artificial intelligence as a study aid (e.g., “How often did you use AI programs to facilitate your studies?”).

The section on social and institutional experiences in academia explored, through two items, the frequency and usefulness of peer study groups (e.g., "If you have attended study groups with other students with SLDs, did you find them useful?“), and assessed, through three items, the experience with university SLD services and the perception of teachers' knowledge on the subject (e.g., ”Based on your university experience, do you consider teachers' knowledge of SLD to be adequate?“ or ”Which supports offered by the university SLD service did you find useful for your needs?").

With regard to psychological aspects, the questionnaire investigated, using a dichotomous scale (“yes” and “no”), the perception of the influence of SLD on the choice of academic path and whether compensatory tools had an impact on the emotional well-being of participants (e.g. “Do you think that the possibility of using compensatory and/or dispensatory tools influences your emotional well-being in pursuing your studies?” and also “Do you think that having a SLD has affected your choice of faculty?”).

3.Results

3.1 Use of Compensatory and dispensatory Tools

In line with the objective of this study, a descriptive analysis was conducted on the responses to the follow-up questionnaire in order to better understand students' experiences regarding the recognition and use of compensatory and dispensatory tools, both during secondary school and within the university context (Table 1).

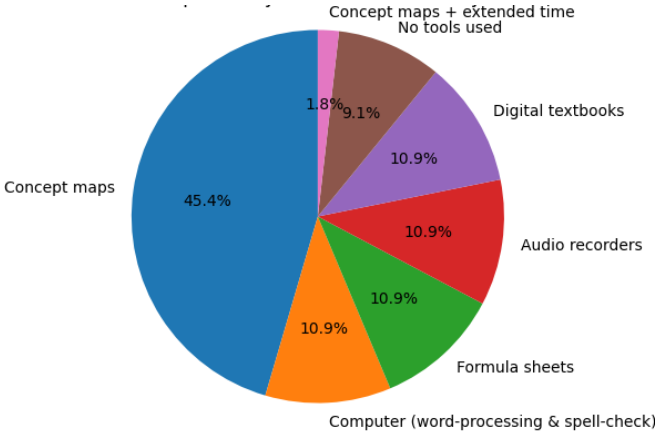
3.2 Compensatory and dispensatory tools: experience during high school.

When asked about how often they had been granted the right to use compensatory and/or dispensatory tools during secondary school, most participants reported having regular access to such measures: 36.36% answered "always" and 38.18% "often." However, a non-negligible proportion reported only partial access ("sometimes," 18.18%; "rarely," 5.45%) or no access at all ("never," 1.82%) (Tab.1). These data suggest that, although the implementation of legal provisions is generally ensured, disparities still exist in how these rights are applied across institutions.

3.3 Compensatory and dispensatory tools: experience and use within the university context.

At the university level, the most frequently used compensatory tools were concept maps (45.45%), followed by computers with word-processing and spell-checking functions (10.91%), formula sheets (10.91%), audio recorders (10.91%), and digital textbooks (10.91%). Interestingly, 9.09% of the sample reported not using any tools at all, while a single participant (1.82%) indicated using a combination of concept maps and extended time. These findings highlight a degree of heterogeneity both in preferences and in opportunities for using available tools. (Fig. 1)

Figure 1. most used compensatory tools



3.4 Compensatory and dispensatory tools: recognition of rights during university examinations.

Regarding examination settings, 47.27% of students reported that their right to use compensatory tools was always recognized, 25.45% said often, and 20% said sometimes. However, 7.27% stated that they had never been allowed to use these measures, indicating potential inconsistencies in how accommodations are applied (Tab. 1) In addition, several participants reported being denied tools they considered essential, particularly concept maps (21.82%) and extended time (9.09%).

3.5 Compensatory and dispensatory tools: emotional well-being.

A large majority of students (70.91%) reported that the ability to use compensatory tools positively affected their emotional well-being, helping them feel calmer and less anxious. Conversely, 29.09% did not perceive a significant impact, often citing personal reasons such as the desire not to “feel different” or negative experiences with the denial of rights. Participants were also asked whether having an SLD had influenced their choice of academic major. Most students (81.82%) stated that their diagnosis had not affected their academic decisions, indicating that their choice was guided by personal interests, passions, and goals. However, nearly one-

fifth of the sample (18.18%) acknowledged that SLD had played a role in their decision-making: for some, awareness of challenges related to writing or foreign-language learning led them to choose fields they considered more accessible.

3.6 Access to new technologies and artificial intelligence.

In respect to the a Artificial Intelligence (AI)–based tools, nearly half of the students (45.45%) reported never using AI programs, while 23.64% used them sometimes, 18.18% rarely, and 9.09% often. Only two students (3.64%) reported always using AI (Tab.1). The most appreciated features included generating summaries (25.45%), text rewriting (7.27%), translation of academic articles (3.64%), and text-to-speech functionality (5.45%). Although the overall adoption of AI remains limited, this emerging trend suggests that such tools could play an increasingly significant role in supporting students with SLD in the coming years

3.7 University support services.

Most students (81.82%) reported having easy access to the university's SLD support services, while 18.18% experienced difficulties, often related to a lack of information or limited staff availability. Among the most useful supports were mediation with instructors (34.55%), personalized counseling meetings (14.55%), and orientation services (14.55%).

3.8 Academic performance (GPA).

Regarding academic performance, measured by Grade Point Average (GPA), the data showed a distribution concentrated in the midrange. The majority of students (61.8%) reported an average score between 20 and 24 out of 30, while 29.1% were in

the higher range (25–28 out of 30). A small proportion (5.5%) had an average below 20/30, and only 3.6% achieved the highest level, corresponding to an average above 28/30.

Table 1 Students' experiences regarding the recognition and use of compensatory and dispensatory tools.

Answer option	Using during high school %	Recognition of the Right to Accomodation During exams %	A.I. use learning %
"Always"	36.36	47.27	3.64
"Often"	38.18	25.45	9.09
"Sometimes"	18.18	20.0	23.64
"Rarely"	5.45	0	18.18
"Never"	1.82	7.27	45.45

4. Discussion

The descriptive analysis of students' use and perception of compensatory tools revealed a persistent gap between normative expectations and actual practice. Overall, the data indicate that the effectiveness of support measures is hindered by institutional discontinuity. A central issue concerns the ongoing heterogeneity in the implementation of accommodations during examinations. While nearly half of the participants reported that such measures were *always* granted, a substantial proportion stated that they were not consistently provided. This finding is consistent with previous research documenting variability in the application of accommodations across institutions (Lombardi et al., 2015; Moriña, 2017). Such inconsistency suggests a lack of procedural standardization within universities, directly affecting the equity of students' academic experiences.

Regarding the type of compensatory tools, concept maps emerged as the most widely used resource, followed by technological aids such as computers, formula sheets, audio recorders, and digital textbooks. The predominance of concept maps suggests that, at the university level, the main challenge for students with SLD extends beyond decoding difficulties to include managing information load. Concept maps assist with hierarchical organization and working memory for complex content, aligning with the well-documented need among students with SLD for visuospatial supports that facilitate information organization and elaboration (Cornoldi et al., 1996). Data seem to confirm specific difficulties observed in developmental population (Peng & Fuchs, 2016) but also ask to precise data on neurocognitive profile of adult students that choose to embrace university path and are at the and of maturational of specific brain circuits connected to executive function (Tervo-Clemmens et al., 2023). Consequently, more fine-grained elevations should target not only reading and writing skills but also executive functions and metacognitive study strategies.

The finding that 9.09% of students reported not using any compensatory tools raises important questions about the adequacy of information provided to students regarding their rights and available resources, as well as about the overall accessibility of university services.

An innovative finding concerns the use of artificial intelligence (AI)–based tools: although the majority of students had not yet adopted them (45.45%), a growing proportion reported occasional use (23.64% “sometimes”; 9.09% “often”). The most valued functions included text summarization and rewriting, confirming the relevance of technologies that help reduce cognitive load. This trend reflects a rapidly evolving academic landscape in which AI may represent a new domain of personalized support for students with SLD (Gaggioli, 2025; Kuerban et al., 2025).

It is particularly noteworthy that over two-thirds of the sample (70.91%) perceived a positive impact of compensatory tools on their emotional well-being. Students reported that such measures reduce anxiety and stress, enhancing their ability to demonstrate competencies under fairer conditions. This finding reinforces the pedagogical and psychological value of compensatory tools, consistent with frameworks that emphasize emotional well-being as a critical component of academic success (Deci & Ryan, 2000; Mammarella et al., 2021). Within this framework, it becomes essential to reflect, and furtherly examine emotional and motivational factors at the base of learning process. In particular studies on f self-regulated learning and positive attitudes toward academic engagement are needed to furtherly investigate relevant aspects of learning path during the university period.

5. Future Directions

This first study have several limitation related to the small number of participants, specific geographical context and the use self-report questionnaire to assess emotional–motivational aspects and compensatory tool usage. Despite these limitations, this study aims to offer a first insight for designing and implementing research on this filed and an unique occasion to further investigate: The study, in fact, offers a crucial exploratory contribution and serves as a foundational step for subsequent research. By highlighting the heterogeneity of compensatory tool use, the variability in perceived institutional support, and the emotional ambivalence associated with accommodations, the findings underscore the need to move beyond descriptive accounts of students' experiences and to investigate the underlying factors that shape these experiences and their academic consequences.

In light of these considerations, the remaining studies included in this dissertation were specifically designed to address the key gaps identified by the first investigation. A primary motivation concerns the limited availability of empirical evidence on the neurocognitive functioning of adults with SLDs, particularly in higher education contexts. While SLDs are well documented in childhood and adolescence, far less is known about how instrumental skills and domain-general cognitive processes such as working memory, executive functions, and processing efficiency, manifest in adulthood among students who access university. A deeper understanding of these characteristics is essential for interpreting students' needs, their reliance on compensatory tools, and their ability to benefit from academic supports.

A second major gap emerging from the first study relates to self-regulated learning. Although autonomy, planning, monitoring, and strategic adaptation are central requirements of university learning, the literature examining self-regulated learning processes in university students with SLDs remains scarce. The experiential findings suggested that difficulties might not lie solely in the availability of tools, but also in students' capacity to regulate their learning effectively within complex academic environments. This observation motivated further investigation into metacognitive, motivational, and emotional processes supporting or hindering self-regulation.

Finally, this study pointed to the need for a more refined understanding of diagnostic heterogeneity and comorbidity. Students' experiences with compensatory measures and academic demands appeared highly variable, suggesting that different SLD profiles, and particularly the presence of multiple diagnoses, may be associated with distinct cognitive and functional patterns. However, comorbidity in adult SLD populations has been only marginally explored in the literature, especially in relation to university learning and academic choices.

Taken together, these limitations and open questions provided the rationale for the subsequent four studies, which progressively shifted the focus from students' lived experiences to a systematic examination of instrumental skills, neurocognitive functioning, motivational–emotional factors, and their evolution across the university trajectory. This integrated approach aims to bridge the gap between subjective academic experiences and objective cognitive profiles, ultimately contributing to the development of more targeted, evidence-based, and equitable support practices in higher education.

5. References

American Psychiatric Association. (2013). DSM-5: Manuale diagnostico e statistico dei disturbi mentali (5th ed.). R. Cortina.

Ben-Eliyahu, A. (2019). Academic Emotional Learning: a critical component of Self-Regulated Learning in the Emotional Learning cycle. *Educational Psychologist, 54*(2), 84–105. https://doi.org/10.1080/00461520.2019.1582345.

Billinghurst, M., & Duenser, A. (2012). Augmented reality in the classroom. *Computer, 45*(8), 56–63.

Bonuomo, M., Marini, M., Vegni, N., Melogno, S., Torregiani, G., Livi, S., & Di Filippo, G. (2023). Analysis of Psychological and Social Functioning in Undergraduate Students with a Specific Learning Disorder (SLD). *Brain Sciences, 13*(7), 1020. https://doi.org/10.3390/brainsci13071020.

Carnovali, S. (2017). The Right to Inclusive Education of Persons with Disabilities in Italy. Reflections and Perspectives. *Athens Journal of Education, 4*(4), 315–326.

Casali, N., Meneghetti, C., Tinti, C., Re, A. M., Sini, B., Passolunghi, M. C., Valenti, A., Montesano, L., Pellegrino, G., & Carretti, B. (2024). Academic Achievement and Satisfaction Among University Students With Specific Learning Disabilities: The Roles of Soft Skills and Study-Related Factors. *Journal of Learning Disabilities, 57*(1), 16–29. https://doi.org/10.1177/00222194221150786.

Cassady, J. C. (2010). Test anxiety: Contemporary theories and implications for learning. In J. C. Cassady (Ed.), *Anxiety in schools: The causes, consequences, and solutions for academic anxieties* (pp. 7–26). Peter Lang.

Cazzaniga, S., Re, A. M., Cornoldi, C., Poli, S., & Tressoldi, P. E. (2005). *Dislessia e trattamento sublessicale (Dyslexia and sublexical treatment)*. Erickson.

Ciuffo, M., Angelini, D., Barletta Rodolfi, C., Gagliano, A., Ghidoni, E., & Stella, G. (2019). *BDA 16-30. Valutazione clinica delle abilità di lettura, scrittura e comprensione del testo in adolescenti e giovani adulti*.

Consensus Conference. (2007). *Disturbi Evolutivi Specifici dell'Apprendimento – Raccomandazioni per la pratica clinica definite con il metodo della Consensus Conference*. Milano, 26 gennaio.

Consiglio Nazionale Ordine degli Psicologi. (2016). *I DSA e gli altri BES: Indicazioni per la pratica professionale*.

D'Alonzo, L. (2022). Promuovere l'inclusione nell'Università. Un salto di qualità. *Scienze dell'Educazione e Società - Open Access, 13*(1). https://doi.org/10.3280/ess1-2022oa13499.

De Beni, R. (1994). Memoria, Apprendimento e immaginazione. In P. Legrenzi (a cura di), *Manuale di psicologia generale*. Il Mulino.

De Beni, R., & Moè, A. (1995). *Questionario di attribuzione. Attribuzione delle cause di successo/fallimento in compiti cognitivi*. Organizzazioni Speciali.

De Beni, R., Moè, A., & Cornoldi, C. (2003). *Test AMOS*. Erickson.

De Beni, R., Moè, A., Cornoldi, C., Meneghetti, C., Fabris, M., Zamperlin, C., & De Min Tona, G. (2014). *Test AMOS -Abilità e motivazione allo studio: prove di valutazione e orientamento per la scuola secondaria di secondo grado e l'università: Nuova edizione*. Erickson.

Fogarolo, F., & Scapin, C. (2010). *Competenze compensative: tecnologie e strategie per l'autonomia scolastica degli alunni con dislessia e altri DSA*. Erickson.

Fong, H., & Soni, A. (2022). A systematic review on test anxiety in children and young people with learning difficulties. *Support for Learning*, *37*(1), 21–43. https://doi.org/10.1111/1467-9604.12393.

Gaggioli, C. (2025). Reading and Writing in the Age of AI. Opportunities and Challenges for Students with dyslexia. *Italian Journal of Special Education for Inclusion*, *XIII*(1), 107–119. https://doi.org/10.7346/sipes-01-2025-8.

Ghisi, M., Bottesi, G., Re, A. M., Cerea, S., & Mammarella, I. C. (2016). Socioemotional Features and Resilience in Italian University Students with and without Dyslexia. *Frontiers in Psychology*, *7*. https://doi.org/10.3389/fpsyg.2016.00478.

Haft, S. L., De Magalhães, C. G., & Hoeft, F. (2022). A systematic review of the consequences of stigma and stereotype threat for individuals with specific learning disabilities. *Journal of Learning Disabilities*, *56*(3), 193–209. https://doi.org/10.1177/00222194221087383.

Hooda, M., & Saini, A. (2017). Academic Anxiety: An Overview. *Educational Quest: An International Journal of Education and Applied Social Science*, *8*(3), 807–810. https://doi.org/10.5958/2230-7311.2017.00139.8.

Huang, C. (2016). Achievement goals and self-efficacy: A meta-analysis. *Educational Research Review*, *19*, 119–137. https://doi.org/10.1016/j.edurev.2016.07.002.

Iaia, M., Vizzi, F., Carlino, M. D., Turi, M., Marinelli, C. V., & Angelelli, P. (2024). Specific learning disabilities and associated emotional-motivational profiles: a study in Italian university students. *Frontiers in Psychology*, *15*. https://doi.org/10.3389/fpsyg.2024.1365980.

Istituto Superiore di Sanità (ISS), Sistema Nazionale Linee Guida. (2011). *Consensus Conference Disturbi Specifici di Apprendimento (CC-ISS)*.

Istituto Superiore di Sanità (ISS). (2022). *Linee Guida sulla gestione dei Disturbi Specifici dell'Apprendimento*.

Jiménez-Mijangos, L. P., Rodríguez-Arce, J., Martínez-Méndez, R., & Others. (2023). Advances and challenges in the detection of academic stress and anxiety in the classroom: A literature review and recommendations. *Education and Information Technologies*, *28*(5), 3637–3666.

Johnson, E., Masser, J. S., & Spears, L. (2023). Self-Regulated Learners: A Comprehensive, Translational Framework for Students with Learning Disabilities. *Exceptionality*, *31*(1), 52–68. https://doi.org/10.1080/09362835.2021.1938063.

Kuerban, Y., Oyelere, S. S., & Sanusi, I. T. (2025). ReadSmart: Generative AI and augmented reality solution for supporting students with dyslexia learning disabilities. *International Journal of Technology in Education and Science (IJTES)*, *9*(1), 159–176. https://doi.org/10.46328/ijtes.599.

Luckin, R., & Holmes, W. (2016). *Intelligence unleashed: An argument for AI in education*. Pearson.

MacCullagh, L., Bosanquet, A., & Badcock, N. A. (2017). University students with dyslexia: A qualitative exploratory study of learning practices, challenges and strategies *Dyslexia*, *23*(1), 3–23. https://doi.org/10.1002/dys.1544

Meneghel, I., Martínez, I. M., Salanova, M., & De Witte, H. (2019). Promoting academic satisfaction and performance: Building academic resilience through coping strategies. *Psychology in the Schools*, *56*(6), 875–890. https://doi.org/10.1002/pits.22253.

Montesano, L., Valenti, A., & Cornoldi, C. (2020). *LSC-SUA. Prove di lettura, comprensione del testo, scrittura e calcolo. Batteria per la valutazione dei DSA e altri disturbi in studenti universitari e adulti*.

Morosini, G., Cuder, A., Bortolotti, E., Bologna, V., Lonciari, I., Passolunghi, M. C., Brumat, R., Iannice, C., Košak Babuder, M., & Pellizzoni, S. (2025). University students with specific learning disabilities: Insights from instrumental, neuropsychological and study-related profiles. *British Journal of Special Education*, *00*, 1–12. https://doi.org/10.1111/1467-8578.70009.

Muis, K. R. (2007). The role of epistemic beliefs in self-regulated learning. Educational psychologist, 42(3), 173-190.

Murdaca, A., Nuzzaci, A., Oliva, P., & Cuzzocrea, F. (2014). Predizione della credenza di autoefficacia, dell'ansia e degli stili decisionali sui risultati universitari. *Formazione Insegnamento*, *12*, 291–310.

Nair, B. M. (2023). The efficacy of artificial intelligence- driven immersive reader for dyslexic students in special schools: A case study. *Journal of English Language Teaching*, *65*(5), 3–8.

Nenzioni, M., & Friso, V. (2020). Being a student with Specific Learning Disorder at university: some results of an exploratory survey within the University of Bologna. *Formazione & insegnamento*, *18*(2), 193–209.

Panicker, A. S., & Chelliah, A. (2016). Resilience and Stress in Children and Adolescents with Specific Learning Disability. *Journal of the Canadian Academy of Child and Adolescent Psychiatry*, *25*(1), 17–23.

Pavone, M. (2018). Le università di fronte alla sfida dell'inclusione degli studenti con disabilità. In *UNIversal Inclusion. Rights and Opportunities for Students with Disabilities in the Academic Context* (pp. 283–298). Franco Angeli.

Pinnelli, S., Fiorucci, A., & Giaconi, C. (2024). *I linguaggi della Pedagogia Speciale: La prospettiva dei valori e dei contesti di vita*. Pensa Multimedia.

Pizzigallo, E., Cornoldi, C., Buono, S., Città, S., Viola, F., & Toffalini, E. (2023). The Intellectual Profile of Adults with Specific Learning Disabilities. *Journal of Intelligence*, *11*(12), 223. https://doi.org/10.3390/jintelligence11120223.

Rega, A., Di Fuccio, R., Inderst, E., & Limone, P. (2024). Learning Enhancer Tools (LET): un modello teorico per la progettazione di applicazioni educative basate sull'intelligenza artificiale. *Sistemi Intelligenti, 3*, 573–586. https://doi.org/10.1422/115331.

Rimm-Kaufman, S. E., Pianta, R. C., & Cox, M. J. (2000). Teachers' judgments of problems in the transition to kindergarten. *Early Childhood Research Quarterly*, *15*(2), 147–166.

Rossi, S., Gottardo, G., & Romano, A. (2024). Per un'epistemologia pratica della progettazione inclusiva all'università. Una revisione sistematica della letteratura. *Q-TIMES WEBMAGAZINE*, *16*(2), 340–358. https://doi.org/10.14668/QTimes_16226.

Smith, C. R. (1994). *Learning disabilities, the interaction of learner, task, and setting* (3rd ed.). Allyn and Bacon.

Spadacini, D. (2024). *Catalizzando l'evoluzione dell'apprendimento: un'analisi delle applicazioni dell'intelligenza artificiale in Learning Analytics*.

Stein, B., Hoeft, F., & Richter, C. G. (2024). Stress, resilience, and emotional well-being in children and adolescents with specific learning disabilities. *Current Opinion in Behavioral Sciences*, *58*, 101410. https://doi.org/10.1016/j.cobeha.2024.101410.

Straus, E., Dev, S. I., & Moore, R. C. (2020). The measurement of resilience and grit: Room for improvement. *Psychiatry Research*, *285*, 112791. https://doi.org/10.1016/j.psychres.2020.112791.

Torrigiani, C. (2019). *Come valutare le politiche per l'inclusione degli studenti con disabilità e degli studenti con disturbi specifici dell'apprendimento nei percorsi universitari?: uno studio di caso*. Formazione & Insegnamento, 17(3), 191–208.

Tressoldi, P. E., Vio, C., Lorusso, M. L., Facoetti, A., & Iozzino, R. (2003). Confronto di efficacia ed efficienza tra trattamenti per il miglioramento della lettura in soggetti dislessici [A comparison of the efficacy of the treatments to improve reading skills in dyslexic subjects]. *Psicologia Clinica dello Sviluppo*, *7*(3), 481–494.

Wechsler, D. (2008). *WAIS-IV. Administration and Scoring Manual*. Pearson.

World Health Organization. (2004). *ICD-10: international statistical classification of diseases and related health problems: tenth revision* (2a ed.). World Health Organization. https://iris.who.int/handle/10665/42980.

World Health Organization. (2019). *International Statistical Classification of Diseases and Related Health Problems (ICD-11)* (11th ed.). World Health Organization. https://icd.who.int/.

Zawacki-Richter, O., Marín, V. I., Bond, M., & Gouverneur, F. (2019). Systematic review of research on artificial intelligence applications in higher education – where are the educators?. *International Journal of Educational Technology in Higher Education*, *16*(39), 1–27.

Zimmerman, B. J., & Moylan, A. R. (2009). *Self-regulation: Where metacognition and motivation intersect.* In D. J. Hacker, J. Dunlosky, & A. C. Graesser

(Eds.), Handbook of metacognition in education (pp. 299–315). Routledge. https://doi.org/10.4324/9780203876428

Zingoni, A., Taborri, J., Panetti, V., Bonechi, S., Aparicio-Martínez, P., Pinzi, S., & Calabrò, G. (2021). Investigating Issues and Needs of Dyslexic Students at University: Proof of Concept of an Artificial Intelligence and Virtual Reality-Based Supporting Platform and Preliminary Results. *Applied Sciences*, *11*(10), 4624.

Sitografia

Linea Guida sulla gestione dei Disturbi Specifici dell'Apprendimento. (2023). Istituto Superiore di Sanità. https://www.iss.it/documents/20126/8331678/LG-389 AIP_DSA.pdf/a288d319-fb01-bb17-9be1-d1cbd6a50e19?t=1677495513359.

Ministero dell'Istruzione. (2022). *I principali dati relativi agli alunni con DSA*. https://www.mim.gov.it/documents/20182/6891182/Focus+sugli+alunni+con+Disturbi+Specifici+dell'Apprendimento_aa.ss.201920_202021#:~:text=%3A%20nell'a.-,s.,e%20al%205%2C8%25.

Ministero dell'Università e della Ricerca. (2021). *Decreto Ministeriale n. 1320 del 17-12-2021*. https://www.mur.gov.it/sites/default/files/2022-01/Decreto%20Ministeriale%20n.%201320%20del%2017-12-2021.pdf

Legge 8 ottobre 2010, n. 170. Nuove norme in materia di disturbi specifici di apprendimento in ambito scolastico. (2010). https://www.istruzione.it/esame_di_stato/Primo_Ciclo/normativa/allegati/legge170_10.pdf

Senato della Repubblica. (2025). *Disegno di legge n. 508: XIX legislatura – Allegato A ai Resoconti – Seduta del 10 luglio 2025*.

https://documenti.camera.it/leg19/resoconti/assemblea/html/sed0508/leg.19.sed0508.allegato_a.pdf

In light of the findings emerging from the first study, which focused on the everyday academic experience of university students with Specific Learning Disorders, it became evident that a more systematic investigation of their cognitive and learning profiles was required. The initial study highlighted substantial variability in the use of compensatory tools, inconsistencies in the implementation of accommodations, and mixed emotional responses associated with support measures. While these findings provided an essential picture of how students with SLDs perceive and navigate the university environment, they also raised a crucial question: which underlying instrumental and neurocognitive characteristics may explain the need for such supports and shape students' ability to benefit from them?

Building on these considerations, the subsequent two studies were designed to move beyond the experiential level and to examine in greater depth the instrumental and neuropsychological foundations of learning in university students with SLDs. Specifically, the second study aimed to describe the profiles of first-year university students with SLDs by assessing instrumental skills (reading and arithmetic), core neuropsychological functions, and study-related abilities. This investigation sought to clarify which difficulties typically observed in childhood persist into adulthood and how they coexist with areas of preserved or enhanced functioning. By integrating measures of instrumental performance, working memory, visuospatial abilities, and self-reported study approaches, the study provided a comprehensive picture of the strengths and vulnerabilities that characterize the early phase of the university transition.

STUDY 2

University students with specific learning disabilities: Insights from instrumental, neuro-psychological and study-related profiles.

(Paper published in: European Journal of Special Needs Education; Morosini, G., Cuder, A., Košak Babuder, M., Lonciari, I., Bortolotti, E., Passolunghi, M. C., & Pellizzoni, S. (2025)

1. Introduction

In recent decades, enhancements in the diagnostic process for specific learning disabilities (SLDs), coupled with increased awareness among educators, parents and school professionals have significantly improved the accuracy of diagnoses and interventions, as well as the effectiveness of support systems in primary and secondary education. These advancements play a crucial role in facilitating access to higher education for individuals with SLDs, by addressing their needs during their school years (Anthony et al., 2024; Laguillo et al., 2023; Ministero dell'Istruzione, 2022). This positive trend has encouraged a greater number of students with SLDs to enrol in higher education, especially because an Italian law (No. 17/1999) extended the right to higher education to all students, regardless of their physical, mental or sensory conditions. This law (supplemented by the subsequent Decree of the President of the Council of Ministers on 9 April 2001 on 'Measures for the Treatment of the Right to Higher Education') promotes the inclusion of young people with disabilities in higher education by providing universities with specific guidelines for their inclusion policies. Nevertheless, the prevalence of students with SLDs in Italian universities is quite imprecise due to the absence of official data and large-scale

prevalence monitoring (Longobardi et al., 2019). On the basis of information collected by SLD services at 19 public universities in Italy (Longobardi et al., 2019), the estimated prevalence ranges from 0.03% to 0.48%. The National Agency for the Evaluation of Universities and Research Institutes (ANVUR, 2022) found an increase in the number of students with disabilities or SLDs in Italian universities, with prevalence rising from 0.27% in 1999/2000 to 1.82% in 2019/2020. While both national and international studies report growing enrolment of students with SLDs (ANVUR, 2022; Del Tufo & Earle, 2020; Newman et al., 2011), research also indicates they tend to have lower levels of academic success, often demonstrating reduced achievement (Casali et al., 2024; Trainin & Swanson, 2005) and facing difficulties with assignments and exams (Becker & McGregor, 2016; McGregor et al., 2016). These challenges could also lead to early dropout or to ending their studies at the Bachelor level (ANVUR, 2022). In other words, the national context is marked by a growing number of students with SLDs aspiring to attend university. However, national reports suggest that the outlook for academic success does not seem promising in terms of attendance and achievement (ANVUR, 2022; Casali et al., 2024).

Examining the Italian context may therefore offer a unique opportunity to identify the obstacles these students face. Previous studies have aimed to characterise and evaluate how students with SLDs differ from their typically developing peers (e.g. Casali et al., 2024; Johnson et al., 2010; Trainin & Swanson, 2005), focusing on factors that appear to shape their academic trajectory, such as neuropsychological profiles (i.e. core cognitive functions that support learning and academic performance), study-related abilities (i.e. the skills and behaviours associated with studying and learning in an academic context) and instrumental abilities (i.e. the specific and practical skills enabling students to effectively meet

school or university demands). However, few studies have explored all these dimensions simultaneously within the university student population with SLDs, particularly in the Italian context (Casali et al., 2024). Given this gap, the general aim of the present study is to assess how the neuropsychological, study-related and instrumental abilities of students with SLDs differ from the normative averages of standardised assessment tools. The findings will offer valuable insights into the strengths and weaknesses of these students, providing professionals and policymakers with essential guidance for developing tailored interventions for this specific student population.

1.1.Neuropsychological characteristics of young adults with SLDs

A crucial factor associated with the diagnosis of SLDs is neuropsychological difficulties, which represent both a marker of the diagnosis itself and a risk factor for learning. Indeed, there is growing evidence to show that students with SLDs exhibit difficulties in different neuropsychological abilities such as working memory (Peng & Fuchs, 2016) and visuospatial (Chamberlain et al., 2018) and verbal abilities (Del Tufo & Earle, 2020). Working memory represents a limited-capacity cognitive system responsible for storing and processing information during task execution (Baddeley, 1996), and it is a cognitive system that is greatly involved in learning throughout development (e.g. Allen et al., 2019; Peng & Fuchs, 2016). Studies consistently show that students with SLDs display weakness in working memory (Peng & Fuchs, 2016; Swanson & Hsieh, 2009; Swanson & Siegel, 2011; Willcutt et al., 2007). For instance, Peng and Fuchs (2016) showed that individuals with learning difficulties tend to exhibit difficulties in verbal and numerical working memory. Similarly, Liebel and Nelson (2017) found that university students with SLDs have weaker auditory working

memory compared to a control group. Additionally, they found that auditory working memory in students with SLDs was weaker than their visual working memory.

Another cognitive skill commonly discussed in relation to SLDs is visuospatial abilities, which enable individuals to process, organise and manipulate spatial representations and relationships between and within objects (Newcombe & Shipley, 2014; Uttal et al., 2013). Some authors (e.g. Gilger et al., 2016) suggest that the relative advantage of SLDs in this domain is a matter of debate, and further studies are needed to explore this topic.

A recent meta-analysis by Chamberlain et al. (2018) showed that students with SLDs tend to have lower visuospatial abilities than their peers. However, the authors noted significant heterogeneity in the literature, highlighting that greater visuospatial abilities might be observed in individuals placed in educational contexts that require strong visuospatial and creative thinking for academic success. Therefore, further exploration of SLDs in the university context could reveal unique patterns related to this issue.

Difficulties in the language domain are equally relevant when considering students with SLDs. For instance, Hall and Barnes (2017) showed that lexical-semantic difficulties are associated with compromised semantic fluency, and these two difficulties are more likely among students with more severe disabilities. In their study, the authors found that difficulties in the lexical-semantic system associated with SLDs might persist into young adulthood, even among those who have managed their disability well enough to pursue university studies. Furthermore, Del Tufo and Earle (2020) show that difficulties experienced in phonological abilities are similar to those experienced in childhood.

Synthesis research on neuropsychological profiles in young adults with SLDs show a consistent impairment in working memory (Peng & Fuchs, 2016; Swanson & Siegel, 2011; Willcutt et al., 2007) and difficulties in the language domain (e.g. Del Tufo & Earle, 2020). However, compared to younger student populations, university students with SLDs remain underexplored in the literature, particularly regarding the inconsistencies found in their visuospatial abilities relative to typically developing students (Chamberlain et al., 2018). This gap underscores the need for more comprehensive investigations that consider not only these factors but also academic, motivational and instrumental abilities, which may also influence academic success.

1.2 Study-related abilities

As the enrolment of students with SLDs in higher education in Italy is a relatively recent (but growing) phenomenon, little is known about study-related abilities among Italian students with SLDs (Casali et al., 2024; Matteucci & Soncini, 2021; Pellegrino et al., 2023). Different studies have tried to evaluate strengths and opportunities in study-related abilities that university students with SLDs must have to obtain good results during their university education, together with weaknesses and obstacles (MacCullagh et al., 2017; Mortimore & Crozier, 2006; Olofsson et al., 2012; Pino & Mortari, 2014). In fact, evidence shows that factors such as study-related abilities are crucial for supporting the academic success of students with SLDs. In particular, study approaches (i.e. the individual's typical and stable methods of learning, processing, storing and retrieving information), study strategies (i.e. specific actions that students employ to solve problems or achieve goals) and learning goals (i.e. objectives that individuals set for themselves, such as mastery-orientated versus performance-orientated goals) (De Beni et al., 2014), are central to success in university (Ben-

Eliyahu, 2019); however, only a few studies have focused on students with SLDs (Ben-Naim et al., 2017). In this context, evidence seems to indicate that students with SLDs display fewer study strategies (e.g. Kirby et al., 2008; Mortimore & Crozier, 2006) and approaches (e.g. Holzer et al., 2009; Kirby et al., 2008) than their peers without SLDs. Furthermore, evidence also shows that adolescents with SLDs might not set competence-orientated goals that are commonly associated with positive outcomes (Diseth et al., 2012; Mega et al., 2014; Roebken, 2007), but instead focus solely on performance-orientated objectives (Baird et al., 2009). Conversely, recent data suggest that university students with SLDs exhibit study strategies and learning goals that are similar to those of their peers without SLDs (Casali et al., 2024). Given these sparse and mixed results, further studies are necessary to better understand the profiles of students with SLDs, taking into account their study-related abilities and neuropsychological profiles.

Recent international evidence further underscores the central role of motivational and metacognitive factors in shaping academic outcomes in higher education. Sharabi et al. (2025a) demonstrated that academic self-efficacy and self-regulated learning (SRL) significantly mediate the relationship between socio-emotional (“soft”) skills and both academic achievement and satisfaction among undergraduate students. In a subsequent cross-national study including students with and without SLD/ADHD, Sharabi et al. (2025b) found that students with neurodevelopmental disorders reported lower academic self-efficacy and SRL, and that these variables fully mediated the relationship between SLD/ADHD status and academic achievement. These findings highlight that motivational and metacognitive processes are not merely correlates of academic performance, but central

mechanisms through which neurodevelopmental conditions may influence academic trajectories.

Taken together, this recent evidence strengthens the rationale for examining study-related abilities alongside instrumental and neuropsychological functioning in university students with SLDs. Understanding how cognitive vulnerabilities interact with self-efficacy beliefs and self-regulatory processes is essential for developing comprehensive models of academic adaptation in higher education.

1.3 The present study

Given the lack of studies targeting university students at the beginning of their university careers, especially in the national context, more data are needed to address differences in instrumental, neuropsychological and study-related factors between students with SLDs and their neurotypical peers. This is particularly significant given that, according to current knowledge, the neurobiological patterns of SLDs can change during an individual's development (Hatcher et al., 2002; Swanson & Hsieh, 2009). Indeed, although these difficulties can be mitigated through compensatory strategies during development, thereby reducing their negative impact on students' learning experiences and daily lives (Deshler, 2005), they remain resistant to treatment and cannot be fully eliminated (Trainin & Swanson, 2005). Research in this area could also enable the development of interventions aimed at promoting well-being, academic success and enjoyment during university education.

Based on the theoretical framework, this study addresses the following research question: how do students with SLDs differ from the normative average of standardised, validated assessments regarding instrumental, neuropsychological

and study-related abilities? In pursuit of this aim, we specified the following hypotheses:

- We hypothesise that university students with SLDs exhibit lower instrumental abilities (i.e. arithmetic fact retrieval and reading skills) compared to the normative average, as evidence suggests that difficulties in these aspects tend to persist into adulthood (Casali et al., 2024; Trainin & Swanson, 2005). Nonetheless, these difficulties may evolve over time and can be mitigated through compensatory strategies developed by the students themselves (George & Pech-Georgel, 2017; Hatcher et al., 2002; Swanson & Hsieh, 2009).

- Considering neuropsychological abilities, we expect to find lower working memory levels in students with SLDs (Peng & Fuchs, 2016; Swanson & Siegel, 2011; Willcutt et al., 2007) relative to the normative average. However, we do not specify hypotheses concerning verbal and visuospatial abilities due to inconsistent findings in the literature (Chamberlain et al., 2018; Del Tufo & Earle, 2020; Operto et al., 2021).
- Considering study-related abilities, we do not expect statistically significant differences in study strategies between students with SLDs and the normative average, largely due to the interventional support students with SLDs typically receive following diagnosis (Casali et al., 2024). Nevertheless, we hypothesise that students with SLDs will exhibit lower levels of study approach and competence-orientated learning goals. Indeed, prior findings suggest that students with SLDs display reduced engagement in behaviours related to regulating and monitoring learning (e.g. asking questions during lectures, managing exam demands, and using metacognitive skills) as well as lower competence-orientated learning goals

(Baird et al., 2009; Diseth et al., 2012; Holzer et al., 2009; Kirby et al., 2008; Mega et al., 2014; Mortimore & Crozier, 2006; Roebken, 2007).

2 METHOD

2.2 Participants

Before conducting the study, we carried out a priori power analysis using G*Power (Faul et al., 2007). Specifically, given the planned statistical approach of comparing participants with SLDs to the normative mean of standardised instruments, we intended to conduct two-tailed one-sample *t*-tests, assuming a medium effect size (Cohen's *d* = 0.50), a statistical power of 0.80 and an alpha level of 0.05. The a priori power analysis indicated that a sample of 34 participants would be sufficient for the planned analyses.

The inclusion criteria for the sample required a documented SLD diagnosis and enrolment in the first year of university. Based on these criteria, 70 undergraduate students with SLDs were initially recruited. We then applied exclusion criteria to remove participants whose additional conditions could confound our analyses, including low IQ, other neurodevelopmental disorders (e.g. ADHD, autism spectrum disorder), acute psychiatric syndromes or incomplete evaluation. As a result, 10 participants were excluded: two had IQ scores below 70, four had a comorbid diagnosis of SLDs and ADHD, and four did not complete the evaluation. Thus, the final sample consisted of 60 participants (Mage = 19.97, SDage = 1.98, MINage = 18, MAXage = 31, 32 females, 28 males). All the participants were enrolled in the first year of university.

Data collection was conducted in conjunction with the diagnosis follow-up at the Children's Hospital Burlo Garofolo. All the participants come from the north-east

of Italy. All the students were white and native Italian speakers, or fluent in Italian (based on the WAIS Verbal Comprehension; Orsini & Pezzuti, 2013). The sample reflects the demographic composition of the Italian university population (ISTAT, 2016), which comprises a very small proportion of students from other EU countries (2.3%) or non-EU countries (2%).

The study received approval from the ethical committees of the University of Trieste and the Children's Hospital Burlo Garofolo. The study was conducted in compliance with the Declaration of Helsinki, the ethical guidelines of the Italian Association of Psychology, and the ethical code of the Italian Register of Professional Psychologists. Written informed consent was obtained before assessing the students. They participated voluntarily and were informed that they could withdraw from the study if they felt distressed during the assessment activities.

Regarding diagnosis (see Table 1), 26 have a single impairment diagnosed (either dyslexia, dysgraphia, dyscalculia or dysorthography), and 34 have a mixed form of SLD with two or three impairments (e.g. dyslexia and dyscalculia). Moreover, our data show a higher frequency of students with dyslexia compared to other diagnostic categories, which display similar frequencies, supporting that the present sample is sufficiently representative of the diagnostic distribution of the Italian SLD population (Ministero dell'Educazione, 2022).

According to the Regional Health System and the Italian Ministry of Health's policies, the diagnosis is made using the ICD-10 diagnostic classification system, which includes subtypes for specific reading, spelling, arithmetic and mixed types. This category is known as ‘Specific Developmental Disorders of Scholastic Skills’ (ICD-10 code: F81). The diagnosis of SLD must be provided by the local health

authority or by private professionals (e.g. psychologists, neuropsychiatrists) and subsequently approved by the local health authority.

TABLE 1 Descriptive characteristics of the sample investigated.

			Age		
ICD-10 diagnosis	***N***	***N*Females**	**M (SD)**	**Median**	**Min–max**
Dyslexia	16	10	19.56 (0.96)	19.5	18-21
Dysorthography	2	0	19.50 (0.71)	19.5	19–20
Dysgraphia	4	0	20.00 (2.16)	19.5	18–23
Dyscalculia	4	3	20.25 (1.89)	19.5	19–23
Mixed SLD	34	19	20.15 (2.39)	19.5	18–31

Abbreviations: M, mean age; Min–Max, minimum and maximum age of the participants; *N*, total number for each diagnosis; *N*Females, number of females for each diagnosis; SD, age standard deviation.

2.3 Procedure

Participants were contacted by telephone from the list of patients awaiting SLD diagnosis renewal at the Children's Hospital Burlo Garofolo. During the phone call to schedule the meeting for the follow-up, they were asked about their willingness to participate in research conducted by the Hospital and the University, focusing on students who intended to continue their education at the university level.

Participants underwent two separate evaluation sessions conducted in close temporal proximity. Students completed the instrumental skills and neuropsychological abilities assessments in the first session, followed by the study-related abilities evaluation in the second session. The initial session was conducted individually by a professional psychologist specialising in SLDs in a quiet room at the hospital. It included an anamnesis, an evaluation of instrumental skills, and a neuropsychological assessment, lasting between 60 and 90 min. Within one week, participants were invited to complete an online survey assessing their study-related abilities. They received a code and a link to access and fill in the questionnaire. All items in the online questionnaire were mandatory to prevent missing data. If a participant left any item unanswered, the system would flag the specific question and prevent further progress until a response was provided.

2.4 Materials

All the instruments used are standardised, valid and reliable (see details of each instrument's standardisation below), and are widely utilised in both Italian and international health systems for diagnostic assessments. In this context, it is important to note that the instruments were standardised on samples of Italian adults and Italian university students. Below, we provide demographic information regarding those validation samples, including their size. To enhance the reader's understanding and comply with the instruments' copyright restrictions, we converted participants' raw scores into standardised Z-scores according to the respective instrument manuals. This procedure allowed us to derive a score for each participant indicating how far their performance or score deviates (in Z-score units) from the normative mean (Z = 0).

Instrumental skills

Reading abilities

Reading abilities were assessed using the Passage Reading task of the VALS battery (George & Pech-Georgel, 2017). According to the authors, the instrument was normed on a sample of 200 Italian adults (M = 31, SD = 10.5). Each participant was asked to read the text entitled 'The bar under the sea' aloud, aiming to do so as quickly and accurately as possible. While reading, the experimenter measured the time taken and errors made by the participant. The reading speed was calculated in syllables per second, and then the score was compared with the normative scores.

Arithmetic facts

Arithmetic facts were assessed using the Numerical Facts task from the LSC-SUA battery (Montesano et al., 2020). This instrument was standardised on a sample of 667 Italian university students (M = 22.94, SD = 4.79). Participants were presented with 30 numerical facts that involved addition, subtraction and multiplication (e.g. 6 × 8, 100 × 100). Participants had to solve each item mentally in no more than three seconds. One point was awarded for each correct answer, and the raw scores could range from 0 to 30. The reliability of the measure is good (Cronbach's α = 0.76).

Neuropsychological abilities

The neuropsychological assessment included subtests evaluating verbal comprehension, visual-perceptual abilities and working memory from the WAIS battery (Orsini & Pezzuti, 2013), an instrument that was standardised on a sample of 1424 Italian adults (M = 36,4, SD = 9.8). The reliability of the neuropsychological scales is good (Cronbach's α ranging from 0.70 to 0.90).

Verbal comprehension

Verbal comprehension was evaluated using the Vocabulary subtest. The subject is asked to give a definition for 26 terms (e.g. ‘apple’ or ‘inauspicious’). The answers are then scored by the examiner, who assigns a score from 0 to 2 points for each item based on the accuracy of the answer. The total raw score can range from 0 to 52.

Visual-perceptual abilities

Visual-perceptual abilities were evaluated using the Drawing with Cubes subtest. Cubes are shown and provided to the participant. Some have two red and two white faces, and some have two half-white and half-red faces. Two-dimensional figures are then shown to the participants, and they are asked to reproduce the figures with the cubes provided. The experimenter assigned the score, checking both the accuracy of reproduction and the execution time. The score could range from 0 (incorrect figure or answers out of time) to 7.

Working memory

Working memory was tested using the Digit Memory subtest. Participants were presented with three numerical span tasks. In the first task, the participant was asked to listen to number series (which increase in length) and repeat them immediately afterwards. In the second task, the participant was asked to listen to the number series read by the experimenter and repeat them starting from the last number read. In the last task, the subject participant was to rearrange the number series heard and recite the numbers from smallest to largest. In the three tasks the number of digits to be

remembered gradually increased, from a minimum of two to a maximum of nine. Each numerical span task consisted of pairs of items belonging to the same level of difficulty (i.e. the numerical series had the same length). If the participant made a mistake in recalling the correct sequence for both items of the same level, the participant was stopped and asked to proceed to the next task.

Study-related abilities

The evaluations presented are part of the AMOS (De Beni et al., 2014), an instrument that assesses studyrelated abilities in high school and university students. According to the authors, the instrument was normed on a sample of Italian students (M = 20.76, SD = 2.00) comprising upper secondary school students (*n* = 361) and university students (*n* = 488).

Study strategy questionnaire (SSQ)

The questionnaire comprises 39 statements regarding the strategies typically employed by students for studying. Participants were asked to indicate on a seven-point Likert scale (1 = ‘never’; 7 = ‘always’) the degree to which they agreed with each statement (e.g. ‘Underlining during the first reading’). The raw score of the instrument could range from 39 to 273 points, with higher scores being associated with better study strategies. This questionnaire has good reliability (Cronbach's α = 0.80).

Study approach questionnaire (SAQ)

The questionnaire consists of 50 items proposed as statements. Participants were asked to rate how much they agreed with each statement using a five-point Likert scale (1 = ‘never’; 5 = ‘always’). The items referred to five different dimensions

related to how the individual approaches learning activities: organisation (e.g. ‘In the early afternoon, I plan all the things I have to do’), process (e.g. ‘When studying, I try to present the contents in my own words’), self-evaluation (e.g. ‘After a written exam, I know whether it went well or not’), preparing for exams (e.g. ‘I try to anticipate what kind of exam awaits me’) and metacognition (e.g. ‘When an exam goes wrong, I try to understand the reasons why I failed’). The raw score of the instrument could range from 50 to 250 points, with higher scores corresponding with a better approach to study. The reliability of this questionnaire appears to be good (Cronbach's α = 0.80).

Learning goals

This evaluates participants' goal orientation. The sub-scale consists of four scenarios (e.g. ‘In a learning situation you prefer to tackle tasks that are quite difficult and that you face as challenges to measure your skills’), each featuring two distinct actions to choose, reflecting the participants' learning goals. Higher scores indicate a stronger tendency in participants to set challenge-orientated goals. The scale has good reliability (Cronbach's α = 0.78).

3 RESULTS

Before running the analyses, we transformed the raw scores of each measure (instrumental skills, neuropsychological abilities and study-related abilities) into Z-scores using the norms provided by the instrument manual. This procedure was adopted because the present study did not include a typically developing control group; therefore, the students’ scores were compared with those obtained from the normative sample on which the instrument was standardized.

Since the instruments adopted in this study provide standardized normative data. Indeed, transforming raw scores into Z-scores allows direct comparison between our data and the manuals' reported normative average. A Z-score of Z = 0 represents the mean of the normative sample; therefore, one-sample t-tests were conducted to determine whether the mean score of students with SLDs significantly differed from the expected normative average. This approach is commonly adopted in clinical and neuropsychological research when validated normative benchmarks are available and allows the estimation of the magnitude and direction of deviation from typical performance.

Descriptive statistics are reported in Table 2.

Comparisons with normative scores

In order to assess how the instrumental skills, neuropsychological profiles and study-related abilities of the participants varied compared to the normative average, we conducted a series of one-sample *t*-tests. We also conducted *p*-values corrections for multiple comparisons due to the several one-sample *t*-tests, using the procedure of Benjamini and Yekutieli (2001), which controls the false discovery rate under conditions of dependency among tests (adjusted p-values are reported in Table 3). Effect sizes (Cohen's *d*) for one-sample *t*-tests are also reported: small effect $d = 0.20$; medium effect $d = 0.50$; large effect $d = 0.80$. The results are shown in Table 3 and graphically in Figure 1.

TABLE 2 Descriptive statistics of the measures (transformed into Z-scores) used in the study.

Measure	Mean	SD	SE	Median	Skewness	Kurtosis
Instrumental skills						
Arithmetic facts	−1.484	1.199	0.155	−1.449	0.173	−0.768
Reading errors	−1.935	1.885	0.243	−1.783	−0.647	−0.271
Reading speed	−3.126	1.389	0.179	−3.031	−0.030	−0.610
Neuropsychological abilities						
Working memory	−0.744	0.716	0.092	−0.670	0.104	−0.148
Visuospatial abilities	0.505	1.064	0.137	0.500	−0.349	0.090
Verbal abilities	−0.172	0.826	0.107	−0.330	1.042	2.193
Study-related abilities						
Study strategies	0.003	1.277	0.174	−0.109	−0.124	−0.509
Study approach	−2.531	1.300	0.177	−2.499	0.028	−0.961
Goals of learning	−0.075	1.163	0.158	0.192	−0.723	−0.899

Abbreviations: SD, standard deviation; SE, standard error.

TABLE3 Results of the one-sample *t*-tests considering instrumental skills, neuropsychological abilities and study-related abilities.

Measure	*t*	*df*	95% CI	*p*	*p* corr.	*d*
Instrumental skills						
Arithmetic facts	−9.584	59	[−1.793, −1.174]	<0.001***	<0.001***	−1.237
Reading errors	−7.952	59	[−2.422, −1.448]	<0.001***	<0.001***	−1.027
Reading speed	−17.429	59	[−3.485, −2.767]	<0.001***	<0.001***	−2.250
Neuropsychological abilities						
Working memory	−8.049	59	[−0.929, −0.559]	<0.001***	<0.001***	−1.039
Visuospatial abilities	3.676	59	[0.230, 0.780]	0.001**	0.002**	0.475
Verbal abilities	−1.612	59	[−0.386, 0.042]	0.112	0.409	−0.208
Study-related abilities						
Study strategies	0.016	53	[−0.346, 0.351]	0.987	1.000	0.002
Study approach	−14.309	53	[−2.885, −2.176]	<0.001***	<0.001***	−1.947
Learning goals	−0.472	53	[−0.392, 0.243]	0.639	1.000	−0.064

Abbreviations: 95% CI, 95% confidence interval; *d*, Cohen's *d*; *df*, degrees of freedom; *p*, *p*-value; *p* corr, Benjamini and Yekutieli (2001) corrected *p*-values; *t*, one- sample *t*-test statistics.

**$p < 0.01$; ***$p < 0.001$.

Instrumental Skills

The results concerning instrumental skills showed that participants with SLDs had a significantly lower score compared to the normative mean in the measures of arithmetic facts ($t[59] = -9.584$, 95% CI [−1.793, −1.174], $p < 0.001$, Cohen's $d = -1.237$), reading errors ($t(59) = -7.952$, 95% CI [−2.422, −1.448], $p < 0.001$, Cohen's

d = −1.027) and reading speed (*t*(59) = −17.429, 95% CI [−3.485, −2.767], *p* < 0.001, Cohen's *d* = −2.250).

Neuropsychological Abilities

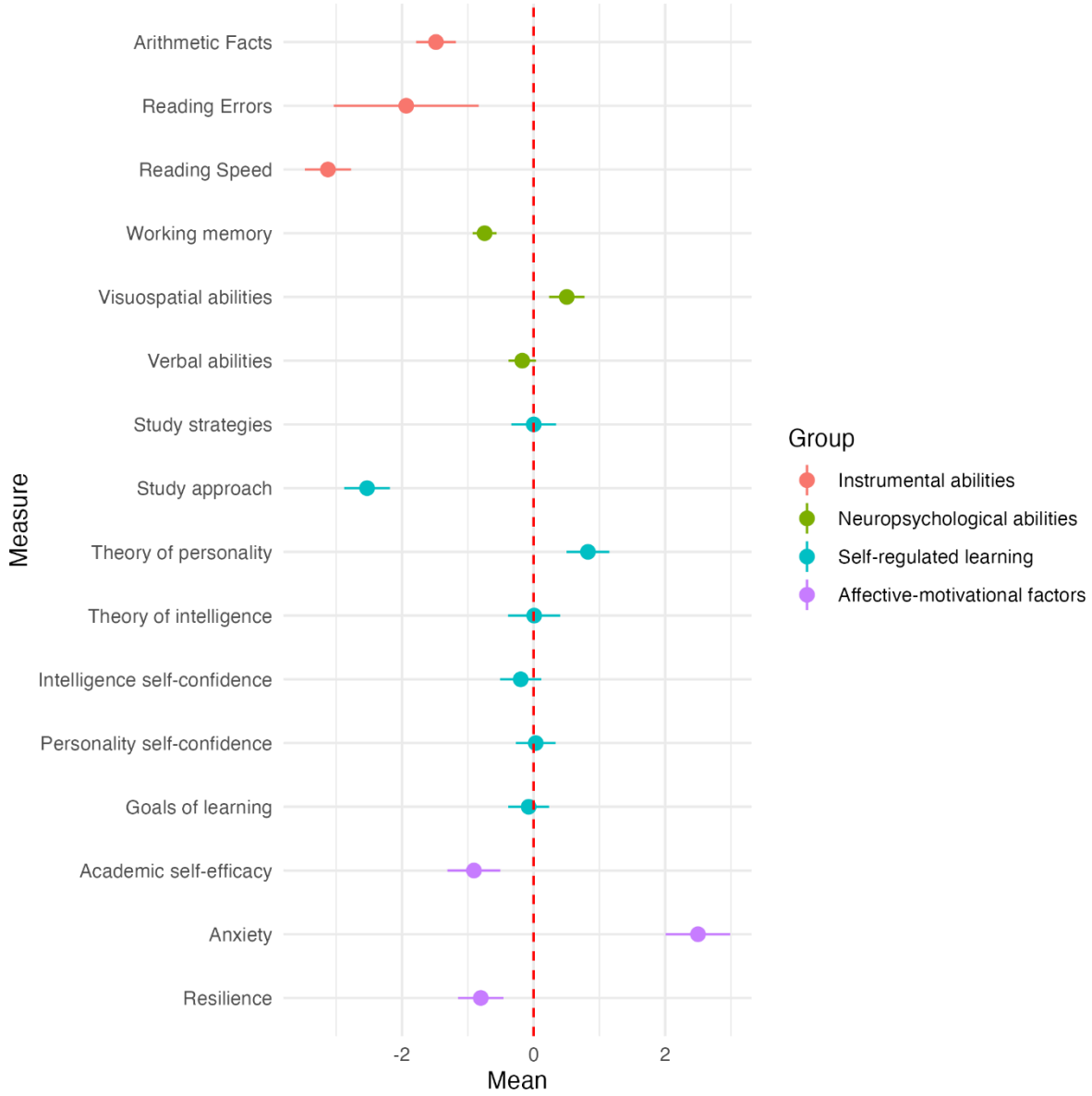
Results related to neuropsychological abilities showed that participants had a significantly lower score than the normative average in working memory (*t*[59] = −8.049, 95% CI [−0.929, −0.559], *p* < 0.001, Cohen's *d* = −1.039) and a significantly higher score in visuospatial abilities (*t*[59] = 3.676, 95% CI [0.230, 0.780], *p* = 0.001, Cohen's *d* = 0.475). The participants did not significantly differ from the normative group average in verbal abilities (*t*[59] = −1.612, 95% CI [−0.386, 0.042], *p* = 0.112, Cohen's *d* = −0.208).

Study Related Abilities

Regarding study-related abilities, participants did not display a significant difference in score from the normative average regarding study strategies (*t*[53] = 0.016, 95% CI [−0.346, 0.351], *p* = 0.987, Cohen's *d* = 0.002). Conversely, participants had a significantly lower score compared to the normative average in study approach (*t*[53] = −14.309, 95% CI [−2.885, −2.176], *p* < 0.001, Cohen's *d* = −1.947). Given the significantly lower global score in study approach, additional

exploratory analyses were conducted on the specific subdimensions of the questionnaire to examine whether particular components (e.g., planning, monitoring, organization) were disproportionately affected. However, no distinct differential pattern emerged across subscales, as all dimensions showed statistically significant lower score compared to normative average. This suggests that the observed vulnerability reflects a generalized difficulty in metacognitive regulation rather than a deficit confined to specific components. No statistically significant difference was found for students with SLDs compared to the normative average for learning goals (t[53] = −0.472, 95% CI [−0.392, 0.243], p = 0.639,Cohen's d = −0.064).

Figure 1
Graphical representation of One Sample *t*-test results relative to the normative average, displaying the means and confidence intervals the measures.



4- DISCUSSION

In recent years, there has been a growing number of students with SLDs enrolling in university programmes (ANVUR, 2022; Del Tufo & Earle, 2020; Newman et al., 2011). In response, universities need to support these students by identifying

both the areas in which they struggle and the strategies best suited to address those challenges (Longobardi et al., 2019; Pellegrino et al., 2023). To this end, the scientific literature has proposed and developed interventions aimed at supporting students with SLDs, leading to the implementation of assistive tools and teaching practices that take account of their specific profiles (Pellegrino et al., 2023; Zeng et al., 2018), as well as more structured intervention models designed to enhance academic success by focusing on the particular difficulties these students face (Johnson et al., 2023). Considering the national context, more studies are needed to acquire specific information concerning instrumental skills, neuropsychological profiles and study-related abilities of this specific group of students, especially at the beginning of the university period (Casali et al., 2024). Indeed, acquiring information on the cognitive and study-related profiles of students with SLDs would provide crucial insights for university services, which are essential for organising evidence-based intervention activities.

In light of the aim of the present study, we first assessed the instrumental skills of students with SLDs in reading (in terms of errors and speed) and arithmetic facts. The data confirm that students with SLDs produce statistically significantly lower scores in all instrumental skills, with large effect sizes across all measures. These findings obtained for adults with SLDs provide a unique and updated evaluation of skills in arithmetic facts and reading abilities, acquired using valid and reliable tools (e.g. George & Pech Georgel, 2017). Our data confirm that the difficulties in instrumental abilities (e.g. reading and arithmetic skills) commonly observed in children with SLDs may persist into adulthood (Hatcher et al., 2002; Swanson & Hsieh, 2009). In this context, difficulties in reading and arithmetic may potentially affect academic performance and success, thereby increasing the risk of university

dropout (ANVUR, 2022). Recognising the instrumental profiles of adult learners with SLDs can guide educators and institutions to implement targeted accommodations and services (e.g. flexible assessment methods and technology-assisted exams) aimed at supporting instrumental skills during academic tasks, thus sustaining students' learning motivation (Pellegrino et al., 2023; Zeng et al., 2018). Moreover, incorporating inclusive teaching and administrative policies (e.g. sharing recorded lessons and slides, providing administrative orientation, and offering peer support) can help address the specific needs of students with SLDs, fostering equal opportunities for academic success, and promoting a sense of engagement and belonging throughout their academic careers (Becker & McGregor, 2016; Pellegrino et al., 2023).

Second, our goal was to evaluate aspects related to neuropsychological development in individuals with SLDs. On the basis of previous literature, which indicates difficulties in working memory among individuals with SLDs (Peng & Fuchs, 2016; Swanson & Siegel, 2011; Willcutt et al., 2007), we expected to find similar results. Our study supports these findings by revealing statistically significant difficulties in working memory in students with SLDs compared to the normative average. Evidence shows that working memory difficulties can negatively affect the comprehension and retention of instructional content during lectures, making it more challenging to follow the flow of information and take notes (Becker & McGregor, 2016). In the university setting, this can lead to a high cognitive load for students with SLDs, who may struggle to simultaneously process, integrate and retain the presented materials. To alleviate these challenges, trained lecturers can implement strategies designed to reduce cognitive burden, such as providing course materials in advance, offering concept maps or structured outlines, and supporting learning through

recorded lectures (Pellegrino et al., 2023). These measures enable students to better prepare for the content and to revisit and consolidate the material in ways and at times that best suit their needs. Regarding visual perceptual abilities in adults with SLDs, we found statistically higher scores in visuospatial abilities. These results confirm studies on children with SLDs (Operto et al., 2021) that may reflect the wide variability reported in the literature on visuospatial abilities in students with SLDs (Chamberlain et al., 2018). Regarding verbal comprehension, no significant differences were found in verbal abilities compared to the normative sample. This result contrasts with previous findings suggesting that students with SLDs may struggle with verbal comprehension compared to their peers (Hall & Barnes, 2017; Ransby & Lee Swanson, 2003). However, recent evidence (Del Tufo & Earle, 2020) indicates that individuals with SLDs may not exhibit differences in this specific measure, particularly when assessed under timed conditions. In this context, the lack of differences from the normative average in verbal comprehension may be attributed to the untimed nature of the task used. Future studies should therefore incorporate both timed and untimed measures to further explore this aspect.

Considering study-related abilities, results also indicated that, in terms of study strategies involving specific actions students use to solve problems or achieve goals, students with SLDs do not differ statistically from the normative average. Similarly, we found no statistically significant differences in learning goals, indicating that students with SLDs show a mastery-oriented approach to learning that is comparable to the normative average. These findings align with recent evidence suggesting that students with SLDs employ study strategies and set learning goals similar to those of their peers without SLDs (Casali et al., 2024). However, they exhibited significantly lower levels of study approach compared to their peers, indicating a reduced use of

advanced metacognitive strategies essential for monitoring and regulating learning (e.g. asking questions during lectures, adopting a metacognitive approach to studying materials). In this context, students with SLDs may have developed a repertoire of study strategies and goal-setting abilities throughout their schooling, potentially stemming from interventions following their initial diagnosis (Casali et al., 2024; Holzer et al., 2009). Yet, with regard to their approach to learning, these students may lag behind their peers in organisation, self-assessment and metacognitive skills at the beginning of their university education (Casali et al., 2024; Holzer et al., 2009; Zeng et al., 2018).

Various studies have shown that targeted interventions aimed at providing students with SLDs with self-regulation strategies, increased awareness of their cognitive processes, and enhanced motivation can have a significant impact on their academic success (Johnson et al., 2023; Zeng et al., 2018). Such interventions seek to strengthen students' ability to plan, monitor and evaluate their own study process, thereby fostering greater autonomy and confidence in their abilities. From this perspective, it is crucial to develop services and programmes designed to enhance self- regulated learning by employing specialised personnel who can tailor strategies to each individual's profile. By both addressing areas of weakness and leveraging students' strengths, these measures can help them become better equipped to meet academic demands, reduce stress and pursue a more stable, motivated path toward academic success (Harrison et al., 2012; Troiano et al., 2010; Zeng et al., 2018).

4.1Limitations

The current study is not without limitations, one of which is the cross-sectional nature of the data. Future studies should use longitudinal designs to capture how the

aspects assessed in this study interplay over time across different developmental stages, especially between high school and university. Second, the analytical strategy employed in the present study did not enable assessment of the interplay between neuropsychological factors, learning strategies and motivational factors. For this reason, future studies should use larger sample sizes to explore how these factors interact with each other in SLD populations, using correlational methods. A major limitation of the present study is that we considered the population of students with SLDs without distinguishing between specific diagnoses and potential comorbidities. This choice was driven by our a priori inclusion criteria and reflects the high comorbidity often reported among various SLD subtypes (Toffalini et al., 2017; Willcutt et al., 2013), a phenomenon that has sparked ongoing debates on whether SLDs should be viewed as a unitary condition or as distinct subtypes (Toffalini et al., 2017). We acknowledge that not differentiating between sub-diagnoses may limit the specificity of our findings. Therefore, we advise caution in extending our results to single diagnostic categories (e.g. dyslexia vs. dyscalculia), as unique patterns may emerge when each sub-diagnosis is considered separately. Future studies should explore the difficulties associated with each diagnostic subtype and their possible overlaps, to better elucidate whether and how different SLD subtypes might differentially affect instrumental, neuropsychological and study-related abilities. Another limitation is the absence of an academic achievement indicator, such as Grade Point Average (GPA). Given that GPA represents a central outcome variable within the university population, its inclusion would have allowed for a more comprehensive understanding of how neuropsychological, motivational, and study-related factors relate to actual academic achievement. Future research should incorporate GPA to better situate the results within the broader context of academic

functioning. Finally, in the present study we did not include a control group. In this context, it is important to emphasise that the scores obtained by the participants were compared with the normative averages of standardised, valid, reliable instruments that are widely used in research and in the Italian and international healthcare systems. While this approach allows for clinically meaningful interpretation of deviations from typical performance, it does not account for potential cohort-specific factors (e.g., university context, academic demands, socio-demographic variables) that could influence performance. Future research should consider including a matched control group to allow more direct between-group comparisons within the same academic environment.

5 CONCLUSION

Even acknowledging these limitations, by identifying specific instrumental, neuropsychological and study-related factors in students with SLDs we draw a complex profile of qualities and abilities that could lead to successful university careers, together with weaknesses and difficulties, underlining the crucial role of non-cognitive factors (Feraco et al., 2022; Lavy, 2020). Our data could inform intervention programmes (Pellegrino et al., 2023; Ruch et al., 2020; Zeng et al., 2018) designed for students at the onset of their university careers. Such programmes would focus on developing study approaches and beliefs, as well as recognising instrumental skills and addressing neuropsychological strengths and challenges. Furthermore, lecturers play a central role in fostering an inclusive learning environment that accommodates the diverse needs of students with SLDs, emphasising the importance of teaching methodologies that offer individual learning styles and providing targeted support where needed (Pellegrino et al., 2023). By addressing

these challenges and maximising students' inherent capabilities, we can enhance the academic success and well-being of students with SLDs in university education

6. References

Allen, K., Higgins, S. & Adams, J. (2019) The relationship between visuospatial working memory and mathematical performance in school-aged children: a systematic review. *Educational Psychology Review*, 31, 509–531. Available from: https://doi.org/ 10.1007/s10648-019-09470-8

Anthony, H., Reupert, A. & McLean, L. (2024) Parent experiences of specific learning disorder diagnosis: a scoping review. *Dyslexia*, 30(1), e1757. Available from: https://doi.org/10.1002/dys.1757

ANVUR. (2022) *Students with disabilities and SLDs in Italian universities: a resource to be valued [Gli studenti con disabilità e DSA nelle università italiane. Una risorsa da valorizzare]*. Available from: https://www.anvur.it/wp-content/uploads/2022/06/ANVUR- Rapporto-disabilita_WEB.pdf

Baddeley, A. (1996) The fractionation of working memory. *Proceedings of the National Academy of Sciences of the United States of America*, 93(24), 13468–13472. Available from: https://doi.org/10. 1073/pnas.93.24.13468

Baird, G.L., Scott, W.D., Dearing, E. & Hamill, S.K. (2009) Cognitive self-regulation in youth with and without learning disabilities: academic self-efficacy, theories of intelligence, learning vs. performance goal preferences, and effort attributions. *Journal of Social and Clinical Psychology*, 28(7), 881–908. Available from: https://doi.org/10.1521/jscp.2009.28.7.881

Becker, T.C. & McGregor, K.K. (2016) Learning by listening to lectures is a challenge for college students with developmental language impairment. *Journal of Communication Disorders*, 64, 32–44. Available from: https://doi.org/10.1016/j.jcomdis.2016.09.001

Ben-Eliyahu, A. (2019) Academic emotional learning: a critical component of self-regulated learning in the emotional learning cycle. *Educational Psychologist*, 54(2), 84–105. Available from: https://doi.org/10.1080/00461520.2019.1582345

Benjamini, Y. & Yekutieli, D. (2001) The control of the false discovery rate in multiple testing under dependency. *Annals of Statistics*, 29(4), 1165–1188.

Ben-Naim, S., Laslo-Roth, R., Einav, M., Biran, H. & Margalit, M. (2017) Academic self-efficacy, sense of coherence, hope and tiredness among college students with learning disabilities. *European Journal of Special Needs Education*, 32(1), 18–34. Available from: https://doi.org/10.1080/08856257.2016.1254973

Casali, N., Meneghetti, C., Tinti, C., Maria Re, A., Sini, B., Passolunghi, M.C. et al. (2024) Academic achievement and satisfaction among university students with specific learning disabilities: the roles of soft skills and study-related factors. *Journal of Learning Disabilities*, 57(1), 16–29. Available from: https://doi. org/10.1177/00222194221150786

Chamberlain, R., Brunswick, N., Siev, J. & McManus, I.C. (2018) Meta-analytic findings reveal lower means but higher variances in visuospatial ability in dyslexia. *British Journal of Psychology*, 109(4), 897–916. Available from: https://doi.org/10.1111/bjop.12321

De Beni, R., Zamperlin, C., Meneghetti, C., Cornoldi, C., Fabris, M., Tona, G.D.M. et al. (2014) *Test AMOS-Abilità e motivazione allo studio: prove di valutazione e orientamento per la scuola secondaria di secondo grado e l'università: nuova edizione*. Trento: Erickson.

Del Tufo, S.N. & Earle, F.S. (2020) Skill profiles of college students with a history of developmental language disorder and developmental dyslexia. *Journal of*

Learning Disabilities, 53(3), 228–240. Available from: https://doi.org/10.1177/0022219420904348

Deshler, D.D. (2005) Adolescents with learning disabilities: unique challenges and reasons for hope. *Learning Disability Quarterly*, 28(2), 122–124. Available from: https://doi.org/10.2307/1593609

Diseth, Å., Danielsen, A.G. & Samdal, O. (2012) A path analysis of basic need support, self-efficacy, achievement goals, life satisfaction and academic achievement level among secondary school students. *Educational Psychology*, 32(3), 335–354. Available from: https://doi.org/10.1080/01443410.2012.657159

Faul, F., Erdfelder, E., Lang, A.-G. & Buchner, A. (2007) G*power 3: a flexible statistical power analysis program for the social, behavioral, and biomedical sciences. *Behavior Research Methods*, 39, 175–191.

Feraco, T., Resnati, D., Fregonese, D., Spoto, A. & Meneghetti, C. (2022) Soft skills and extracurricular activities sustain motivation and self-regulated learning at school. *Journal of Experimental Education*, 90(3), 550–569. Available from: https:// doi.org/10.1080/00220973.2021.1873090

George, F. & Pech-Georgel, C. (2017) *VALS – assessment of reading and writing difficulties in adulthood [VALS – Valutazione delle difficoltà di lettura e scrittura in età adulta]*. Trento: Erickson.

Gilger, J.W., Allen, K. & Castillo, A. (2016) Reading disability and enhanced dynamic spatial reasoning: a review of the literature. *Brain and Cognition*, 105, 55–65. Available from: https://doi.org/ 10.1016/j.bandc.2016.03.005

Hall, C. & Barnes, M.A. (2017) Inference instruction to support reading comprehension for elementary students with learning disabilities. *Intervention*

in School and Clinic, 52(5), 279–286. Available from: https://doi.org/10.1177/1053451216676799

Harrison, A.G., Areepattamannil, S. & Freeman, J. (2012) Effects of the learning opportunities task force (LOTF) programs on postsecondary students with learning disabilities. *Exceptionality Education International*, 22(1), 1. Available from: https://doi.org/ 10.5206/eei.v22i1.7688

Hatcher, J., Snowling, M.J. & Griffiths, Y.M. (2002) Cognitive assessment of dyslexic students in higher education. *British Journal of Educational Psychology*, 72(1), 119–133. Available from: https:// doi.org/10.1348/000709902158801

Holzer, M.L., Madaus, J.W., Bray, M.A. & Kehle, T.J. (2009) The test taking strategy intervention for college students with learning disabilities. *Learning Disabilities Research & Practice*, 24(1), 44–56. Available from: https://doi.org/10.1111/j.1540-5826.2008. 01276.x

ISTAT (Istituto Nazionale di Statistica). (2016) *University students and enrollment areas [Studenti e bacini universitari]*. Rome: ISTAT.

Johnson, E., Masser, J.S. & Spears, L. (2023) Self-regulated learners: a comprehensive, translational framework for students with learning disabilities. *Exceptionality*, 31(1), 52–68. Available from: https://doi.org/10.1080/09362835.2021.1938063

Johnson, E.S., Humphrey, M., Mellard, D.F., Woods, K. & Swanson, H.L. (2010) Cognitive processing deficits and students with specific learning disabilities: a selective meta-analysis of the literature. *Learning Disability Quarterly*, 33(1), 3–18. Available from: https://doi.org/10.1177/073194871003300101

Kirby, A., Edwards, L. & Hughes, A. (2008) Parents' concerns about children with specific learning difficulties: insights gained from an online message centre.

Support for Learning, 23(4), 193–200. Available from: https://doi.org/10.1111/j.1467-9604.2008.00393.x

Laguillo, T., Cueli, M. & González-Castro, P. (2023) Teachers' knowledge about and perception towards learning disabilities in reading. *Psychology, Society, and Education*, 15(2), 45–55. Available from: https://doi.org/10.21071/psye.v15i2.16621

Lavy, S. (2020) A review of character strengths interventions in twenty-first-century schools: their importance and how they can be fostered. *Applied Research in Quality of Life*, 15(2), 573–596. Available from: https://doi.org/10.1007/s11482-018-9700-6

Liebel, S.W. & Nelson, J.M. (2017) Auditory and visual working memory functioning in college students with attention-deficit/hyperactivity disorder and/or learning disabilities. *Archives of Clinical Neuropsychology*, 32(8), 980–991. Available from: https://doi.org/ 10.1093/arclin/acx014

Longobardi, C., Fabris, M.A., Mendola, M. & Prino, L.E. (2019) Examining the selection of university courses in young adults with learning disabilities. *Dyslexia*, 25(2), 219–224. Available from: https://doi.org/10.1002/dys.1611

MacCullagh, L., Bosanquet, A. & Badcock, N.A. (2017) University students with dyslexia: a qualitative exploratory study of learning practices, challenges and strategies. *Dyslexia*, 23(1), 3–23. Available from: https://doi.org/10.1002/dys.1544

Matteucci, M.C. & Soncini, A. (2021) Self-efficacy and psychological well-being in a sample of Italian university students with and without specific learning disorder. *Research in Developmental Disabilities*, 110, 103858. Available from: https://doi.org/10.1016/j. ridd.2021.103858

McGregor, K.K., Langenfeld, N., Van Horne, S., Oleson, J., Anson, M., & Jacobson, W. (2016). The University Experiences of Students with Learning Disabilities. *Learning Disabilities Research & Practice*, 31(2), 90–102. https://doi.org/10.1111/ldrp.12102

Mega, C., Ronconi, L. & De Beni, R. (2014) What makes a good student? How emotions, self-regulated learning, and motivation contribute to academic achievement. *Journal of Educational Psychology*, 106(1), 121–131. Available from: https://doi.org/10. 1037/a0033546

Ministero dell'Istruzione. (2022) *Key data on students with SLDs [I principali dati relativi agli alunni con DSA]*. Rome: Ufficio di Statistica.

Montesano, L., Valenti, A. & Cornoldi, C. (2020) *LSC-SUA: tests of Reading, text comprehension, writing, and calculation [LSC-SUA: prove di lettura, comprensione del testo, scrittura e calcolo]*. Trento: Erickson.

Mortimore, T. & Crozier, W.R. (2006) Dyslexia and difficulties with study skills in higher education. *Studies in Higher Education*, 31(2), 235–251. Available from: https://doi.org/10.1080/03075070600572173

Newcombe, N.S. & Shipley, T.F. (2014) Thinking about spatial thinking: new typology, new assessments. In: Gero, J.S. (Ed.) *Studying visual and spatial reasoning for design creativity*. Dordrecht: Springer, pp. 179–192.

Newman, L., Wagner, M., Knokey, A.-M., Marder, C., Nagle, K., Shaver, D. et al. (2011) *The post-high school outcomes of young adults with disabilities up to 8 years after high school: a report from the National Longitudinal Transition Study-2 (NLTS2) NCSER 2011-3005*. Washington D.C.: National Center for

Special Education Research. Available from: https://eric.ed.gov/?id=ED524044

Olofsson, Å., Ahl, A. & Taube, K. (2012) Learning and study strategies in university students with dyslexia: implications for teaching. *Procedia-Social and Behavioral Sciences*, 47, 1184–1193. Available from: https://doi.org/10.1016/j.sbspro.2012.06.798

Operto, F.F., Smirni, D., Scuoppo, C., Padovano, C., Vivenzio, V., Quatrosi, G. et al. (2021) Neuropsychological profile, emotional/ behavioral problems, and parental stress in children with neurodevelopmental disorders. *Brain Sciences*, 11(5), 5. Available from: https://doi.org/10.3390/brainsci11050584

Orsini, A. & Pezzuti, L. (2013) *WAIS-IV: contribution to the Italian standardization (ages 16– 69) [WAIS-IV. Contributo alla taratura italiana (16– 69 anni)]*. Florence: Giunti OS.

Pellegrino, G., Casali, N., Meneghetti, C., Tinti, C., Anna, M.R., Sini, B. et al. (2023) Universal and specific services for university students with specific learning disabilities: the relation to study approach, academic achievement, and satisfaction. *Learning Disabilities Research & Practice*, 38(4), 274–284. Available from: https://doi.org/10.1111/ldrp.12323

Peng, P. & Fuchs, D. (2016) A meta-analysis of working memory deficits in children with learning difficulties: is there a difference between verbal domain and numerical domain? *Journal of Learning Disabilities*, 49(1), 3–20. Available from: https://doi.org/ 10.1177/0022219414521667

Pino, M. & Mortari, L. (2014) The inclusion of students with dyslexia in higher education: a systematic review using narrative synthesis. *Dyslexia*, 20(4), 346–369. Available from: https://doi.org/10. 1002/dys.1484

Ransby, M.J. & Lee Swanson, H. (2003) Reading comprehension skills of young adults with childhood diagnoses of dyslexia. *Journal of Learning Disabilities*, 36(6), 538–555. Available from: https://doi.org/10.1177/00222194030360060501

Roebken, H. (2007) The influence of goal orientation on student satisfaction, academic engagement and achievement. *Electronic Journal of Research in Educational Psychology*, 5(3), 679–704.

Ruch, W., Niemiec, R.M., McGrath, R.E., Gander, F. & Proyer, R.T. (2020) Character strengths-based interventions: open questionsand ideas for future research. *Journal of Positive Psychology*, 15(5), 680–684. Available from: https://doi.org/10.1080/17439760.2020.1789700

Sharabi, A., Cueli, M., Pellegrino, G., Rodríguez, C., & Carretti, B. (2025). The Mediating Role of Academic Self-Efficacy and Self-Regulated Learning in Academic Success Among Higher Education Students With SLD or ADHD. *Learning Disabilities Research & Practice*, 09388982251388008.

Sharabi, A., Carretti, B., Cueli, M., Rodríguez, C., & Pellegrino, G. (2025). Undergraduates' achievement and satisfaction: the role of study-related factors and soft skills. *Frontiers in Psychology*, *16*, 1653072.

Swanson, H.L. & Hsieh, C.J. (2009) Reading disabilities in adults: a selective meta-analysis of the literature. *Review of Educational Research*, 79(4), 1362–1390. Available from: https://doi.org/10. 3102/0034654309350931

Swanson, H.L. & Siegel, L. (2011) Learning disabilities as a working memory deficit. *Experimental Psychology*, 49(1), 5–28.

Toffalini, E., Giofrè, D. & Cornoldi, C. (2017) Strengths and weaknesses in the intellectual profile of different subtypes of specific learning disorder: a study on

1,049 diagnosed children. *Clinical Psychological Science*, 5(2), 402–409. Available from: https://doi. org/10.1177/2167702616672038

Trainin, G. & Swanson, H.L. (2005) Cognition, metacognition, and achievement of college students with learning disabilities. *Learning Disability Quarterly*, 28(4), 261–272. Available from: https://doi.org/10.2307/4126965

Troiano, P.F., Liefeld, J.A. & Trachtenberg, J.V. (2010) Academic support and college success for postsecondary students with learning disabilities. *Journal of College Reading and Learning*, 40(2), 35–44. Available from: https://doi.org/10.1080/10790195.2010.10850329

Uttal, D.H., Meadow, N.G., Tipton, E., Hand, L.L., Alden, A.R., Warren, C. et al. (2013) The malleability of spatial skills: a meta-analysis of training studies. *Psychological Bulletin*, 139(2), 352–402. Available from: https://doi.org/10.1037/a0028446

Willcutt, E.G., Betjemann, R.S., Pennington, B.F., Olson, R.K., DeFries, J.C. & Wadsworth, S.J. (2007) Longitudinal study of reading disability and attention-deficit/hyperactivity disorder: implications for education. *Mind, Brain, and Education*, 1(4), 181–192. Available from: https://doi.org/10.1111/j.1751-228X.2007.00019.X

Willcutt, E.G., Petrill, S.A., Wu, S., Boada, R., DeFries, J.C., Olson, R.K. et al. (2013) Comorbidity between reading disability and math disability: concurrent psychopathology, functional impairment, and neuropsychological functioning. *Journal of Learning Disabilities*, 46(6), 500–516. Available from: https://doi.org/10. 1177/0022219413477476

Zeng, W., Ju, S. & Hord, C. (2018) A literature review of academic interventions for college students with learning disabilities. *Learning Disability Quarterly*, 41(3), 159–169. Available from: https://doi.org/10.1177/0731948718760999

The third study further expanded this line of inquiry by providing a fine-grained analysis of instrumental and neuropsychological functioning in relation to both diagnostic subtypes of SLD and academic enrolment choices at university entry. Specifically, this study aimed to examine whether differences in instrumental and cognitive profiles were associated with enrolment in STEM versus non-STEM degree programs, and to delineate distinct patterns of strengths and weaknesses across different SLD diagnoses. By focusing on reading, writing, arithmetic, and key neuropsychological processes, the study sought to clarify the extent to which specific learning profiles may influence academic trajectories in early adulthood.

Results showed that the presence of an SLD diagnosis was not associated with enrolment in STEM versus non-STEM programs, suggesting that academic choices at university entry are not primarily driven by the type of learning disorder. However, students enrolled in STEM programs exhibited fewer writing errors, pointing to selective differences in instrumental skills that may support adaptation to specific academic demands. Moreover, clear heterogeneity emerged across diagnostic subtypes: students with dyscalculia and dysorthographia displayed broader and more pervasive difficulties across instrumental and neuropsychological domains, whereas students with dyslexia showed more circumscribed difficulties, primarily confined to reading-related processes. No statistically significant differences were observed for students with dysgraphia, highlighting further variability within the SLD population.

Overall, this study adds an important layer of specificity to the cognitive portrait outlined in the previous investigations by demonstrating that SLDs in adulthood are characterized not only by persistence, but also by marked heterogeneity linked to diagnostic subtype rather than to academic field. These findings underscore the

importance of individualized assessment at university entry and support the need for tailored interventions and policies that take into account the diversity of SLD profiles, rather than assuming uniform challenges or barriers across students and degree programs.

STUDY 3

From High School to University: STEM Choices, Instrumental and Neuropsychological Profiles in Students with Specific Learning Disabilities

(Under revision at Learning Disability Quarterly)

1. Introduction

*Specific Learning Disabilities (SLDs) are classified as neurodevelopmental conditions and are characterized by persistent and significant difficulties in instrumental skills such as reading, writing, and mathematics (ICD-11; World Health Organization, 2019). Prevalence estimates suggest that S*LDs affect approximately 5-15% of school-aged children and about 4% of adults (American Psychiatric Association, 2013). Notably, many adults with SLD remain undiagnosed during childhood, and these disorders can substantially impact daily life, academic performance, and occupational outcomes in adulthood (American Psychiatric Association, 2013). At the same time, several international reports document a recent increase in university enrolment among students with SLD (Dumitru et al., 2024), who nonetheless tend to achieve lower academic success than their peers (Casali et al., 2024). University students with SLD are also at heightened risk of dropping out or interrupting their studies (Rußmann et al., 2024) and continue to be markedly underrepresented in fields such as STEM education (Moon et al., 2012). Although students with SLD are often treated as a homogeneous group, recent evidence highlights significant diagnostic subtype differences in instrumental and neuropsychological skills (Brandenburg et al., 2021; Morosini et al., 2025a; World Health Organization, 2021), emphasizing the need for research that accounts for the

variability within this population. In this context, the present study adopts a fine-grained, subtype-wise assessment that directly contrasts dyslexia, dyscalculia, dysorthographia, and dysgraphia across instrumental and neuropsychological skills, using standardized instruments, while also testing the associations with STEM versus non-STEM enrolment. This study aims to advance the literature by extending the investigation of SLD subtype differences into early adulthood, a developmental period that has received limited empirical attention compared to childhood and adolescence (Casali et al., 2024). Moreover, by jointly analyzing instrumental and neuropsychological domains and examining their association with STEM versus non-STEM enrolment, the study introduces an applied dimension that links SLD subtypes to real educational choices and, ultimately, bridges diagnostic assessment and educational policy. By shifting from a monolithic view of SLD diagnosis to diagnosis-informed, cross-subtype profiling, we aim to identify both vulnerabilities and strengths with direct implications for targeted interventions, assessment practices, and inclusive policies in higher education.

1.1 SLD Students in Higher Education

Students with SLD typically exhibit difficulties in domain-specific skills, for example, word-level reading in dyslexia, arithmetic calculation in dyscalculia, spelling accuracy in dysorthographia, or handwriting fluency in dysgraphia. These, labelled as instrumental skills, are defined as discrete abilities that enable students to acquire and use information across academic domains, thereby meeting educational demands. Difficulties in instrumental skills arise independently of environmental or emotional disadvantage and prove unusually resistant to intervention, making them key diagnostic indicators of SLD (American Psychiatric Association, 2013). According to

the ICD-11 (World Health Organization, 2019), an SLD diagnosis must be based on a comprehensive assessment that combines standardized measures of instrumental and neuropsychological skills. Although threshold definitions to establish a diagnosis of SLD vary, the prevailing benchmark is instrumental skills that fall well below age or grade-level expectations, typically at least two standard deviations beneath the normative average (American Psychiatric Association, 2013).

The diagnostic classifications of SLD differ significantly between DSM-5 (American Psychiatric Association, 2013) and ICD-11 (World Health Organization, 2019). Both frameworks agree on fundamental criteria, such as the presence of instrumental skills below age expectations, the early onset of symptoms, and the persistence of learning difficulties. However, DSM-5 integrates the various subtypes of SLD (dyslexia, dysgraphia, and dyscalculia) into a single diagnostic category, using specifiers to indicate the affected academic domains, emphasizing the overlap between neuropsychological profiles. In contrast, ICD-11 retains a distinct classification for each type of SLD, supporting the hypothesis of qualitative specificity in symptoms and neurocognitive correlates. In this regard, Brandenburg et al. (2021) recently found that cognitive similarities tend to emerge within diagnostic subtypes, while distinct differences are observed between dyslexia and dyscalculia subtypes. These findings challenge the uniformity suggested by the DSM-5 without fully supporting the specificity proposed by the ICD-11, underscoring the need for a more in-depth investigation of the instrumental and neuropsychological skills associated with SLD.

1.2 Neuropsychological Characteristics of SLD Students

Neuropsychological abilities are closely linked to SLDs and play a crucial role both as diagnostic markers and as factors influencing academic achievement (Casali et al., 2024). Given that neuropsychological abilities mature through childhood and adolescence into young adulthood (Anderson, 2002; Huizinga et al., 2006; Tamnes et al., 2010), examining them in adults with SLD is relevant, as their development may differ from earlier stages.

Among the most studied is working memory, a limited-capacity system for temporary storage and real-time processing, representing a central cognitive system in learning (Baddeley & Logie, 1999; Gathercole et al., 2006). Students with SLD, particularly those with dyslexia or dyscalculia, consistently show reduced working memory compared to their peers (Agostini et al., 2022; Peng & Fuchs, 2016; Sinha et al., 2024). On the other hand, visuospatial skills, involving the perception, organization, and manipulation of spatial information (Newcombe & Shipley, 2014; Uttal et al., 2013), show mixed findings in SLD. Some evidence indicates poorer but a highly variable performance in dyslexia (Chamberlain et al., 2018), potentially due to comorbidities or compensatory strategies used by the students. Finally, fluency abilities, defined as the rapid generation of verbal or non-verbal responses under specific rules (Spark et al., 2017), are less studied but often impaired in SLD. Specifically, difficulties are documented in verbal fluency, particularly phonemic (Smith-Spark et al., 2017; Moura et al., 2014; Kavé & Sapir-Yogev, 2023), and in nonverbal fluency, where dyslexia has been linked to less effective completion strategies (Reiter et al., 2005). Taken together, evidence indicates that, beyond core instrumental deficits, SLD is often accompanied by neuropsychological weaknesses,

underscoring the need for comprehensive assessment across different SLD subtypes, particularly in adults with SLD.

1.3 Current Study

To date, few studies have examined differences among SLD subtypes in instrumental and neuropsychological skills, and evidence has focused mainly on primary and secondary school students (Brandenburg et al., 2021), although evidence suggests neuropsychological skills typically mature fully in young adulthood, leaving the university-aged population largely unexplored (Casali et al., 2024; Morosini et al., 2025a; Tervo-Clemmens et al., 2023). Furthermore, no previous research has explored whether specific diagnostic subtypes or distinct instrumental and neuropsychological profiles might relate to STEM course enrolment in students with SLD. In this context, the general aim of this study is to describe how instrumental and neuropsychological abilities differ among students with SLD as they transition to higher education, considering both their course enrolment (STEM vs. non-STEM) and their diagnostic subtype. Specifically, the study addresses two specific research questions:

(1) Does the frequency of STEM (vs. non-STEM) course enrolment differ across the four SLD subtypes (i.e., dyslexia, dyscalculia, dysorthographia, and dysgraphia), and which instrumental and neuropsychological skills are associated with STEM course enrolment? Since this research question addresses an area with limited prior evidence in the literature, we did not formulate specific hypotheses for this aim.

(2) Do instrumental and neuropsychological abilities differ significantly across the four SLD subtypes? We expect each diagnostic subtype to present predominant difficulties in the instrumental skills corresponding to the specific diagnosis (i.e., reading in individuals with dyslexia, arithmetic in those with

dyscalculia, and writing in those with dysorthographia or dysgraphia). Furthermore, we did not formulate specific hypotheses regarding students' neuropsychological abilities, as existing literature reveals widespread neuropsychological difficulties (Morosini et al., 2025a) while other studies report considerable heterogeneity within and across diagnostic subtypes (Brandenburg et al., 2021), underscoring the need for further investigation.

2. Methods

2.1 *Participants*

Data were collected during the diagnostic follow-up at the Burlo Garofolo Child Hospital in Trieste. Of 178 participants, 17 were excluded due to IQ below 70 or comorbid neurodevelopmental disorders, yielding a final sample of 161 students with SLD (M_{AGE} = 19.81, SD_{AGE} = 1.66; 73 males, 88 females; Table 1). Participants were either first-year university students or in the last semester of high school, enrolling in university in a few months. All were from northeastern Italy, Caucasian, and native or fluent Italian speakers (WAIS-IV Verbal Comprehension; Wechsler, 2008), reflecting the demographics of the Italian university population. Sixty-three students had a single SLD diagnosis, and ninety-eight had two or more (e.g., dyslexia and dyscalculia) (see Table 1). Diagnoses included dyslexia (n = 113), dyscalculia (n = 68), dysorthographia (n = 80), and dysgraphia (n = 43). Sixty participants were enrolled in STEM courses and 101 in non-STEM courses. Diagnoses followed ICD-10 criteria (F81; "Specific Developmental Disorders of Scholastic Skills") and were issued by licensed professionals, then approved by the Local Health Authority in line with Regional Health System and Ministry of Health policies.

Table 1

Composition and age of the sample.

Diagnosis	**N (single diagnosis)**	**$N_{females}$**	**Age**		
			M(SD)	**Median**	**Range**
Dyslexia	113 (32)	60	19.8 (1.64)	19	18-25
Dysorthographia	80 (7)	39	19.7 (1.41)	19	18-31
Dysgraphia	43 (11)	25	19.7 (1.57)	19	18-25
Dyscalculia	68 (13)	38	19.5 (1.17)	19	18-23
Multiple diagnosis	98	49	19.7 (1.28)	19	18-25

Note. N = total number of students per diagnosis, numbers in parentheses indicate the number of students with a single SLD diagnosis; M = mean SD = standard deviation.

The study was approved by the Ethics Committee of the University of Trieste and the Burlo Garofolo Children's Hospital, and adhered to the Declaration of Helsinki, the Italian Psychological Association guidelines, and the ethical code of the Italian Register of Professional Psychologists. All students provided informed consent and could withdraw at any time. Participants were on the waiting list for the renewal of their SLD diagnosis at the Burlo Garofolo Children Hospital and were contacted by phone. During the call, they were invited to voluntarily take part in a research study conducted by the hospital in collaboration with the university. Participants underwent a single evaluation session, conducted individually by a professional psychologist specialized in SLD, in a quiet room at the hospital. The session included anamnestic interviews and assessment of instrumental and neuropsychological skills. All instruments were standardized, valid, and reliable, and are widely used in research and healthcare systems. All instruments were previously standardized on the Italian population.

2.3 Materials

Instrumental Skills

Reading Skills. Reading skills were evaluated using the *BDA 16-30 Reading Passage task* (Ciuffo et al., 2019). Participants were asked to read aloud a 1000-syllable unpublished narrative text, containing specific vocabulary and some low-frequency words, as quickly and accurately as possible. The experimenter timed the reading, recorded errors, and calculated reading speed in syllables per second. Raw scores were then converted to normative scores according to the instrument manual. The test demonstrates acceptable reliability (Cronbach's $\alpha = 0.80$).

Writing Skills. Writing skills were assessed using the *Dictation task with rapid reading* from the *BDA 16-30 battery* (Ciuffo et al., 2019). The examiner dictated a 1000-

character text in two equal sections, timing the writing and allowing a short pause between them. In “rapid reading,” 6-8 words are dictated before a pause, with the next sentence starting as the participant writes the last word of the previous one. The passage contained only familiar words to minimize vocabulary-related errors. Spelling errors were identified, and raw scores were converted to normative scores according to the manual. The test shows satisfactory reliability (Cronbach’s α = 0.78).

Arithmetic Skills. Arithmetic skills were assessed using the *Arithmetic Facts* task from the *LSC-SUA battery* (Montesano et al., 2020). Participants solved 30 arithmetic facts (additions, subtractions, multiplications; e.g., 6×8, 100×100) mentally within three seconds each. The task measures automatization, i.e., the rapid retrieval of results from memory without calculation. One point was awarded per correct answer (range 0–30), and raw scores were converted to normative scores following the manual instructions. The test shows acceptable reliability (Cronbach’s α = 0.76).

Neuropsychological skills

Working Memory. Working memory was evaluated using the *Digit Span* subtest from the *WAIS-IV battery* (Wechsler, 2008; Italian adaptation from Orsini & Pezzuti, 2013). The subtest consists of three different numerical span tasks: in the direct memory task, the participant had to repeat a series of digits read by the examiner in the same order they were presented; in the second task, the participant had to repeat the digits in reverse order; and in the last task, the participant had to repeat the digits in ascending order. In all three tasks, the number of digits gradually increased, from a minimum of two to a maximum of nine. Each numerical span task consisted of pairs of items at the same level of difficulty. If the participant failed to recall the correct sequence for both items at a given level, the task was stopped, and the next one was administered. One

point was awarded for each correct span, so each pair could receive a score of 0 (if neither sequence was recalled), 1 (if only one sequence was recalled), or 2 (if both were recalled correctly). The total score was the sum of the points obtained across the three tasks and was sub sequentially converted into normative score according to the instrument's manual. The test reliability is satisfactory according to the instrument's manual (Cronbach's α = 0.85).

Visuo-spatial Skills. Visuo-spatial skills were assessed using the *Block Design subtest* from the *WAIS-IV battery* (Wechsler, 2008; Italian adaptation from Orsini & Pezzuti, 2013). The participant was provided with coloured cubes, some with white faces, some with red faces, and others with half red and half white faces. Within a set time limit, the participant had to combine the cubes to reproduce figures shown in two-dimensional format. The examiner scored the task, with the score ranging from 0 (incorrect figure or out of time) to 7, based on both the accuracy of the reproduction and the time taken. According to the author, the task assesses spatial ability and visual memory, based on an individual's ability to manipulate and combine three-dimensional objects. The reliability is satisfactory according to the instrument's manual (Cronbach's α = 0.85).

Verbal Fluency Test and Non-verbal Fluency Test. Fluency was assessed using the *Verbal Fluency Test* (TFV) and the *Non-verbal Fluency Test* (TFNV) from the *BFE-A battery* (Balconi et al., 2021). In the TFV, participants produced as many meaningful words as possible within 60 seconds for each of three stimulus letters (<p>, <e>, <l>), excluding proper nouns, function words, and derivations (e.g., '*happy*', '*happiness*'). Correct responses, intrusions, repetitions, and total errors were recorded, and normative scores were derived per the manual. In the TFNV, participants completed two matrices of 40 graphic configurations (five dots: four corners, one center), creating

as many distinct drawings as possible within 180 seconds by connecting at least two elements with straight lines, leaving no square empty. Configurations were scored, and normative scores were calculated according to the manual. Both tests are validated for the Italian population.

3 Results

Before analysing the data, the raw scores for each measure were transformed into Z-scores (arithmetic skills, reading speed), weighted scores (verbal working memory, visuospatial abilities), or percentiles (reading errors, writing errors, verbal fluency, nonverbal fluency), following instruments' manual instructions. Descriptive statistics for the sample are presented in Table 2. Out of the total sample of 161 participants, *n* = 46 did not complete the verbal fluency task, while *n* = 57 did not complete the non-verbal fluency task. Effect sizes for the observed differences were calculated using Cohen's *d*, interpreted according to Cohen's (1998) guidelines: small effect (*d* = .20), medium effect (*d* = .50), and large effect (*d* = .80).

Table 2 Descriptive statistics of the sample.

	n	Mean	SD
Arithmetic skills	161	-1.302	1.307
Reading errors	161	17.620	27.288
Reading speed	161	-2.296	1.521
Writing errors	161	12.434	17.898
Verbal WM	161	7.534	2.591
Visuospatial skills	161	10.714	3.591
Verbal fluency	115	39.887	11.586
Nonverbal fluency	104	53.250	15.103

Note. n = sample size; SD = standard deviation.

To facilitate the following analyses, each diagnostic status (i.e., dyslexia; dyscalculia; dysgraphia; dysorthographia) was dummy-coded. Specifically, for each diagnostic subtype, participants were assigned a value of 1 if the diagnosis was present and 0 if it was absent. This approach enabled direct comparisons between individuals with and without each specific diagnosis.

STEM comparisons

Chi-square tests showed no significant differences in SLD diagnosis prevalence between students enrolled in STEM and non-STEM courses: dyslexia, $\chi^2(1) = 0.001$, $p = .968$; dyscalculia, $\chi^2(1) = 0.196$, $p = .658$; dysgraphia, $\chi^2(1) < .001$, $p = .993$, and dysorthographia, $\chi^2(1) = 0.070$, $p = .791$. We then conducted a series of Welch's t-

tests (Table 3) to assess whether instrumental and neuropsychological abilities differed between SLD students enrolled in STEM versus non-STEM programs. Results showed that SLD participants enrolled in STEM programs made statistically significantly fewer writing errors, $t(82.72) = -2.794$, $p = .006$, $d = -0.52$. No other statistically significant differences between the groups were found for the remaining instrumental or neuropsychological skills.

Table 3 Welch's t-test comparisons between students STEM courses enrolment and those enrolled in non-STEM courses.

	STEM ***M (SD)***	***Non-STEM*** ***M (SD)***	***t*** **statistic**	***df***	***p***	***d***
STEM vs non-STEM enrollment						
Arithmetic skills	-1.27 (1.45)	-1.32 (1.22)	-0.261	108.03	.794	-0.04
Reading errors	20.62 (30.20)	15.84 (25.39)	-1.029	107.73	.306	-0.17
Reading speed	-2.31 (1.62)	-2.29 (1.46)	0.107	114.18	.915	0.02
Writing errors	18.09 (22.85)	9.07 (13.18)	-2.794	82.73	.006**	-0.52
Verbal WM	7.53 (2.69)	7.53 (2.54)	0.003	118.59	.997	<0.01
Visuospatial skills	10.70 (3.75)	10.72 (3.51)	0.038	117.56	.970	0.01

Verbal fluency	41.57 (12.36)	38.92 (11.09)	-1.150	78.18	.253	-0.23
Nonverbal fluency	55.38 (16.05)	52.07 (14.54)	-1.038	68.38	.303	-0.22

Note. *df* = degrees of freedom; *p* = p-value, *d* = Cohen's *d*.

Diagnosis comparisons

To determine whether instrumental and neuropsychological abilities varied as a function of diagnosis, we created a binary dummy variable for each condition (dyslexia, dyscalculia, dysgraphia, and dysorthographia) that distinguished students who exhibited that specific diagnostic subtype from those who did not (e.g., students with dyslexia vs. those with other diagnoses). We then compared the two resulting groups on every outcome measure using Welch-adjusted independent-samples t-tests (see Table 4).

Participants diagnosed with Dyslexia committed statistically significant more reading errors, $t(59.798) = 4.922$, $p < .001$, $d = 1.054$, and exhibited statistically significantly slower reading speed, $t(84.213) = 5.932$, $p < .001$, $d = 1.046$, compared to students with other diagnoses. Students diagnosed with dyscalculia showed statistically significant poorer arithmetic skills, $t(158.991) = 9.649$, $p < .001$, $d = 1.466$, visuospatial skills, $t(150.313) = 3.265$, $p = .001$, $d = 0.515$, and nonverbal fluency, $t(101.487) = 3.715$, $p < .001$, $d = 0.723$, compared to those with other diagnoses. Students with dysgraphia showed statistically significantly lower verbal WM, $t(46.049) = -2.216$, $p = .030$, $d = -0.423$, compared to those with other diagnoses. Participants with Dysorthographia showed statistically significant more writing errors, $t(101.244) =$

5.086, $p < .001$, $d = 0.798$, and less Verbal Fluency $t(110.674) = 2.590$, $p = .011$, $d = 0.484$ compared to participants with other diagnoses. No other statistically significant differences emerged in the remaining instrumental or neuropsychological measures across diagnostic subtypes.

Table 4

Results of Welch's independent-samples t-tests comparing instrumental and neuropsychological skills of students with a specific SLD diagnosis (dyslexia, dyscalculia, dysgraphia, or dysorthographia) with those of students holding other SLD diagnoses. Positive *t* values and Cohen's *d* indicate lower performance for the focal diagnosis group.

	***t* statistic**	***df***	***p***	***d***
Dyslexia				
Arithmetic skills	0.537	67.293	.593	0.107
Reading errors	4.922	59.798	<.001***	1.054
Reading speed	5.932	84.213	<.001***	1.046
Writing errors	0.877	83.245	.383	0.156
Verbal WM	0.140	70.746	.889	0.027
Visuospatial skills	-1.273	72.048	.207	-0.243
Verbal fluency	-0.954	87.088	.343	-0.179
Nonverbal fluency	0.352	59.464	.726	0.076
Dyscalculia				
Arithmetic skills	9.649	158.991	<.001***	1.466
Reading errors	0.232	150.416	.817	0.037
Reading speed	-1.366	149.685	.174	-0.216
Writing errors	0.917	158.996	.361	0.140
Verbal WM	1.512	147.371	.133	0.240
Visuospatial skills	3.265	150.313	.001***	0.515
Verbal fluency	0.247	109.372	.805	0.046

Nonverbal fluency	3.715	101.487	<.001***	0.723
Dysgraphia				
Arithmetic skills	-1.299	61.266	.199	-0.261
Reading errors	-1.934	57.718	.058	-0.405
Reading speed	-0.579	60.696	.565	-0.117
Writing errors	-0.536	70.760	.593	-0.098
Verbal WM	-2.216	66.134	.030*	-0.423
Visuospatial skills	-1.035	66.371	.304	-0.197
Verbal fluency	-0.211	60.802	.834	-0.043
Nonverbal fluency	-1.190	57.249	.239	-0.254
Dysorthographia				
Arithmetic skills	0.293	156.269	.770	0.046
Reading errors	0.736	157.951	.463	0.116
Reading speed	-0.123	156.886	.903	-0.019
Writing errors	5.086	101.244	<.001***	0.798
Verbal WM	1.574	157.137	.118	0.248
Visuospatial skills	0.094	158.836	.925	0.015
Verbal fluency	2.590	110.674	.011*	0.484
Nonverbal fluency	0.016	101.540	.987	0.003

Note. *df* = degrees of freedom; *p* = p-value, *d* = Cohen's *d*.
*$p < .05$; ***$p < .001$

4 Discussion

Entering university entails increased academic demands, different teaching methods, and greater self-regulation in learning (Heikkilä & Lonka, 2006; Morosini et al., 2025b). For students with SLD, these changes may be particularly challenging due

to difficulties in instrumental and neuropsychological skills. The present study examined how these skills differ among SLD students during the transition to higher education, considering both course enrolment (STEM vs. non-STEM) and their diagnostic subtype. While most studies compare students with SLD to typically developing peers, this study adopts a fine-grained approach, identifying nuanced differences between SLD subtypes. Such an approach can inform the development of diagnosis-specific interventions, moving beyond a monolithic view of SLD to address the distinct needs within this heterogeneous population. Furthermore, most SLD research has focused on earlier developmental stages, leaving university students largely underexplored (Casali et al., 2024; Morosini et al., 2025a): understanding their STEM enrolment patterns and related instrumental and neuropsychological skills can help universities and policymakers design more tailored services for students transitioning to higher education.

STEM enrolment

Although the literature indicates that students with SLD are generally underrepresented in STEM courses (Freeman et al., 2023), this broader trend does not necessarily imply differences among diagnostic subtypes within the SLD population. In our study, no association emerged between STEM course enrolment and any diagnostic subtype.Given that STEM fields are strongly characterized by mathematics-intensive curricula, one might reasonably expect, for instance, that students with dyscalculia, due to their difficulties with core mathematical skills, would be less inclined to choose such programs. In this context, research on typically developing students suggests that affective-motivational factors, rather than instrumental or cognitive skills, play a more central role in STEM choice (Cuder et al., 2024; Daker et al., 2021). This may also apply to students with SLD, who, despite specific skill deficits, might be guided

more by motivational drivers. Additionally, our sample included students in their final year of high school and first year of university; difficulties linked to specific diagnoses may impact achievement and retention later in their academic careers, underscoring the need for longitudinal research. Importantly, focusing on students at the very beginning of their university path provides a unique window into a period in which academic habits, coping strategies, and help-seeking behaviors are still being consolidated. From an institutional perspective, this timing is particularly relevant for university support services. Identifying subtype-specific cognitive profiles at entry may allow disability offices and academic advisors to anticipate potential areas of difficulty before they translate into academic underachievement or disengagement. Early screening and proactive support during the first year could therefore play a preventive role, especially for students whose instrumental or neuropsychological vulnerabilities might only become fully apparent under the increased demands of higher education. In this sense, time since enrolment should not be considered a mere descriptive variable, but rather a critical developmental marker for tailoring interventions and monitoring academic risk over time.

Interestingly, STEM students made fewer writing errors than non-STEM peers, a counterintuitive result given the heavier writing demands of non-STEM courses. However, STEM programs often require more technical, structured writing that prioritizes precision over interpretation, where fewer errors may aid academic success. Future studies should explore additional factors, specifically motivational factors that may influence differential STEM enrolment among students with SLD.

Diagnosis Comparisons

Students with dyslexia made more reading errors and read more slowly than peers with other diagnoses, with no additional statistically significant differences in other instrumental or neuropsychological skills. Consistent with prior research, these difficulties appear confined to reading-related abilities (American Psychological Association, 2013; Brandenburg et al., 2021), suggesting that targeted support in reading and writing may be most beneficial for this group (Mortimore & Crozier, 2006). From a practical perspective, these findings have implications for both courses' management and university assessment practices. Specifically, effective intervention strategies may include implementing inclusive approaches aimed at reducing the reading load for students with dyslexia such as providing learning materials and lecture recordings in advance, allowing extended time for exams, or offering compensatory tools to support reading tasks (Tops et al., 2022).

As expected, findings also showed that students with dyscalculia performed statistically significantly worse on arithmetic tasks than peers with other SLD diagnoses. Furthermore, we found that these participants showed lower visuospatial abilities compared to their peers with different diagnoses, supporting previous findings that link visuospatial skills specifically to this diagnostic subtype (Brandenburg et al., 2021; Geary et al., 2020). Our data also make a novel contribution by revealing lower nonverbal fluency in dyscalculic participants compared to SLD students with other diagnosis. Indeed, research on non-verbal fluency is not as consistent and mainly focus on dyslexic participants (Reiter et al., 2005; Smith-Spark et al., 2017). In light of these results, students with dyscalculia should be granted accommodations not only to compensate for the instrumental difficulties underlying the diagnosis, but also to address the cognitive challenges they may experience in working memory,

visuospatial abilities, and nonverbal fluency. In this context, students with dyscalculia may benefit from the use of calculators, formula sheets, and reference tables, as well as from early access to lecture materials, especially in courses that rely heavily on arithmetic skills and geometry. Additionally, to address cognitive challenges, it may be particularly helpful to offer tools that reduce cognitive load, such as task checklists, manipulatives, and 2D or 3D visual manipulation software designed to support weaknesses in working memory, visuospatial abilities and nonverbal fluency.

Students with dysgraphia scored higher in verbal working memory and showed no other significant differences from peers with other SLD diagnoses, suggesting comparatively milder instrumental and neuropsychological difficulties. This finding, however, should not be misinterpreted as evidence that they are free of difficulties, especially considering the limited number of studies on this diagnostic subtype and existing evidence pointing to persistent motor skill difficulties in higher education (Tal-Saban & Weintraub, 2019). Indeed, the assessment battery we used did not assess these skills, the hallmark difficulty in dysgraphia. In higher education, the shift to digital technologies has reduced reliance on handwriting and other graphic output, often masking underlying writing difficulties. However, tasks that still require manual production (e.g., handwritten exams or technical drawings) can remain challenging for students with dysgraphia (Tal-Saban & Weintraub, 2019). These students may therefore benefit from targeted accommodations, including assistive writing tools and extended assessment time, to address their graphomotor difficulties.

The findings on dysorthographia indicate that these students exhibit a higher number of writing errors and less verbal fluency compared to their peers with other diagnoses. This reflects one of the core features of the condition, a marked difficulty in written expression, as documented in the literature (Chung et al.,2020). However,

studies specifically targeting this diagnostic subgroup in higher education are missing from literature. These results also have practical implications, highlighting the need to adapt educational practices that rely on writing. Specifically, the use of assistive technology for note-taking during lectures and for writing during exams can help reduce the burden of the writing process for these students. Such tools can minimize errors and allow them to focus more on the content of the lessons and the quality of their responses.

Limitations

This study has some limitations. First, its cross-sectional design prevents examination of temporal trajectories or causal relationships, offering only a snapshot of associations at a single point in time. Longitudinal research is needed to track the progression and interplay of instrumental and neuropsychological skills, particularly during key transitions such as from secondary to higher education, and to allow the use of advanced analyses (e.g., path analysis). Second, we did not account for potential comorbidities, despite evidence of high comorbidity rates among SLD subtypes (Toffalini et al., 2017; Willcutt et al., 2019), which complicates whether SLD should be considered a unitary condition or distinct co-occurring subtypes. While this may limit interpretation, our results still provide useful insights into subtype-specific profiles. Future work should explore how comorbidities may differentially relate to instrumental and neuropsychological skills. Finally, the exclusive focus on cognitive domains overlooks the growing recognition of non-cognitive factors such as affective-motivational components, personal beliefs, and metacognitive processes (Casali et al., 2024; Morosini et al., 2025b), which should be integrated in future research for a more comprehensive understanding of SLD subtypes.

5 Conclusions

The transition to higher education represents a critical developmental step for students with SLD, demanding increased autonomy, self-regulation, and adaptation to complex learning environments. By examining a sample of university students with SLD, the present study describes how instrumental and neuropsychological skills differ across SLD subtypes in early adulthood. Our results indicate that, overall, the SLD diagnosis' subtype does not constrain academic choice, as students with different subtypes enroll in both STEM and non-STEM courses. However, neuropsychological and instrumental differences do emerge across diagnostic subtypes. Students with dyscalculia and dysorthographia showed difficulties involving both instrumental and neuropsychological skills, whereas students with dyslexia exhibited primarily reading-related difficulties. These findings emphasize the heterogeneity within the SLD population and highlight the importance of adopting a nuanced, diagnosis-informed approach when supporting students in higher education. Beyond their theoretical contribution, the results have clear applied value for improving inclusive practices and guiding institutional policy toward a more equitable learning environment for neurodivergent students.

Implications for practice

The present findings highlight the need for universities to move beyond a "one-size-fits-all" approach in supporting students with SLD. Because each diagnostic subtype presents a distinct pattern of strengths and weaknesses, accommodations should be tailored accordingly. For instance, students with dyslexia may benefit from reduced reading load, access to recorded lectures, and extended exam time; those with dyscalculia from the use of calculators, visual supports, additional time during

exams, and step-by-step instruction; students with dysorthographia from speech-to-text tools and structured writing aids; and those with dysgraphia may benefit from digital writing (Becker & McGregor, 2016; Pellegrino et al., 2023; Zeng et al., 2018). Moreover, since STEM enrolment was not associated with any specific SLD subtype, universities should avoid assumptions linking certain diagnoses to particular academic fields and instead focus more on individual learning profiles. Overall, our findings may suggest that implementing diagnosis-informed and flexible support policies can promote equitable participation, academic success, and well-being for neurodivergent students in higher education (Newman et al., 2019).

6 References

Agostini, F., Zoccolotti, P., & Casagrande, M. (2022). Domain-general cognitive skills in children with mathematical difficulties and dyscalculia: A systematic review of the literature. *Brain sciences*, *12*(2), 239. https://doi.org/10.3390/brainsci12020239

American Psychological Association (2013). *DSM-5: Diagnostic and Statistical Manual of Mental Disorders (5th ed)*. Raffaello Cortina Editore.

Anderson, P. (2002). Assessment and Development of Executive Function (EF) During Childhood. *Child Neuropsychology*, *8*(2), 71–82. https://doi.org/10.1076/chin.8.2.71.8724

Baddeley, A. D., & Logie, R. H. (1999). Working Memory: The Multiple-Component Model. In A. Miyake & P. Shah (A c. Di), *Models of Working Memory* (1ª ed., pp. 28–61). Cambridge University Press. https://doi.org/10.1017/CBO9781139174909.005

Balconi, M., Losasso, D., Balena, A., Crivelli, D. (2021). *Executive Functions Battery for Addiction [BFE-A - Batteria per le Funzioni Esecutive nell'Addiction]*. Giunti.

Becker, T. C., & McGregor, K. K. (2016). Learning by listening to lectures is a challenge for college students with developmental language impairment. *Journal of Communication Disorders*, *64*, 32–44. https://doi.org/10.1016/j.jcomdis.2016.09.001

Brandenburg, J., Huschka, S. S., Visser, L., & Hasselhorn, M. (2021). Are different types of learning disorder associated with distinct cognitive functioning

profiles?. *Frontiers in Psychology*, *12*, 725374. https://doi.org/10.3389/fpsyg.2021.725374

Casali, N., Meneghetti, C., Tinti, C., Maria Re, A., Sini, B., Passolunghi, M. C., Valenti, A., Montesano, L., Pellegrino, G., & Carretti, B. (2024). Academic Achievement and Satisfaction Among University Students With Specific Learning Disabilities: The Roles of Soft Skills and Study-Related Factors. *Journal of Learning Disabilities*, *57*(1), 16–29. https://doi.org/10.1177/00222194221150786

Chamberlain, R., Brunswick, N., Siev, J., & McManus, I. C. (2018). Meta-analytic findings reveal lower means but higher variances in visuospatial ability in dyslexia. *British Journal of Psychology*, *109*(4), 897–916. https://doi.org/10.1111/bjop.12321

Chung, P. J., Patel, D. R., & Nizami, I. (2020). Disorder of written expression and dysgraphia: Definition, diagnosis, and management. *Translational Pediatrics*, *9*(Suppl 1), Article Suppl 1. https://doi.org/10.21037/tp.2019.11.01

Ciuffo, M., Angelini, D., Barletta Rodolfi, C., Gagliano, A., Ghidoni, E., & Stella, G. (2019). *BDA 16-30. Valutazione clinica delle abilità di lettura, scrittura e comprensione del testo in adolescenti e giovani adulti [BDA 16–30. Clinical assessment of reading, writing, and text comprehension skills in adolescents and young adults].* Florence.

Cuder, A., Pellizzoni, S., Di Marco, M., Blason, C., Doz, E., Giofrè, D., & Passolunghi, M. C. (2024). The impact of math anxiety and self-efficacy in middle school STEM choices: A 3-year longitudinal study. *British Journal of Educational Psychology*, *94*(4), 1091-1108. https://doi.org/10.1111/bjep.12707

Daker, R. J., Gattas, S. U., Sokolowski, H. M., Green, A. E., & Lyons, I. M. (2021). First-year students' math anxiety predicts STEM avoidance and

underperformance throughout university, independently of math ability. *npj Science of Learning*, *6*(1), 17. https://doi.org/10.1038/s41539-021-00095-7

Dumitru, C. T., Koulianou, M., & Mastrothanasis, K. (2024). Inclusion of students with specific learning disorders in higher education: A systematic literature review. *Journal of Educational Sciences & Psychology*, 14(2), 46–64. https://doi.org/10.51865/JESP.2024.2.06

Freeman, J. A., Gottfried, M. A., & Plasman, J. S. (2023). STEM-focused career courses and college pipeline for students with learning disabilities. *Educational Policy*, *37*(2), 308-338. https://doi.org/10.1177/08959048211019988

Gathercole, S. E., Alloway, T. P., Willis, C., & Adams, A.-M. (2006). Working memory in children with reading disabilities. *Journal of Experimental Child Psychology*, *93*(3), 265–281. https://doi.org/10.1016/j.jecp.2005.08.003

Geary, D. C., Hoard, M. K., Nugent, L., Ünal, Z. E., & Scofield, J. E. (2020). Comorbid learning difficulties in reading and mathematics: The role of intelligence and in-class attentive behavior. *Frontiers in Psychology*, *11*, 572099. https://doi.org/10.3389/fpsyg.2020.572099

Gilger, J. W., Allen, K., & Castillo, A. (2016). Reading disability and enhanced dynamic spatial reasoning: A review of the literature. *Brain and Cognition*, *105*, 55–65. https://doi.org/10.1016/j.bandc.2016.03.005

Heikkilä, A., & Lonka, K. (2006). Studying in higher education: students' approaches to learning, self-regulation, and cognitive strategies. *Studies in higher education*, *31*(1), 99-117. https://doi.org/10.1080/03075070500392433

Huizinga, M., Dolan, C. V., & Van Der Molen, M. W. (2006). Age-related change in executive function: Developmental trends and a latent variable analysis.

Neuropsychologia, *44*(11), 2017–2036. https://doi.org/10.1016/j.neuropsychologia.2006.01.010

Kavé, G., & Sapir-Yogev, S. (2023). Differences Between Semantic and Phonemic Verbal Fluency in Adolescents With Reading Disorders. *Archives of Clinical Neuropsychology*, *38*(1), 126–130. https://doi.org/10.1093/arclin/acac062

Montesano, L., Valenti, A., & Cornoldi, C. (2020). *LSC-SUA. Tests of reading, text comprehension, writing, and arithmetic. Battery for the assessment of SLDs and other disorders in university students and adults [LSC-SUA. Prove di lettura, comprensione del testo, scrittura e calcolo. Batteria per la valutazione dei DSA e altri disturbi in studenti universitari e adulti].* Erikson.

Moon, N. W., Todd, R. L., Morton, D. L., & Ivey, E. (2012). Accommodating students with disabilities in science, technology, engineering, and mathematics (STEM): Findings from research and practice for middle grades through university education. *Center for Assistive Technology and Environmental Access, Georgia Institute of Technology*, 8-21.

Morosini, G., Cuder, A., Bortolotti, E., Bologna, V., Lonciari, I., Passolunghi, M. C., Brumat, R., Iannice, C., Košak Babuder, M., & Pellizzoni, S. (2025a). University students with specific learning disabilities: Insights from instrumental, neuropsychological and study-related profiles. *British Journal of Special Education*, 1–12. https://doi.org/10.1111/1467-8578.70009

Morosini, G., Cuder, A., Košak Babuder, M., Lonciari, I., Bortolotti, E., Passolunghi, M. C., & Pellizzoni, S. (2025b). Non-cognitive predictors of self-regulated learning skills in university students with specific learning disorders. *European Journal of Special Needs Education*, 1-12. https://doi.org/10.1080/08856257.2025.2500138

Mortimore, T., & Crozier, W. R. (2006). Dyslexia and difficulties with study skills in higher education. *Studies in higher education*, *31*(2), 235-251. https://doi.org/10.1080/03075070600572173

Moura, O., Simões, M. R., & Pereira, M. (2014). Executive Functioning in Children With Developmental Dyslexia. *The Clinical Neuropsychologist*, *28*(sup1), 20–41. https://doi.org/10.1080/13854046.2014.964326

Newcombe, N.S. & Shipley, T.F. (2014) *Thinking about spatial thinking: new typology, new assessments.* In: J.S. Gero (Ed.) Studying visual and spatial reasoning for design creativity. Dordrecht: Springer, pp. 179–192.

Newman, L. A., Madaus, J. W., Lalor, A. R., & Javitz, H. S. (2019). Support Receipt: Effect on Postsecondary Success of Students With Learning Disabilities. *Career Development and Transition for Exceptional Individuals*, *42*(1), 6–16. https://doi.org/10.1177/2165143418811288

Orsini, A., Pezzuti. L. (2013). WAIS-IV. Contribution to the Italian standardization (ages 16–69) [WAIS-IV. Contributo alla taratura italiana (16–69 anni)]. Florence.

Pellegrino, G., Casali, N., Meneghetti, C., Tinti, C., Anna, M. R., Sini, B., Passolunghi, M. C., Valenti, A., Montesano, L., & Carretti, B. (2023). Universal and Specific Services for University Students with Specific Learning Disabilities: The Relation to Study Approach, Academic Achievement, and Satisfaction. *Learning Disabilities Research & Practice*, *38*(4), 274–284. https://doi.org/10.1111/ldrp.12323

Peng, P., & Fuchs, D. (2016). A Meta-Analysis of Working Memory Deficits in Children With Learning Difficulties: Is There a Difference Between Verbal Domain and

Numerical Domain? *Journal of Learning Disabilities*, *49*(1), 3–20. https://doi.org/10.1177/0022219414521667

Reiter, A., Tucha, O., & Lange, K. W. (2005). Executive functions in children with dyslexia. *Dyslexia*, *11*(2), 116–131. https://doi.org/10.1002/dys.289

Rußmann, M., Netz, N., & Lörz, M. (2024). Dropout intent of students with disabilities. *Higher Education*, *88*(1), 183–208. https://doi.org/10.1007/s10734-023-01111-y

Sinha, N., Nikki Arrington, C., Malins, J. G., Pugh, K. R., Frijters, J. C., & Morris, R. (2024). The reading-attention relationship: Variations in working memory network activity during single word decoding in children with and without dyslexia. *Neuropsychologia*, *195*, 108821. https://doi.org/10.1016/j.neuropsychologia.2024.108821

Smith-Spark, J. H., Henry, L. A., Messer, D. J., & Zięcik, A. P. (2017). Verbal and Non-verbal Fluency in Adults with Developmental Dyslexia: Phonological Processing or Executive Control Problems? *Dyslexia*, *23*(3), 234–250. https://doi.org/10.1002/dys.1558

Tal-Saban, M., & Weintraub, N. (2019). Motor functions of higher education students with dysgraphia. *Research in Developmental Disabilities*, *94*, 103479. https://doi.org/10.1016/j.ridd.2019.103479

Tamnes, C. K., Østby, Y., Walhovd, K. B., Westlye, L. T., Due-Tønnessen, P., & Fjell, A. M. (2010). Neuroanatomical correlates of executive functions in children and adolescents: A magnetic resonance imaging (MRI) study of cortical thickness. *Neuropsychologia*, *48*(9), 2496–2508. https://doi.org/10.1016/j.neuropsychologia.2010.04.024

Tervo-Clemmens, B., Calabro, F. J., Parr, A. C., Fedor, J., Foran, W., & Luna, B. (2023). A canonical trajectory of executive function maturation from adolescence to adulthood. *Nature Communications*, *14*(1), 6922. https://doi.org/10.1038/s41467-023-42540-8

Tops, W., Jansen, D., Ceulemans, E., & Petry, K. (2022). Participation problems and effective accommodations in students with dyslexia in higher education. *European Journal of Special Needs Education*, 37(3), 1–19. https://doi.org/10.1080/08856257.2022.2089507

Uttal, D.H., Meadow, N.G., Tipton, E., Hand, L.L., Alden, A.R., Warren, C. et al. (2013) The malleability of spatial skills: a meta-analysis of training studies. *Psychological Bulletin*, *139*(2), 352–402. https://doi.org/10.1037/a0028446

Wechsler, D. (2008). *WAIS-IV. Administration and Scoring Manual*. San Antonio: Pearson.

Willcutt, E. G., McGrath, L. M., Pennington, B. F., Keenan, J. M., DeFries, J. C., Olson, R. K., & Wadsworth, S. J. (2019). Understanding Comorbidity Between Specific Learning Disabilities. *New Directions for Child and Adolescent Development*, *2019*(165), 91–109. https://doi.org/10.1002/cad.20291

World Health Organization (2019). I*nternational Statistical Classification of Diseases and Related Health Problems (ICD-11)* (11ª ed.). Geneva.

Zeng, W., Ju, S., & Hord, C. (2018). A Literature Review of Academic Interventions for College Students With Learning Disabilities. *Learning Disability Quarterly*, *41*(3), 159–169. https://doi.org/10.1177/0731948718760999

The fourth study focusing on the non-cognitive dimension of the university experience and examining predictors of self-regulated learning. Analyses showed that motivational components, specifically academic self-efficacy and learning goals, were the strongest predictors of self-regulation, whereas academic anxiety did not exert a main effect but interacted significantly with gender: among female students, the negative link between anxiety and self-regulation was more pronounced. Academic resilience, while positively associated with self-regulation in simpler models, lost predictive power once motivational variables were introduced, suggesting a more indirect role, likely mediated by efficacy beliefs and learning goals. Overall, the study underscores the importance of complementing interventions targeting cognitive abilities with measures designed to strengthen motivation and manage anxiety, with particular attention to gender differences. This study directly extends the cognitive research outlined in Study 2 and 3, showing that even when cognitive deficits persist, motivational resources, and their interaction with affective factors, play a decisive role in shaping adaptive learning behaviors.

STUDY 4

Non-cognitive predictors of self-regulated approach to learning in university students with Specific Learning Disorders

(published in European Journal of Special Needs Education; Morosini, G., Cuder, A., Košak Babuder, M., Lonciari, I., Bortolotti, E., Passolunghi, M. C., & Pellizzoni, S. (2025)

1 Introduction

Students with Specific Learning Disorders (SLD) face persistent academic challenges and are at increased risk of school withdrawal, lower psychological well-being, and socio-emotional difficulties (Nelson & Harwood, 2011; Stein et al., 2024). While much research has focused on younger populations, the investigation of non-cognitive factors in university students with SLD remain underrepresented in the literature, despite the unique challenges they encounter in higher education (Casali et al., 2024; Author et al., under review). As learning becomes more complex at the university level, shifts in study organization, lecture attendance, and the need for a self-regulated learning represent significant obstacles for SLD student (Casali et al., 2024; van der Zanden et al., 2018). Specifically, evidence suggests that students with SLD exhibit weaker self-regulated learning skills, characterized by a limited ability to

reflect on and organize their learning activities (Ben-Eliyahu, 2019; Johnson et al., 2023; Usher & Schunk, 2017). However, despite it is well known that non-cognitive factors play a crucial role in modulating self-regulated approach to learning (Usher & Schunk, 2017), their interplay remains underexplored among university students with SLD. For this reason, the present study aims to evaluate the contribution of motivational factors, academic anxiety, and academic resilience to self-regulated approach to learning among university students with SLD. By focusing on students with SLD, the findings aim to offer theoretical and practical guidance for professionals and policymakers, with the ultimate goal of promoting self-regulated learning, enhancing academic achievement, and supporting the well-being of students with SLD through tailored interventions.

1.1 Self-regulated approach to learning

The self-regulated approach to learning encompasses the methods and strategies students use when engaging with academic activities, such as organizing their study efforts, processing information, conducting self-evaluation, employing learning strategies, and utilizing metacognitive skills (Ben-Eliyahu, 2019; De Beni et al., 2014; Usher & Schunk, 2017). Research consistently shows that self-regulated learning is a strong predictor of academic achievement throughout both the developmental and university years (De Beni et al., 2014; Usher & Schunk, 2017). Moreover, prominent theories of self-regulated learning suggest that students approach academic tasks with a set of non-cognitive forethoughts and beliefs, which may in turn influence their self-regulated approach to learning (Usher & Schunk, 2017; Zimmerman, 2013). Specifically, evidence indicates that students' emotional and motivational perceptions influence the self-regulated approach to learning, affecting

not only the learning process itself but also the preparatory phases that precede it (for a review, see Ben-Eliyahu, 2019).

In the context of students with SLD, research shows that self-regulated learning is often challenging, partly due to a reliance on surface learning strategies and the difficulties posed by the cognitive profiles associated with the diagnosis (Casali et al., 2024; De Beni et al., 2014; Johnson et al., 2023). Moreover, evidence suggests that students with SLD frequently influenced by negative non-cognitive factors when engaging in academic tasks (Casali et al., 2024; Stein et al., 2024). These factors can impede the maintenance of an effective self-regulated approach to learning, particularly in students with SLD, underscoring the need to examine the relationship between these two aspects in this population. However, research on how these aspects affect university students with SLD remains scarce, indicating a need for further investigation to better support these learners in higher education.

1.2 Contribution of non-cognitive factors to self-regulated approach to learning

Various non-cognitive factors may influence self-regulated learning, including motivational and affective factors, as well as student resilience. Among these, motivational factors stand out as particularly significant, helping students initiate and sustain learning behaviors in the face of challenges and shaping how they engage with academic activities (Usher & Schunk, 2017). One key motivational factor is academic self-efficacy, which refers to a students' belief in their ability to successfully complete academic tasks, overcome challenges, and achieve learning goals (Bandura, 1977). Research has consistently shown that students with higher academic self-efficacy are more likely to engage in effective learning strategies, persist through difficulties, and achieve better academic outcomes (Marsh et al., 2019; Usher &

Schunk, 2017). Students with SLD often experience additional academic struggles that can undermine their belief in their own capabilities, leading to lower academic self-efficacy (Casali et al., 2024). This, in turn, negatively affects their self-regulated learning and academic performance (Ben-Naim et al., 2017; Casali et al., 2024). Another significant motivational factor is learning goals, which refer to the underlying objectives or purposes driving students' engagement in academic tasks (Mega et al., 2014). Learning goals are generally categorized into mastery-oriented and performance-oriented goals. Mastery goals focus on developing a deep understanding of the material, improving skills, and achieving personal growth, whereas performance goals are centered on reaching specific learning objectives, often driven by a desire for external validation (Poortvliet & Darnon, 2010; Zhoc et al., 2019). Furthermore, when students set mastery-oriented goals, they are more likely to adopt more adaptive self-regulation strategies, leading to successful academic outcomes (Usher & Schunk, 2017). Learning goals are especially significant for students with SLD because they may face additional obstacles to academic success that influence their goal orientation. Studies suggest that these students are more likely to adopt performance goals due to repeated academic struggles and external pressures, which can hinder their ability to self-regulate in learning activities (Baird et al., 2009; Johnson et al., 2023).

Academic emotions also play a key role in self-regulated learning (Ben-Eliyahu, 2019). Academic anxiety, for instance, refers to the emotional and physiological responses that students experience in academic settings, often involving feelings of worry, tension, and fear of failure, which can negatively affect both learning and performance (Gonzaga et al., 2022). Anxiety may influence self-regulated learning by affecting how and whether a task is performed (Usher & Schunk, 2017). Students with

SLD often face heightened stress due to repeated academic failures, negative feedback, and the increased cognitive effort required to complete tasks. Evidence shows that students with SLD experience moderately higher levels of academic anxiety compared to their peers (see meta-analysis by Nelson & Harwood, 2011), which can lead to avoidance behaviours toward learning (Haft et al., 2019; Lau et al., 2024). In addition to affective factors, academic resilience, defined as the ability to adapt and recover from stressful academic challenges, encompasses traits like perseverance, optimism, and maintaining motivation in adversity (Stein et al., 2024; Straus et al., 2020). Resilience plays a key role in academic success since resilient students cope better with stress, stay focused on long-term goals, and continue effective learning under pressure (Martin & Marsh, 2006; Hartley, 2011). This trait is particularly crucial for students with SLD, who often face obstacles that undermine their confidence and motivation (Stein et al., 2024). Fostering resilience through supportive environments, personalized learning plans, and positive feedback can significantly enhance their ability to manage challenges and succeed academically (Wong, 2003).

1.3 The present study

According to the abovementioned theoretical framework, students' self-regulated approach to learning is driven by forethought non-cognitive factors such as motivational factors, academic anxiety, and academic resilience. However, to date, only a few studies have focused on these aspects in university students with SLD (Casali et al., 2024), despite university represent a critical period when students need to self-regulate to tackle more complex learning demands and challenges. Focusing on university students with SLD would allow for a better understanding of the

challenges they face - challenges that can be accommodated to reduce negative effects on their learning experience and everyday life, but cannot be eliminated by any form of treatment. For this reason, evaluating the interplay between non-cognitive factors and self-regulated approach to learning could provide deeper insights into university students with SLD, allowing to gain theoretical insights for the development of interventions to promote well-being and success during higher education.

The aim of the present study was to assess the contribution of motivational factors (i.e., self-efficacy and learning goals), academic anxiety and academic resilience on self-regulated approach to learning. In doing so, we hypothesized that motivational factors, specifically academic self-efficacy and learning goals would influence self-regulated approach to learning. We expect that both academic self-efficacy and mastery-oriented learning goals play a significant role in self-regulated approach to learning. These factors are particularly deficient among students with SLD, yet they enable students to self-regulate in academic activities and to initiate and sustain learning (Baird et al., 2009; Usher & Schunk, 2017). Secondly, we hypothesize that academic anxiety, a factor moderately elevated in individuals with SLD compared to their peers, is related to the self-regulated approach to learning. Evidence suggests that anxiety hinders students' self-regulated approach to learning, leading them to develop fear or avoidance behavioral patterns toward academic activities (Haft et al., 2017; Lau et al., 2024). Furthermore, knowing from the literature that there are typically gender differences in anxiety (von der Embse et al., 2018), we also aimed to explore the interaction between these two aspects and their contribution in self-regulated approach to learning. Finally, we hypothesize that academic resilience will show a statistically significant effect on the self-regulated approach to learning. Indeed, although students with SLD exhibit lower academic resilience (Stein et al., 2024),

various studies indicate that resilience helps students better cope with stress and motivates them when facing academic challenges (Stein et al., 2024; Straus et al., 2020).

2. Method

2.1 Participants

Before conducting the study, we performed an a priori power analysis using G*Power (Faul et al., 2007) to determine the sample size required for our analyses. In particular, given the study's hypotheses, we aimed to test the significance of specific predictors in a hierarchical regression model. The most complex model included six predictors (i.e., academic self-efficacy, learning goals, academic anxiety, academic resilience, gender, and the anxiety × gender interaction). Based on a hypothesized small-to-medium effect size (f^2 = 0.10), an alpha level of 0.05, a statistical power of 0.8, and six predictors, the a priori power analysis indicated that a sample of 81 participants was needed. A total of 94 undergraduate students with SLDs were initially enrolled in the study. However, 6 were subsequently excluded for different reasons: two had an IQ index below 70 and four had a comorbid diagnosis of SLD and Attention Deficit Hyperactivity Disorder (ADHD). The final sample consisted of 88 participants (M_{age} = 19.90, SD_{age} = 1.74, MIN_{age} = 18, MAX_{age} = 23; 53 females, 35 males), all of whom were first-year university students. In accordance with the policies of the Regional Health System and the Italian Ministry of Health, diagnoses were made using the ICD-10 classification system, which includes subtypes for specific disabilities in reading, spelling, arithmetic, and mixed types. The local health authority provided all the diagnoses for the participants: 54 had a single diagnosed deficit (either dyslexia,

dysgraphia, dyscalculia, or dysorthography), and 34 had a mixed form of SLD with two or more impairments. All participants were native Italian speakers or fluent in Italian.

The study received approval from the ethical committee of the University Trieste and was conducted in compliance with the Declaration of Helsinki, the ethical guidelines of the Italian Association of Psychology, and the ethical code of the Italian Register of Professional Psychologists. Written informed consent was obtained before assessing the students. The students participated voluntarily and were informed that they could withdraw from the study if they felt distressed during the assessment activities.

2.2 Procedure

Participants were contacted by phone from a list of patients awaiting an SLD diagnosis renewal at Burlo Garofolo Children's Hospital. During the call, they were informed about a research study being conducted by the Hospital and University, involving students currently enrolled in university. Participants were asked to complete an online survey evaluating motivational-emotional factors and self-regulated approach to learning.

2.3 Materials

The students were tested using the AMOS questionnaire (Meneghetti et al., 2023; De Beni et al., 2014), a standardized questionnaire that demonstrates excellent psychometric properties and allows for the assessment of attitudes related to studying in higher education.

2.3.1 Self-regulated approach to learning

The scale consists of 50 items, grouped into five dimensions that reflect how individuals approach learning activities: organization (e.g., "*In the early afternoon, I plan all the things I have to do*"), processing (e.g., "*When studying, I try to present the contents in my own words*"), self-evaluation (e.g., "*After a written exam, I know whether it went well or not*"), exam preparation (e.g., "*I try to anticipate what kind of exam awaits me*"), and metacognition (e.g., "*When an exam goes wrong, I try to understand the reasons why I failed*"). Participants rate their agreement with each statement on a 5-point Likert scale (1 = "never"; 5 = "always"), and the total score ranges from 50 to 250 points, with higher scores indicating a better approach to study. The scale demonstrates good reliability (*Cronbach's α* = 0.80).

2.3.2 Academic Self-efficacy

The scale assesses participants' beliefs in their ability to perform academic activities effectively (e.g., "*Evaluate your learning skills*"). It consists of five items rated on a 5-point Likert scale. The raw score ranges from 5 to 25, with higher scores indicating greater academic self-efficacy. The reliability of the instrument is good (*Cronbach's α* = 0.80).

2.3.3 Learning Goals

The Learning Goals scale evaluates participants' goal orientation through four scenarios (e.g., "*In a learning situation, you prefer to tackle tasks that are quite difficult and face them as challenges to measure your skills*"). Each scenario presents two distinct actions to choose from, reflecting the participants' learning goals: mastery or performance-oriented goals. Higher scores indicate a stronger tendency to set mastery-oriented goals. The reliability of the scale is good (*Cronbach's α* = 0.78).

2.3.4 Learning Anxiety

The questionnaire aimed to measure anxiety experienced during learning. It consists of 7 items, with participants indicating their level of agreement with each statement (e.g., "*The mere thought of certain subjects makes me anxious*") on a 5-point Likert scale (1 = "never"; 5 = "always"). Scores range from 7 to 35, with higher scores indicating greater levels of learning anxiety. The questionnaire shows good reliability (*Cronbach's α* = 0.86).

2.3.5 Academic Resilience

The scale aimed to assess students' academic resilience. The questionnaire comprised 7 items (e.g., "*I am able to overcome my disappointment over a failure at university.*"), with participants indicating their agreement on a 5-point Likert scale (1 = "*never*"; 5 = "*always*"). Scores ranged from 7 to 35, with higher scores reflecting greater levels of academic resilience. The scale shows good reliability (*Cronbach's α* = 0.76).

3. Results

Descriptive statistics and bivariate correlations related to our sample are reported in Table 1. Furthermore, to assess how the variables varied compared to the normative average, we conducted a series of *One-Sample t-tests* (see Table 1). This procedure allowed us to compare the participants' scores with the normative averages reported by the instrument validation manual, providing insight into how our sample differs from the population on which the instrument was standardized. Effect sizes (Cohen's *d*) for the *One-Sample t-tests* are also reported: small effect *d* = 0.20; medium effect *d* = 0.50; large effect *d* = 0.80.

Table 1

Descriptive statistics, normative comparisons and bivariate correlations of the measures used in the study.

Measure	Mean	SD	*p*	*d*	1.	2.	3.	4.	5.
1. Self-regulated approach to learning	167.56	19.52	<.001***	-2.298	-				
2. Academic Self-efficacy	16.88	3.53	<.001***	-0.577	.53**	-			
3. Learning goals	2.44	1.48	.047*	-0.214	.35**	.24*	-		
4. Academic anxiety	21.60	7.19	<.001***	1.355	-.16	-.28**	-.22*	-	
5. Academic resilience	23.01	4.69	<.001***	-0.768	.35**	.38**	.22*	-.48**	-
6.Gender (Female = 1; Male = 0)	-	-	-	-	.06	.03	-.18	.36**	-.19

Note. SD = Standard Deviation, *p* = *p*-value for the One-Sample t-test, *d* = Cohen's *d*.

*$p < .05$, **$p < .01$, ***$p < .001$.

The descriptive analyses indicate that, compared to the normative mean, students with SLD exhibit statistically significant lower levels of self-regulated approach to learning, lower academic self-efficacy, lower learning goals, and reduced academic resilience, while showing higher levels of academic anxiety**.**

3.1 Hierarchical Multiple Regression Analysis

We run a hierarchical regression model comprising four models evaluating the contribution of motivational factors (i.e., academic self-efficacy, learning goals), academic anxiety and academic resilience on self-regulated approach to learning (Table 2), controlling for gender in each block. The aim of the first model (Model 1) was to assess the contribution of motivational factors (i.e., Self-Efficacy and Learning

Goals) on self-regulated approach to learning. The second model (Model 2) assessed the contribution of academic anxiety on self-regulated approach to learning. The third model (Model 3) we assessed the role of academic resilience on self-regulated approach to learning. In the fourth model (Model 4) we regressed the motivational factors, academic anxiety and academic resilience predictors simultaneously, in order to assess the contribution of both motivational and emotional regulation factors on self-regulated approach to learning. Finally, based on the literature indicating typical gender differences in anxiety in literature (von der Embse et al., 2018), we introduced an interaction term between gender and anxiety in the final block (Model 5). All variables were standardized prior to the analysis, and we reported R^2 indicating the variance explained by each model.

In the *Block 1*, we have included the motivational factors, i.e., self-efficacy and learning goals, controlling for gender. Findings showed that both self-efficacy [β = 0.469, $t(84) = 5.117$, $p < .001$], and learning goals, [$\beta = 0.248$, $t(84) = 2.669$, $p = .009$], had a positive statistically significant association with self-regulated approach to learning. In the *Block 2* we included the academic anxiety, controlling for gender. Results showed that academic anxiety [$\beta = -0.209$, $t(85) = -1.832$, $p = .070$] seems to have no effect on the self-regulated approach to learning. In the *Block 3* we included the academic resilience, controlling for gender. Results showed that academic resilience [$\beta = 0.375$, $t(85) = 3.661$, $p < .001$] seems to have a positive effect on the self-regulated approach to learning. Considering the *Block 4*, we introduced both the motivational and emotional regulation factors. Results showed that both learning goals [$\beta = 0.236$, $t(82) = 2.534$, $p = .013$] and self-efficacy [$\beta = 0.417$, $t(82) = 4.230$, $p < .001$] keep having a positive effect on self-regulated approach to learning, while academic resilience [$\beta = 0.192$, $t(82) = 1.830$, $p = .071$], and academic anxiety [$\beta = 0.066$, $t(82)$

= 0.611, p = .543] seems to have no effect on the self-regulated approach to learning. Finally, considering the *Block 5*, we introduced an interaction term between Anxiety and Gender (Anxiety × Gender) to assess whether the relationship between anxiety and study strategies changes according to participants' gender. Results revealed that both self-efficacy [β = 0.412, t(81) = 4.256, p <.001], and learning goals [β = 0.191, t(81) = 2.032, p = .045], maintained a statistical significant association with self-regulated approach to learning. Furthermore, the interaction term showed a statistical significant positive association with self-regulated approach to learning [β = -0.418, t(81) = -2.018, p = .047]. As indicated by the simple slope analysis (Figure 1), the negative association between academic anxiety and self-regulated approach to learning was significantly stronger among female students than among male students. Specifically, higher levels of anxiety were associated with a marked decrease in self-regulated learning strategies for females, whereas this relationship was weaker for males. This interaction suggests that academic anxiety may represent a greater risk factor for impaired self-regulation among female students with SLD.

Table 2

Hierarchical linear regression models, considering as dependent variable the self-regulated approach to learning.

	B	**SE**	***t* value**	***p***	***R²***
Block 1					
Intercepts	-0.106	0.141	-0.749	.456	0.34

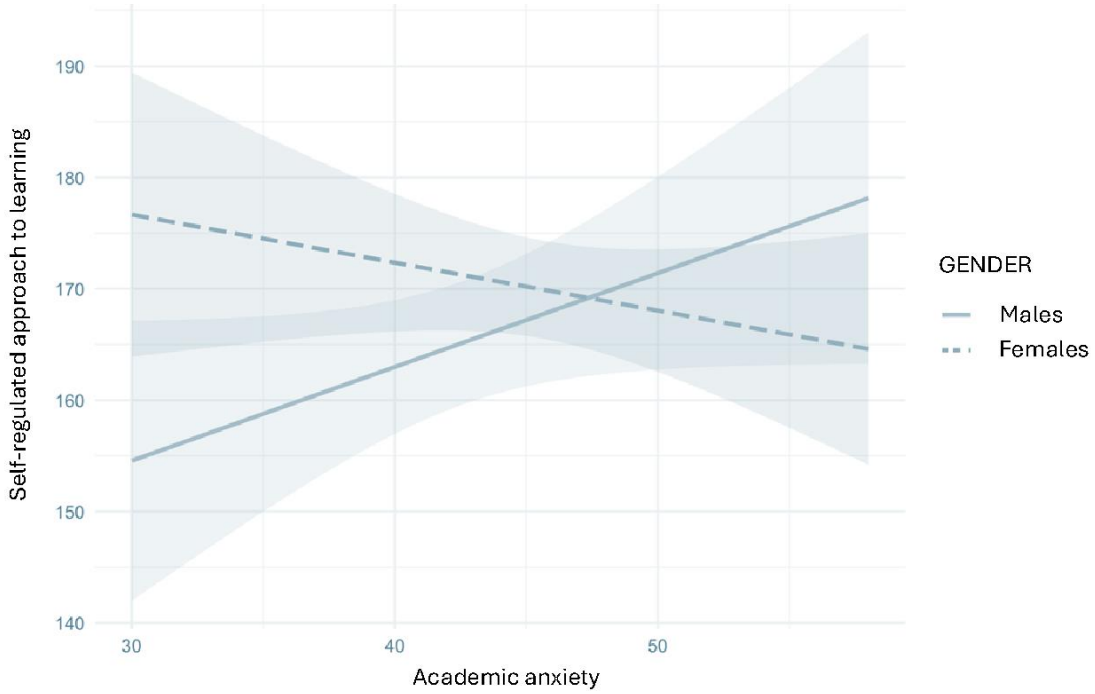
Academic Self-efficacy	0.469	0.092	5.117	<.001***	
Learning goals	0.248	0.093	2.669	.009**	
Gender (Female = 1; Male = 0)	0.176	0.184	0.958	.341	
Block 2					
Intercepts	-0.160	0.175	-0.917	.362	0.04
Academic Anxiety	-0.209	0.114	-1.832	.070	
Gender (Female = 1; Male = 0)	0.266	0.231	1.151	0.253	
Block 3					
Intercept	-0.154	0.160	-0.962	.339	0.13
Academic resilience	0.375	0.102	3.661	<.001***	
Gender (Female = 1; Male = 0)	0.256	0.208	1.231	.222	
Block 4					
Intercepts	-0.120	0.147	-0.819	.415	0.37
Academic Self-efficacy	0.417	0.099	4.230	<.001***	
Learning goals	0.236	0.093	2.534	.013*	
Academic Anxiety	0.066	0.107	0.611	.543	

Academic Resilience	0.192	0.105	1.830	.071	
Gender (Female = 1; Male = 0)	0.200	0.196	1.019	.311	
Block 5					
Intercepts	0.010	0.158	0.065	.948	0.40
Academic Self-efficacy	0.412	0.097	4.256	<.001***	
Learning goals	0.191	0.094	2.032	.045*	
Academic Anxiety	0.323	0.165	1.951	.055	
Academic Resilience	0.161	0.105	1.543	.127	
Gender (Female = 1; Male = 0)	0.105	0.198	0.530	.598	
Anxiety × Gender	-0.418	0.207	-2.018	.047*	

Note. β = standardized regression coefficient; SE = Standard error; p = p-value; R^2 = variance explained by the model.

*$p < .05$, **$p < .01$, ***$p < .001$

Figure 1 the interaction Anxiety × Gender



Simple slope analysis of the interaction between gender and academic anxiety, specifying self-regulated approach to learning as dependent variable.

4. Discussion

It is well documented in the literature that the difficulties experienced by students with SLD tend to persist into higher education, posing challenges for their learning and well-being (Casali et al., 2024). However, the university population with SLD has been scarcely studied to date, particularly considering the role of non-cognitive factors in self-regulated approach to learning (Casali et al., 2024). In this context, our study aimed to evaluate the unique contribution of specific motivational factors, academic anxiety, and academic resilience to self-regulated learning. The

results showed that motivational factors (i.e., academic self-efficacy and learning goals) were positively related to the self-regulated approach to learning. Furthermore, when academic anxiety and academic resilience were simultaneously added to the model, only academic self-efficacy and learning goals showed statistically significant positive effects on the self-regulated approach to learning. These results support theoretical frameworks suggesting that motivational factors have a main role in self-regulated approach to learning (Butler & Schnellert, 2015). Specifically, evidence primarily gathered on typical development participants show that higher academic self-efficacy and mastery-oriented goals are associated to better self-regulated approach to learning, leading individuals in persisting through difficulties and pursue goals in face of difficulties (Mega et al., 2014; Usher & Schunk, 2017; Zhoc et al., 2019). Extending previous findings, these results highlight motivational factors as key protective factors that may support students with SLD in implementing self-regulatory skills in their university learning activities (Usher & Schunk, 2017).

Our results concerning academic anxiety and academic resilience are somewhat mixed. Specifically, while academic resilience appears to positively predict the self-regulated approach to learning, this effect seems to be suppressed upon the introduction of motivational factors into the regression model. These findings' pattern suggests that resilience plays a role in self-regulated approaches to learning; however, motivational beliefs may be more directly linked to self-regulation strategies, with academic resilience that may act as an indirect predictor of self-regulated approach to learning. In other words, resilience may represent a higher-order trait in students, initially influencing motivational aspects that subsequently play a key role in supporting self-regulated learning (e.g., Hossain et al., 2022; Stein et al., 2024). In this context, future studies should explore the interplay among these factors longitudinally, aiming

to assess the temporal and directional associations between the examined constructs in path analysis models.

Regression models also showed that academic anxiety does not have a main effect on the self-regulated approach to learning, which contrasts with evidence in the literature suggesting that affective factors are associated with a student's ability to self-regulate (Ben-Eliyahu, 2019; Usher & Schunk, 2017). However, our results also indicated that the interaction between academic anxiety and gender is associated with the self-regulated approach to learning. Specifically, simple slope analysis revealed that the negative relationship between anxiety and self-regulated learning was stronger for females than for males. In other words, our findings suggest that academic anxiety may represent a risk factor for the use of self-regulated learning strategies, particularly among female students. In this context, the literature indicates that females typically exhibit higher levels of anxiety, especially in academic contexts (e.g., von der Embse et al., 2018), posing a gender-related risk factor in hindering self-regulation approach to learning.

4.1 Limitations

The study has some limitations. First, it examines the relationships between variables in a cross-sectional sample, which limits the ability to explore temporal relationships between variables or draw conclusions about the directionality of the effects. Although this study is cross-sectional in nature and does not allow testing the directionality of effects, it is worth noting that it builds on theoretical foundations suggesting that beliefs, as forethoughts, shape students' self-regulated approaches to learning (for a review, see Usher & Schunk, 2017; Zimmerman, 2013). These theoretical premises provide a theorical and methodological basis for the proposed regression models (Thoemmes, 2015), leading to the specification of the self-

regulated approach to learning as the dependent variable. Second, although we applied strict exclusion criteria for participants, the sample includes students with various SLD diagnoses, sometimes with comorbidities, which prevents a clear assessment of differences in affective-motivational profiles or self-regulated approaches to learning across diagnostic subgroups. Lastly, the study did not include a control group of typically developing students, which might have allowed for a comparison of the relationship between non-cognitive factors and the self-regulated approach to learning in students with SLD. Despite these limitations, we believe the findings provide valuable insights into the protective and risk factors associated with the self-regulation approach to learning in students with SLD.

4.2 Conclusion

Several studies have shown that students with SLD exhibit significant difficulties in self-regulated learning compared to their peers (Casali et al., 2024; Johnson et al., 2023; van der Zanden et al., 2018). This issue may become even more pronounced upon entering university, where increased academic demands can exacerbate these challenges. However, to date, few studies have specifically focused on this population within the university context to identify the contribution of non-cognitive factors to self-regulated learning (Casali et al., 2024). Results indicate that motivational factors play a primary role in self-regulated learning among university students with SLD. Interestingly, academic anxiety emerges as a risk factor for self-regulated learning, particularly affecting female students. Theoretically, these findings add new evidence to the literature by highlighting the role of non-cognitive factors in modulating self-regulated learning, an aspect that could be crucial in supporting academic success and well-being among students with SLD. In this context, it is important for future studies to investigate whether interventions aimed at promoting motivational and

affective aspects can play a role in supporting a self-regulated approach to learning, making higher education an opportunity accessible to all students.

5. References

Baird, G. L., Scott, W. D., Dearing, E., & Hamill, S. K. (2009). Cognitive self-regulation in youth with and without learning disabilities: Academic self-efficacy, theories of intelligence, learning vs. performance goal preferences, and effort attributions. *Journal of Social and Clinical Psychology*, *28*(7), 881-908. https://guilfordjournals.com/doi/10.1521/jscp.2009.28.7.881

Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. *Psychological Review*, *84*(2), 191–215. https://doi.org/10.1037/0033-295X.84.2.191

Ben-Eliyahu, A. (2019). Academic Emotional Learning: A Critical Component of Self-Regulated Learning in the Emotional Learning Cycle. *Educational Psychologist*, *54*(2), 84–105. https://doi.org/10.1080/00461520.2019.1582345

Ben-Naim, S., Laslo-Roth, R., Einav, M., Biran, H., & Margalit, M. (2017). Academic self-efficacy, sense of coherence, hope and tiredness among college students with learning disabilities. *European Journal of Special Needs Education*, *32*(1), 18–34. https://doi.org/10.1080/08856257.2016.1254973

Butler, D. L., & Schnellert, L. (2015). Success for students with learning disabilities: What does self-regulation have to do with it? In T. Cleary (Ed.), *Self-regulated learning interventions with at-risk youth: Enhancing adaptability, performance, and well-being* (pp. 89–111). American Psychological Association. https://doi.org/10.1037/14641-005

Casali, N., Meneghetti, C., Tinti, C., Maria Re, A., Sini, B., Passolunghi, M. C., Valenti, A., Montesano, L., Pellegrino, G., & Carretti, B. (2024). Academic Achievement

and Satisfaction Among University Students With Specific Learning Disabilities: The Roles of Soft Skills and Study-Related Factors. *Journal of Learning Disabilities*, *57*(1), 16–29. https://doi.org/10.1177/00222194221150786

Cohen, J. (2013). *Statistical power analysis for the behavioral sciences*. Routledge.

De Beni, R., Zamperlin, C., Meneghetti, C., Cornoldi, C., Fabris, M., Tona, G. D. M., & Moè, A. (2014). *Test AMOS-Abilità e motivazione allo studio: prove di valutazione e orientamento per la scuola secondaria di secondo grado e l'università: Nuova edizione.* Erickson.

Faul, F., Erdfelder, E., Lang, A.-G., & Buchner, A. (2007). G*Power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. *Behavior Research Methods*, *39*, 175-191.

Gonzaga, L. R. V., Dellazzana-Zanon, L. L., & Becker Da Silva, A. M. (Eds.). (2022). *Handbook of Stress and Academic Anxiety: Psychological Processes and Interventions with Students and Teachers*. Springer International Publishing. https://doi.org/10.1007/978-3-031-12737-3

Haft, S. L., Duong, P. H., Ho, T. C., Hendren, R. L., & Hoeft, F. (2019). Anxiety and Attentional Bias in Children with Specific Learning Disorders. *Journal of Abnormal Child Psychology*, *47*(3), 487–497. https://doi.org/10.1007/s10802-018-0458-y

Hartley, M. T. (2011). Examining the Relationships Between Resilience, Mental Health, and Academic Persistence in Undergraduate College Students. *Journal of American College Health*, *59*(7), 596–604. https://doi.org/10.1080/07448481.2010.515632

Hossain, B., Chen, Y., Bent, S., Parenteau, C., Widjaja, F., Haft, S. L., Hoeft, F., & Hendren, R. L. (2022). The role of grit and resilience in children with reading

disorder: A longitudinal cohort study. *Annals of Dyslexia*, *72*(1), 1–27. https://doi.org/10.1007/s11881-021-00238-w

Johnson, E., Masser, J. S., & Spears, L. (2023). Self-Regulated Learners: A Comprehensive, Translational Framework for Students with Learning Disabilities. *Exceptionality*, *31*(1), 52–68. https://doi.org/10.1080/09362835.2021.1938063

Lau, N. T., Ansari, D., & Sokolowski, H. M. (2024). Unraveling the interplay between math anxiety and math achievement. *Trends in Cognitive Sciences*. https://doi.org/10.1016/j.tics.2024.07.006

Marsh, H. W., Pekrun, R., Parker, P. D., Murayama, K., Guo, J., Dicke, T., & Arens, A. K. (2019). The murky distinction between self-concept and self-efficacy: Beware of lurking jingle-jangle fallacies. *Journal of Educational Psychology*, *111*(2), 331–353. https://doi.org/10.1037/edu0000281

Martin, A. J., & Marsh, H. W. (2006). Academic resilience and its psychological and educational correlates: A construct validity approach. *Psychology in the Schools*, *43*(3), 267–281. https://doi.org/10.1002/pits.20149

Mega, C., Ronconi, L., & De Beni, R. (2014). What makes a good student? How emotions, self-regulated learning, and motivation contribute to academic achievement. *Journal of Educational Psychology*, *106*(1), 121–131. https://doi.org/10.1037/a0033546

Nelson, J. M., & Harwood, H. (2011). Learning Disabilities and Anxiety: A Meta-Analysis. *Journal of Learning Disabilities*, *44*(1), 3–17. https://doi.org/10.1177/0022219409359939

Poortvliet, P. M., & Darnon, C. (2010). Toward a More Social Understanding of Achievement Goals: The Interpersonal Effects of Mastery and Performance

Goals. *Current Directions in Psychological Science*, *19*(5), 324–328. https://doi.org/10.1177/0963721410383246

Stein, B., Hoeft, F., & Richter, C. G. (2024). Stress, resilience, and emotional well-being in children and adolescents with specific learning disabilities. *Current Opinion in Behavioral Sciences*, *58*, 101410. https://doi.org/10.1016/j.cobeha.2024.101410

Straus, E., Dev, S. I., & Moore, R. C. (2020). The measurement of resilience and grit: Room for improvement. *Psychiatry Research*, *285*, 112791. https://doi.org/10.1016/j.psychres.2020.112791

Thoemmes, F. (2015). Reversing Arrows in Mediation Models Does Not Distinguish Plausible Models. *Basic and Applied Social Psychology*, *37*(4), 226–234. https://doi.org/10.1080/01973533.2015.1049351

Usher, E. L., & Schunk, D. H. (2017). Social Cognitive Theoretical Perspective of Self-Regulation. In *Handbook of Self-Regulation of Learning and Performance* (2ª ed.). Routledge.

van der Zanden, P. J. A. C., Denessen, E., Cillessen, A. H. N., & Meijer, P. C. (2018). Domains and predictors of first-year student success: A systematic review. *Educational Research Review*, *23*, 57–77. https://doi.org/10.1016/j.edurev.2018.01.001

von der Embse, N., Jester, D., Roy, D., & Post, J. (2018). Test anxiety effects, predictors, and correlates: A 30-year meta-analytic review. *Journal of Affective Disorders*, *227*, 483–493. https://doi.org/10.1016/j.jad.2017.11.048

Wong, B. Y. L. (2003). General and Specific Issues for Researchers' Consideration in Applying the Risk and Resilience Framework to the Social Domain of Learning

Disabilities. *Learning Disabilities Research & Practice*, *18*(2), 68–76. https://doi.org/10.1111/1540-5826.00060

Zhoc, K. C. H., King, R. B., Law, W., & McInerney, D. M. (2019). Intrinsic and extrinsic future goals: Their differential effects on students' self-control and distal learning outcomes. *Psychology in the Schools*, *56*(10), 1596–1613. https://doi.org/10.1002/pits.22287

Zimmerman, B. J. (2013). From Cognitive Modeling to Self-Regulation: A Social Cognitive Career Path. *Educational Psychologist*, *48*(3), 135–147. https://doi.org/10.1080/00461520.2013.794676

.

The fifth study extended the analysis to a larger sample of students with and without SLDs, assessing non-cognitive factors and their evolution over time since enrollment. Results showed a stable deficit in self-regulated learning among students with SLDs, regardless of length of time at university. However, a temporal dynamic was observed for learning goals and academic anxiety: as studies progressed, students with SLDs tended to report a weaker mastery orientation and higher levels of anxiety compared to peers. By contrast, no significant differences emerged in self-efficacy or resilience, which therefore appear to represent relatively preserved resources. These findings suggest that self-regulation should be supported through timely interventions from the outset of university, while goals and anxiety should be monitored and addressed throughout the academic journey in order to prevent negative consequences for well-being and academic careers. This study concludes the logical trajectory of the dissertation by situating the profiles of students with SLDs within a comparative and developmental framework, showing how vulnerabilities may intensify over time in the university context

STUDY 5

Self-Regulated Learning, affective-motivational and emotional factors at the beginning of the university: a study on young adults with and without specific learning disorder

(Accepted for publication at the “Learning Disabilities Research and Practice” journal)

1 Introduction

Specific learning difficulties (SLD) are neurodevelopmental conditions characterized by ongoing and significant challenges in acquiring essential academic skills, such as reading, writing, and mathematics, that typically emerge in the early stages of education (World Health Organization, 2019). Research indicates that these difficulties extend beyond samples of school-aged children, as university students with SLD also continue to have difficulties with basic academic skills (Morosini et al., 2025a) and certain neurocognitive aspects, creating a significant barrier to academic success (Hellendoorn & Ruijssenaars, 2000). Although the literature has extensively examined basic academic skills and neuropsychological abilities in students with SLD, far less attention has been devoted to self-regulated learning and affective-motivational factors that influence learning in higher education. Specifically, difficulties in self-regulated learning, such as time management, the development of effective study strategies and planning, can hinder academic success if not adequately addressed (Ben-Eliyahu, 2019; Morosini et al., 2025b). Alongside self-regulation challenges, university students with SLD often experience affective-motivational difficulties, such

as lower academic self-efficacy, less adaptive learning goals and heightened academic anxiety (De Beni et al., 2014; Kampylafka et al., 2023; Pellegrino et al., 2023). These issues are frequently rooted in previous negative academic experiences and in a perceived gap with university peers (Buonuomo et al., 2023; Wiener & Schneider, 2002), which may reinforce negative attitudes in learning activities.

The present study aims to examine whether university students with SLD differ from their neurotypical peers in terms of their self-regulated learning skills and affective-motivational factors, and whether such differences may vary as a function of time since enrolment. While neurocognitive aspects of higher education learning in SLD populations have been relatively well studied, the aforementioned correlates remain less systematically explored, despite their strong association with academic outcomes (Casali et al., 2024; Pellegrino et al., 2023). It also remains unclear whether the differences in self-regulated learning and affective-motivational factors may be moderated by time since enrolment at university. Investigating these issues is particularly relevant in early adulthood, a developmental stage marked by significant cognitive milestones (Tervo-Clemmens et al., 2023) and a reshaping of life goals and motivation. Gaining a deeper understanding of factors that could promote (or hinder) SLD students' studies could benefit not only these students themselves, but also lecturers, and university policymakers, by fostering greater awareness of their specific needs and informing the design of targeted interventions.

Self-regulated learning and affective-motivational factors in students with SLD

A growing body of research indicates that self-regulated learning and affective-motivational factors influence academic outcomes as strongly as cognitive abilities. These constructs are particularly salient for university students with SLD, who may

differ from their peers and face specific challenges throughout their university experience (Casali et al., 2024; De Beni et al., 2014). Self-regulated learning (SRL) includes abilities such as planning, monitoring, and critically reflecting on one's own learning processes (Zimmerman, 2002), making it a key factor in academic achievement. In general, SRL plays a crucial role throughout education, from childhood (Dent & Koenka, 2016) to higher education (Casali et al., 2024; Theobald, 2021). From a metacognitive perspective, SRL entails the use of approach strategies, ranging from surface to deep learning approach (Casali et al., 2024; De Beni et al., 2015), and study strategies through which the student is able to connect new information to prior knowledge, organize learning plans, or create outlines and concept maps, promoting a more structured and longer-lasting learning (Zimmerman, 2002). Several studies have examined SRL in university students with SLD (Casali et al., 2024; Morosini et al., 2025b; Mortimore & Crozier, 2006; Olofsson et al. 2012; Pellegrino et al., 2023). Due to difficulties with information processing and retrieval, university students with SLDs often rely on less effective strategies and may adopt a surface approach strategy, rendering their learning less effective (e.g., MacCullagh et al., 2017; Morosini et al., 2025b; Mortimore & Crozier, 2006). Furthermore, literature shows that university students with SLDs often struggle to apply appropriate strategies effectively, highlighting the need for targeted support to help them develop more functional learning methods (MacCullagh et al., 2017; Olofsson et al., 2012; Pino & Mortari, 2014).

Beyond SRL, motivational factors are also central in influencing learning outcomes, particularly learning goals and academic self-efficacy. With regard to learning goals, the literature distinguishes between mastery-oriented goals, which focus on a desire to learn and personal growth, and performance-oriented goals, which

emphasize comparison with others and the avoidance of failure (Elliot & McGregor, 2001). Mastery goals are generally more adaptive than performance goals. This is particularly true when a performance goal takes the form of avoiding failure, which is itself often linked with academic anxiety and a superficial approach to learning. Evidence collected on primary and secondary school students with SLD appear to show lower mastery-oriented goal preferences compared to their neurotypical peers (Baird et al., 2009; Kampylafka et al.,2023). For instance, Kampylafka et al., (2023) found that fifth- and sixth-grade students with SLD exhibited fewer mastery goals, were more avoidance-oriented and reported higher levels of performance goals compared to students without SLD, highlighting a potentially more vulnerable motivational profile among students with SLD. However, literature is not always consistent on this aspect, especially when considering university students, for whom no statistically significant differences have been found across goal types (Casali et al., 2024). Another relevant motivational factor is academic self-efficacy, defined as students' belief in their ability to successfully complete specific tasks (Bandura, 1997). Academic self-efficacy influences motivation and engagement. While high academic self-efficacy is associated with greater study effort and the use of effective strategies, low self-efficacy may impair students' ability to handle cognitive demands and reduce their autonomy in studying (Baird et al., 2009; Hen & Goroshit, 2014).

In university settings, academic self-efficacy is positively associated with perseverance, the use of appropriate learning strategies, and overall academic performance considering both students with SLD and their peers (Casali et al., 2024; De Beni et al., 2014; Honicke & Broadbent, 2016; Linnenbrink, 2005; Mega et al., 2014). However, numerous studies indicate that university students with SLD tend to report lower levels of academic self-efficacy compared to their peers (Ben-Naim et al.,

2017; Casali et al., 2024). This may be due to a cumulative effect of negative school experiences and a self-narrative that emphasizes difficulties rather than competencies (Baird et al., 2009).

In addition to the above-mentioned aspects, emotional factors play a critical role in academic performance and university students' ability to overcome academic challenges (De Beni et al., 2014). Academic anxiety involves worry and tension related to academic performance, which can negatively affect learning by impairing concentration and hindering the effective use of strategies (Bonuomo et al., 2023). Numerous studies have shown that students with SLD often have higher levels of academic anxiety compared to their neurotypical peers, both considering school aged (Gallegos et al., 2012; Nelson & Harwood, 2011) and university students (Iaia et al., 2024). University students with SLD often report experiencing academic anxiety symptoms related to their performance and the judgment of others (Buonuomo et al., 2023; Ghisi et al., 2016; Iaia et al., 2024). Academic anxiety at university can stem from repeated experiences of failure, negative feedback and more demanding cognitive requirements, potentially interfering critically with concentration, motivation, and performance (Spielberger, 1980; Usher & Schunk, 2017). Academic resilience, on the other hand, refers to the capacity to maintain focus and determination even in the face of obstacles and setbacks (De Beni et al., 2014) and it serves as an essential protective factor. Indeed, low resilience levels are often linked to increased emotional vulnerability and difficulty recovering from failure (De Beni et al., 2014; Martin, 2013). Literature indicates that university students with SLD exhibit lower levels of academic resilience compared to their peers (Casali et al., 2024; Iaia et al., 2024), although the data on this population is mixed (Ghisi et al., 2016).

In summary, the data suggest that students with SLD may experience difficulties in SRL as well as in affective-motivational factors, despite some mixed evidence regarding academic resilience. These findings indicate that challenges in higher education may arise not only from well-established neurocognitive difficulties, but also from insufficient affective-motivational support, the lack of which can exacerbate existing struggles. Given the lifelong consequences of SLD for multiple aspects of life and higher education (see Casali et al., 2024; Deshler, 2005), further investigation is needed to clarify how these factors differ across SLD students and their neurotypical peers in order to inform the development of policies and intervention programmes.

The Italian context

SRL and affective-motivational factors are closely intertwined with the educational and policy frameworks that regulate the support provided to students with SLD and ultimately shape their academic experience. In Italy, the definition of SLD follows national legislation (Law 170/2010) and the international ICD-11 classification (World Health Organization, 2019), both of which identify dyslexia, dysgraphia, dysorthography, and dyscalculia as the core diagnostic categories and inform clinical practice. In line with ICD-11, SLDs are characterized by significant and persistent difficulties in the acquisition of academic skills (i.e., reading, writing, and/or arithmetic) that are markedly below what would be expected for the individual's age, and cannot be explained by other factors such as inadequate instruction, intellectual disability, sensory impairments, neurological conditions, or socio-environmental disadvantage. In Italy, SLD certification is issued exclusively by public health services or accredited clinical centres. The diagnosis can be formally made from the end of second grade of primary school onwards, once adequate learning opportunities have been provided

(Ministry of Education, 2011). Certification grants access to specific educational support across all levels of schooling, including higher education. In Italy, this is particularly relevant given the evolving legislative context, where access to education is guaranteed to all citizens, regardless of disability. Specifically, following the approval of Law No. 170 on October 8, 2010, which addresses SLD, and the subsequent publication of related Guidelines on July 12, 2011, in collaboration with the Ministry of Universities and Research (MUR), universities have increased their efforts to support students with SLD by establishing more systematic ways to accommodate students and provide required resources. However, the application of Law No. 170/2010 at the university level differs from its implementation in other levels of schooling (e.g., universities do not implement individualized education plans). Additionally, the 2024 guidelines from the National Conference of University Delegates for Disabilities (CNUDD) recommend the use of assistive tools and accommodations, however, these guidelines are advisory, and adherence is left to the discretion of individual faculty members. Furthermore, even if accurately quantifying the exact prevalence of university students with SLD in Italy remains challenging (Longobardi et al., 2019), a report by the National Agency for the Evaluation of the University and Research System (ANVUR, 2022a) noted an increase in the number of students with disabilities or SLDs enrolled in Italian universities, with prevalence rising from 0.27% (fewer than 3,000 students) in the academic year 1999-2000 to 1.82% (more than 18,000 students) in 2019-2020. This growth indicates, on the one hand, a greater awareness and improved inclusion of students with SLDs in higher education but equally raises concerns about the university system's ability to effectively address the specific educational needs of SLD students. Despite the improved access provided by legislation and inclusion programmes, students with SLDs still encounter many

challenges that affect their academic and personal development in Italy (ANVUR, 2022b; Feraco et al., 2025). Though there is little exploration of SLD in the Italian higher education system in existing literature (Casali et al., 2024), the rapid increase in students with disabilities or SLD over the last twenty years highlights the need for further research in this specific context. Indeed, Italian universities show both progress and persistent challenges in its policies for supporting students with SLD and further investigation is particularly relevant, as national contexts may critically shape SRL and affective-motivational correlates of students with SLD, with differences potentially emerging at different stages of university enrolment.

The present study

The transition to university involves significant changes in study organization, time management, and independent learning, which can present considerable challenges for many students (van der Zanden et al., 2018), especially for those with SLDs. We believe it is crucial to focus on this period, as difficulties related to SLDs may manifest at any time of life, but new learning environments could be particularly challenging for this population of students (Hatcher et al., 2002; Swanson & Hsieh, 2009; Tervo-Clemmens et al., 2023). These challenges may contribute to the well-documented early dropout from higher education (ANVUR, 2022a) as well as reduced social wellbeing and life satisfaction (Casali et el., 2024; Feraco et al, 2025). Given the theoretical framework described above, the aim of the present study is to assess how students with SLD differ from their peers in terms of SRL, motivational (i.e. academic self-efficacy and learning goals) and emotional factors (academic anxiety and academic resilience) and to explore whether these differences vary according to the time since enrolment. In doing so, we hypothesized:

H1. SRL abilities would be weaker in SLD students compared with neurotypical peers (MacCullagh et al., 2017; Morosini et al., 2025b; Olofsson et al., 2012). Specifically, evidence shows that university students with SLD, experience challenges in reading, writing, memorization, learning organization, and concentration, also often describing their studying experience as particularly exhausting and ineffective (Camia et al., 2025; Doikou-Avlidou, 2015).

H2. SLD students would exhibit lower levels of academic self-efficacy compared to the control group. This difference is likely due to the frequent experiences of learning failure in SLD students compared to neurotypical students which may influence their efficacy beliefs (Baird et al., 2009; Hen & Goroshit, 2014; Lackaye & Margalit, 2006; Tabassam & Grainger, 2002). Indeed, such differences have been observed at various developmental stages, including primary school (Tabassam & Grainger, 2002), secondary school (Lackaye & Margalit, 2006), and at the university level (Casali et al., 2024; Hen & Goroshit, 2014), supporting well-established findings in the existing literature.

H3. Students with SLD would be more performance-oriented compared to typically developing peers. Indeed, evidence from school-aged students (Baird et al., 2009; Kampylafka et al., 2023) shows that individuals with SLD seem to set more performance-oriented goals rather than mastery-oriented ones, prioritizing the demonstration of their abilities over a deeper understanding of learning material. However, when considering university students, the literature is still sparse (Casali et al., Morosini et al., 2025a).

H4. Individuals with SLD would report statistically significant higher academic anxiety scores than their neurotypically developing peers, as documented in recent studies conducted with both school aged (Gallegos et al., 2012; Haft et al., 2023; Nelson & Harwood, 2011) and university students (Buonuomo et al., 2023; Iaia et al., 2024). Indeed, literature in the field, although not always consistent, shows higher levels of academic anxiety, internalizing behavioral problems and emotional distress among students with SLD (Camia et al., 2025; Doikou-Avlidou, 2015; Ghisi et al., 2016; Morosini et al., 2025b; Mugnaini et al., 2009).

We have not formulated specific hypotheses regarding academic resilience, since the existing literature indicates mixed results showing lower academic resilience scores in university students with SLD (Casali et al., 2024; Iaia et al., 2024) but not in others (Ghisi et al., 2016). Furthermore, we did not advance specific hypotheses concerning whether differences between students with SLD and their typically developing peers in the factors under examination might vary as a function of time since enrolment, leaving this objective exploratory. Although existing literature suggests that learning experiences can influence aspects such as academic self-efficacy and academic anxiety (D'Agostino et al., 2022; Du et al., 2021; Marsh et al., 2019), there has been little investigation into these dynamics with respect to potential differences between students with SLD and their peers. To the best of our knowledge, this is the first study to focus on evaluating SRL, motivational, and emotional factors during the transition from high school to university, exploring whether differences between students with SLD and their peers vary according to time since enrolment.

2.Method

Participants

The questionnaire was administered to a total of 421 participants. From this sample, 8 participants were excluded due to careless responses (i.e., inattentive or thoughtless responses to questions that were identified by checking individuals' response consistency; see Curran, 2016), 7 participants had not yet enrolled in university, and 14 participants were excluded due to outlier age values. The final sample consisted of 392 university students (M_{age} = 20.42; SD_{age} = 1.63; N_{males} = 124; $N_{females}$ = 268). Among them, 98 participants had a a diagnosis of SLD diagnosis (M_{age} = 20.06; SD_{age} = 1.26; N_{males} = 42; $N_{females}$ = 56), while 294 participants had no diagnosis of SLD (M_{age} = 20.54; SD_{age} = 1.73; N_{males} = 82; $N_{females}$ = 212). Participants were enrolled in the following disciplinary areas: psychology (n = 169); physics and engineering (n = 65); biology and chemistry (n = 33); education (n = 37); economics and political sciences (n = 33); social and health sciences (n = 26); humanities (n = 29). The final sample did not include individuals who, based on mandatory screening questions, reported comorbid neurodevelopmental disorders (e.g., ADHD, autism spectrum disorders) or acute psychiatric syndromes. The study was conducted in line with the Declaration of Helsinki and the Italian Association of Psychology's ethical guidelines. Before taking part in the study, participants were informed about its aims and the data processing and their written consent was obtained. The study was approved by the ethical committee of the University of Trieste.

Procedure

SLD participants were invited to take part during their scheduled appointments for the renewal of their SLD diagnosis at Burlo Garofolo Children's Hospital. Prior to

their visit, they were asked whether they would be interested in participating. The students were contacted though their institutional e-mail and volunteers in the research programme. All the participants needed to sign an informed consent form and fill in an online form to participate to the study. All participants were asked to complete a self-report questionnaire. Specifically, students completed scaled-response questions from the AMOS test battery, or, to use the full Italian title *Abilità e MOtivazione allo Studio* (Study Skills and Motivation) acronym (De Beni et al., 2014). The test battery is a standardized instrument for assessment used in Italy and demonstrates excellent psychometric properties and assesses learning strategies, SRL skills, and affective-motivational factors related to learning in higher education. We chose to use this test battery because, in addition to being one of the most widely used tools for assessing learning-related skills in Italian higher education, it has been shown to be effective in distinguishing individuals with SLD from those without SLD using the above-mentioned areas of assessment (Buonuomo et al., 2023; Casali et al., 2024; Pellegrino et al., 2023; Morosini et al., 2025a). According to the authors, AMOS's norms were established using a sample of Italian students ($M = 20.76$, $SD = 2.00$) comprising upper secondary school students ($n = 361$) and university students ($n = 488$). In line with the aims and hypotheses of this study, the following scales were used: the self-regulated learning skills scale, the academic self-efficacy scale, the learning goals scale, and the academic anxiety and resilience scale. Detailed descriptions of these scales are provided in the subsequent sections.

Self-regulated learning skills scale

The scale consists of 20 items that reflect how individuals self-regulate during learning activities: organization, processing, self-evaluation, exam preparation, and metacognition (e.g., "I make sure I have a clear plan of the study tasks I need to

complete", "While studying, I try to generate questions about the material"). Participants rate their agreement with each statement on a 5-point Likert scale, and the total score ranges from 20 to 100 points, with higher scores indicating a better SRL. As stated in the AMOS manual, the scale shows satisfactory internal consistency (Cronbach's α = .76).

Academic self-efficacy scale

This scale assesses participants' beliefs in their ability to perform academic activities effectively (e.g., "How confident are you in your ability to succeed in your studies?"). It consists of five items rated on a 5-point Likert scale and the raw score ranges from 5 to 25, with higher scores indicating greater academic self-efficacy. As stated in the AMOS manual, the scale shows satisfactory internal consistency (Cronbach's α = .80).

Learning goals scale

The learning goals scale evaluates participants' goal orientation through four scenarios. Each scenario presents two distinct actions to choose from, reflecting the participants' learning goals: mastery-oriented or performance-oriented goals (e.g., "In a learning situation, what do you prefer? a) Tasks that are fairly difficult, which you approach as challenges to test your abilities. [mastery-oriented goals]; b) Tasks that are easy enough to give you the confidence that you will do well [performance-oriented goals]). The raw score ranges from 0 to 4 and higher scores indicate a stronger tendency to set mastery-oriented goals. As stated in the AMOS manual, the scale shows satisfactory internal consistency (Cronbach's α = .78).

Academic anxiety and resilience scale

The questionnaire aims to assess both academic anxiety and resilience experienced during learning and assessments. It consists of 14 items divided equally

into two subscales: seven items measuring academic anxiety (e.g., “Just thinking about taking a test or exam sends me into a panic”) and seven measuring academic resilience (e.g., “I overcome agitation and tension and recover from difficult moments while studying”). Participants indicated their level of agreement with each statement on a 5-point Likert scale. Subscale scores ranged from 7 to 35, with higher scores indicating greater academic anxiety or academic resilience, respectively. As stated in the AMOS manual, the scale shows satisfactory internal consistency both for the academic anxiety (Cronbach’s α = .86) and academic resilience subscales (Cronbach’s α = .76).

Data analysis

All analyses were conducted using R (R Core Team, 2025). Before testing the aims of our study, we planned to examine descriptive statistics and bivariate correlations between the measures. Then, we prepared to run linear models to examine whether SRL and affective-motivational factors scores were associated with diagnosis status (SLD vs. non-SLD), months since enrolment, and participants’ gender. Before running these models, we examined whether the data met the assumptions of multiple regression. Specifically, for the hypothesized models (see Table 2), we assessed linearity, homoscedasticity, and normality of residuals using diagnostic plots (residuals vs. fitted values and Q–Q plots). Multicollinearity was evaluated using variance inflation factors (VIF). Inspection of these plots and VIF indices indicated no violations of the multiple regression assumptions. Furthermore, for assessing the independence assumption in the presence of potential hierarchical structure, we examined whether participants’ degree programmes introduced significant clustering in the data. Given theoretical evidence that students with SLD

may preferentially select certain university fields (Brunswick et al., 2025), we computed infraclass correlation coefficients (ICCs) for all outcome variables. ICC values were negligible (ICC < 0.015 for each measure), indicating that clustering by degree programme did not significantly affect the data and that multilevel modelling was not warranted.

To examine whether students with and without SLD differed in SRL and affective-motivational factors considered, we conducted hierarchical multiple regression analyses. Specifically, for each outcome variable (i.e., SRL, academic self-efficacy, learning goals, academic anxiety, and resilience), we first specified a first block (Block 1) in which diagnostic group was entered as predictor, and the number of months since enrolment and participants' gender were specified as covariates. In the second block (Block 2), we introduced an interaction term between diagnosis and number of months since enrolment. The outcome variables and the months since enrolment were standardized before conducting the analysis.

3 Results

Descriptive statistics and bivariate correlations between the variables are presented in Table 1.

Table 1. Descriptive statistics and bivariate correlations between the measures considered in the study.

		SLD group		Non-SLD group					
	R	**M**	**SD**	**M**	**SD**	**1.**	**2.**	**3.**	**4.**
1. SRL	.76	71.98	6.97	73.73	7.21	1			
2. Self-efficacy	.80	18.27	3.32	18.50	2.84	0.42***	1		
3. Learning goals	.78	2.33	1.65	2.28	1.55	0.21***	0.17***	1	
4. Anxiety	.86	20.45	6.40	21.11	6.29	-0.12*	-0.24***	-0.35***	1
5. Resilience	.76	23.52	4.87	23.80	4.33	0.31***	0.34***	0.35***	-0.55***

Note. R = Reliability, expressed as Cronbach's α, as reported in the AMOS manual (De Beni et al., 2014); M = Mean, SD = Standard Deviation; SRL = Self-regulated Learning. $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$.

Bivariate correlations showed that SRL was statistically significantly and positively associated with self-efficacy ($r = .42$, $p < .001$), learning goals ($r = .21$, $p < .001$), and resilience ($r = .31$, $p < .001$), and displayed a statistically significant negative association with anxiety ($r = -.12$, $p < .05$). Self-efficacy showed a statistically significant, positive correlation with learning goals ($r = .17$, $p < .001$) and resilience ($r = .34$, $p < .001$) and a negative correlation with anxiety ($r = -.24$, $p < .001$). Learning goals had a statistically significant, positive relation to resilience ($r = .35$, $p < .001$) and a negative relation to anxiety ($r = -.35$, $p < .001$). Finally, anxiety showed a statistically significant negative correlation with resilience ($r = -.55$, $p < .001$).

Group comparison

The results of the hierarchical regression models are presented in Table 2.

Table 2. Results from the hierarchical multiple regression analyses.

Variable	Estimate	SE	*t*	*p*	R^2
Model 1: self-regulated learning					
Block 1					
Intercept	73.960	0.714	103.622	<.001***	0.012
Diagnosis[a]	-1.849	0.851	-2.172	.030*	
Months since enrolment	-0.200	0.369	-0.542	.588	
Gender[b]	-0.295	0.797	-0.371	.711	
Block 2					
Intercept	74.026	0.721	102.708	<.001***	0.013
Diagnosis[a]	-1.752	0.863	-2.029	.043*	
Months since enrolment	-0.306	0.401	-0.763	.446	
Gender[b]	-0.377	0.806	-0.468	.640	
Diagnosis[a] x Months	0.731	1.076	0.680	.497	
Model 2: academic self-efficacy					
Block 1					
Intercept	18.149	0.296	61.408	<.001***	0.008
Diagnosis[a]	-0.120	0.352	-0.341	.733	
Months since enrolment	0.168	0.153	1.096	.274	
Gender[b]	0.467	0.330	1.416	.157	
Block 2					
Intercept	18.152	0.299	60.785	<.001***	0.008
Diagnosis[a]	-0.116	0.358	-0.325	.745	
Months since enrolment	0.164	0.166	0.984	.325	
Gender[b]	0.464	0.334	1.389	.166	
Diagnosis[a] x Months	0.028	0.446	0.064	.949	
Model 3: learning goals					
Block 1					
Intercept	2.531	0.157	16.139	<.001***	0.012
Diagnosis[a]	0.001	0.187	0.007	.994	
Months since enrolment	0.038	0.081	0.470	.639	
Gender[b]	-0.349	0.175	-1.993	.047*	
Block 2					
Intercept	2.478	0.157	15.765	<.001***	0.028
Diagnosis[a]	-0.078	0.188	-0.414	.679	
Months since enrolment	0.125	0.087	1.430	.153	
Gender[b]	-0.281	0.176	-1.601	.110	
Diagnosis[a] x Months	-0.601	0.234	-2.561	.011*	
Model 4: academic anxiety					
Block 1					
Intercept	19.266	0.618	31.197	<.001***	0.044
Diagnosis[a]	-0.360	0.736	-0.488	.625	
Months since enrolment	-0.365	0.320	-1.141	.254	
Gender[b]	2.582	0.689	3.746	<.001***	

Block 2					
Intercept	19.490	0.618	31.532	<.001***	0.062
Diagnosis[a]	-0.029	0.740	-0.039	.969	
Months since enrolment	-0.727	0.344	-2.113	.035*	
Gender[b]	2.302	0.691	3.329	<.001***	
Diagnosis[a] x Months	2.503	0.923	2.713	.007**	
Model 5: academic resilience					
Block 1					
Intercept	25.045	0.439	57.020	<.001***	0.031
Diagnosis[a]	-0.568	0.524	-1.084	.279	
Months since enrolment	-0.140	0.227	-0.617	.537	
Gender[b]	-1.721	0.490	-3.510	<.001***	
Block 2					
Intercept	24.952	0.442	56.404	<.001***	0.038
Diagnosis[a]	-0.705	0.530	-1.331	.184	
Months since enrolment	0.011	0.246	0.043	.966	
Gender[b]	-1.604	0.495	-3.240	.001**	
Diagnosis[a] x Months	-1.044	0.660	-1.581	.115	

Note. SE = standard error; *t* = t-test statistic; *p* = p-value; R^2 = coefficient of multiple determination.

*p < .05, **p < .01, ***p < .001

[a] Group without SLD = 0; Group with SLD = 1;

[b] Males = 0; Females = 1

The results of Model 1 showed that students with SLD reported statistically significant lower SRL scores compared to students without SLD both in Block 1 (β = -1.849, t = -2.172, p = .030) and in Block 2 (β = -1.752, t = -2.029, p = .043). The introduction of the interaction term between diagnosis and months since enrolment in Block 2 showed no statistically significant association with SRL scores (β = 0.731, t = 0.680, p = .497), indicating that the association between SLD diagnosis and SRL does not differ according to time since student enrolment. This suggests that, in our sample, SRL difficulties reported by university students with SLD are similar, regardless of how long they have been attending university. R^2 in Model 1 indicated that Block 1 and Block 2 explained 1.2% and 1.3% of the variance in SRL, respectively.

The results of Model 2 did not reveal any statistically significant effects of SLD diagnosis on academic self-efficacy, in either Block 1 (β = -0.120, t = -0.341, p = .733)

or Block 2 (β = -0.116, t = -0.325, p = .745). Similarly, the interaction term introduced in Block 2 between diagnosis and months since enrolment showed no statistically significant association with academic self-efficacy scores (β = 0.028, t = 0.064, p = .949), suggesting that the relationship between SLD diagnosis and academic self-efficacy is not moderated by months since enrolment. R^2 in Model 2 indicated that both Block 1 and Block 2 explained 0.8% of the variance in academic self-efficacy.

Considering Model 3, SLD diagnosis showed no statistically significant association with learning goals scores, in either in Block 1 (β = 0.001, t = 0.007, p = .994) or Block 2 (β = -0.078, t = -0.414, p = .679). However, a statistically significant association emerged in Block 2 between the interaction term (diagnosis x months since enrolment) and learning goals scores (β = -0.601, t = -2.561, p = .011), indicating that the relationship between SLD diagnosis and learning goals is moderated by months since enrolment. Specifically, the negative coefficient suggests that, among students who have been enrolled for a longer period, those with SLD report lower levels of mastery-oriented goals compared to their peers. R^2 in Model 3 indicated that Block 1 and Block 2 explained 1.2% and 2.8% of the variance in learning goals, respectively.

The results of Model 4 showed that SLD diagnosis had no statistically significant association with academic anxiety scores, in either Block 1 (β = -0.360, t = -0.488, p = .625) or Block 2 (β = -0.029, t = -0.039, p = .969). However, in Block 2, the interaction between diagnosis and months since enrolment was statistically significant and positively associated with academic anxiety (β = 2.503, t = 2.713, p = .007). This pattern suggests that, among students who have been at studying for longer, those with SLD tend to report higher levels of academic anxiety compared to their peers. R^2

in Model 4 indicated that Block 1 and Block 2 explained 4.4% and 6.2% of the variance in academic anxiety, respectively.

In Model 5, SLD diagnosis showed no statistically significant association with resilience scores, either in Block 1 (β = -0.568, t = -1.084, p = .279) or in Block 2 (β = -0.705, t = -1.331, p = .184). The interaction term introduced in Block 2 between diagnosis and months since enrolment was also not statistically significant (β = -1.044, t = -1.581, p = .115), indicating that the relationship between SLD and academic resilience is not moderated by how long students have been enrolled. R^2 in Model 5 indicated that Block 1 and Block 2 explained 3.1% and 3.8% of the variance in academic resilience, respectively.

4 Discussion

Universities are increasingly committed to promoting inclusion policies, resulting in a rise in enrolments of students with SLD both in Italy and internationally (Brunswick et al., 2025; Dumitru et al., 2024; Longobardi et al., 2019; Punch et al., 2025). However, there has been comparatively less investigation into SLD students at university than at earlier educational stages, especially considering the importance of students' SRL and affective-motivational profiles at university (Casali et al., 2024). Indeed, the issue is particularly important in higher education, where cognitive demand increases, learning processes reach their highest level of complexity, and students are required to develop new and autonomous study strategies. Given the limited literature on this population, particularly in the Italian university system (Bonuomo et al., 2023; Casali et al., 2024), our research aimed to assess how SLD students differ from their neurotypical peers in terms of SRL, motivational (i.e. academic self-efficacy and learning goals) and affective factors (academic anxiety and academic resilience), and to explore whether these difference vary as a function of time since enrolment.

Analysing these factors among university students with SLD can provide valuable insights for developing targeted clinical interventions and university policies, ultimately fostering a more inclusive and organized academic environment.

Firstly, as far as SRL is concerned, our data confirms the existing literature showing that university SLD students have weaker SRL abilities compared to their peers (MacCullagh et al., 2017; Morosini et al., 2025b; Olofsson et al., 2012). These students often describe their experience of studying as particularly exhausting and ineffective, finding memorization, learning organization, self-evaluation, concentration and preparing for exams challenging and demonstrating lower self-management skills (Camia et al., 2025; MacCullagh et al., 2017; Olofsson et al., 2012). Furthermore, our analysis reveals that the relationship between SLD diagnosis and SRL does not change based on students' time since enrolment. This point highlights that SRL difficulties observed among university students with SLD appear to be present regardless of how long they have been enrolled in university. From a practical perspective, our results suggests that SRL difficulties may not be not spontaneously compensated through academic exposure, underscoring the importance of implementing structured SRL training interventions early in the academic pathway, rather than assuming that students will progressively adapt through experience alone. Secondly, we addressed whether academic self-efficacy in university students with SLD differed from that of their neurotypical peers. Our results showed that students with SLD did not show a statistically significant difference in academic self-efficacy compared to neurotypical students, nor did these differences vary as a function of time since enrolment. These results contrast with our initial hypothesis, in which we predicted that SLD students would show less academic self-efficacy compared to their peers. Indeed, the transition from high school to university may be a challenge for all

students (van der Zanden et al., 2018), and this may be especially true for students who need to work harder to overcome learning difficulties. In this context, it is plausible that the absence of statistically significant differences between the two groups partly reflects the measurement approach we adopted. Given the heterogeneity of the sample across degree programmes, in the present study, academic self-efficacy was operationalized globally, focusing on the general perceived efficacy in study activities. This operationalization is broader than the theoretical conception of self-efficacy, which refers to task or domain-specific judgments. As a result, our measure may have failed to capture differences specific to particular tasks or disciplines. In addition, the findings may reflect a selection bias in our sample as we examined students who opted for a university pathway, a subset likely to be more motivated and to hold efficacy beliefs sufficient to sustain that choice. This interpretation is consistent with evidence that academic self-efficacy contributes to the choice to attend university and persist with studies (Ahmed, 2018; Daker et al., 2021).

Thirdly, we tested whether individuals with SLD tend to have more performance-oriented goals compared to their neurotypical peers (Baird et al., 2009; Kampylafka et al., 2023; Morosini et al., 2025a). Our data showed that there were no statistically significant differences in goal orientation between the two groups. These findings contribute to the mixed evidence reported in previous studies in university students (Casali et al., 2024; Morosini et al., 2025a) and in school-aged students (Baird et al., 2009; Kampylafka et al., 2023). However, results indicated that the difference in goal orientation between students with and without SLD is moderated by time since enrolment. Among students who had been enrolled in university for a longer period, those with SLD reported less mastery-oriented goals than their peers. This pattern may suggest a possible cumulative effect of prolonged academic

demands. Rather than reflecting an initial motivational deficit, the reduction in mastery orientation may emerge progressively as students encounter repeated academic strain. Time since enrolment therefore appears to act as a contextual amplifier of vulnerability, highlighting the need for continuous motivational monitoring throughout the university path, not only during the transition phase. This points to the need for future research to examine students who have accumulated substantial experience within the university context, which may help clarify the mixed findings observed in the literature.

Fourthly, we evaluated whether students with SLD differ from neurotypical peers in terms of academic anxiety. The literature shows that individuals diagnosed with SLD report higher academic anxiety scores than their peers, as documented in recent studies conducted on university students (Bonuomo et al., 2023; Iaia et al., 2024; Morosini et al., 2025b). Again, our data shows that academic anxiety experienced by university students with SLD showed no significant statistical difference from the data reported for neurotypical students. However, this difference becomes larger among those who have been enrolled in university for a longer period.

The moderating role of time since enrolment is particularly relevant from a preventive perspective. It suggests that anxiety may not be immediately elevated at university entry, but may increase later, as academic challenges accumulate. This pattern support the hypothesis of a “cumulative stress” mechanism, whereby prolonged exposure to high cognitive demands without adequate regulatory support intensifies emotional vulnerability. Monitoring anxiety levels longitudinally may therefore allow university services to identify critical periods in which targeted psychological or academic interventions are most needed. Other research has highlighted the significant prevalence of academic anxiety and depression among

individuals with SLD (Gallegos et al., 2012; Givon & Court, 2010; Iaia et al., 2024; Nelson & Harwood, 2011; Stein et al. 2024), caused by repeated unsuccessful experiences, negative feedback, and increasing educational cognitive demands. Literature indicates that chronic academic difficulties and experiences of failure can lead to increased emotional vulnerability (Bonuomo et al., 2023; Gallegos et al., 2021; Mugnaini et al., 2009). Academic anxiety often intensifies due to the perception of excessive cognitive load, which arises when students feel the need to exert more effort than their peers to compensate for their struggles. This cognitive overload, combined with perceived pressure and the need to invest additional effort in their studies, can result in high levels of stress and insecurity and may reinforce a cycle of worry and self-doubt for students with SLD (Sweller et al., 2011). Moreover, academic anxiety not only undermines academic performance but also negatively affects students' quality of life and their ability to effectively tackle academic challenges (Bonuomo et al., 2023; Sweller et al., 2011).

Fifthly, we explored whether students with SLD differed from neurotypical peers in academic resilience. The literature indicates mixed results showing lower resilience score in university students with SLD compared to their neurotypical peers in some studies (Casali et al., 2024; Iaia et al., 2024), but not in others (Ghisi et al., 2016). Our findings provide no evidence of systematic differences in the resilience profiles of students enrolled in university, nor were resilience differences observed as a function of time since enrolment. Our findings highlight that, although academic resilience is considered an important resource for students with SLD (Casali et al., 2024), its role at the university level remains unclear. In line with what we observed for self-efficacy, it is possible, albeit speculatively, that students with SLD who possess higher academic resilience are more likely to pursue a university degree after compulsory

schooling. Within this hypothesis, the differences in academic resilience between university students with SLD and their peers may appear minimal because those SLD students with lower resilience may have opted for alternative pathways, such as entering the job market rather than pursuing higher education.

Limitations and future prospects

Some limitations must be acknowledged when interpreting these findings. First, the cross-sectional design of the study does not allow for causal inferences or for tracking the development of the investigated processes over time. Indeed, our results provide preliminary evidence that motivational and emotional factors may differ between students depending on how long they have been enrolled in university enrolment. However, given the cross-sectional design, a longitudinal approach would be essential to clarify whether these differences change over the course of their studies.

Secondly, the study is limited by the heterogeneity of the sample in terms of the type and severity of SLD. Although this variability reflects the inherent heterogeneity of the diagnosis, it may have hindered the detection of more subtle group differences. In this context, future studies should take into account or control for different types of SLD diagnoses (e.g., dyslexia, dyscalculia), the presence of comorbidities, and the use of compensatory tools or additional services by students with SLD compared to their peers, as these aspects may have influenced our results.

Finally, it is important to acknowledge a potential selection bias. The sample includes only students who have chosen to pursue and persist in higher education, a subgroup that is likely to be more motivated and resilient than the broader population of young adults with SLD. Future studies adopting a longitudinal design could begin

assessments in the final years of high school to determine whether SRL and affective-motivational factors influence the decision to pursue university, thereby introducing a selection bias that may account for the absence of statistically significant differences in these factors at the university level. Furthermore, regarding the sampling method, the study employed a convenience sample rather than a population-based sampling strategy. In this context, because our SLD group was recruited during scheduled appointments for the renewal of their diagnosis, the sample consists exclusively of students who applied for services. We therefore cannot determine whether students with SLD who chose not to apply for, or renew, such services may differ from those included in our study.

General Conclusions

The present study offers important theoretical and practical implications for the understanding and support of university students with SLD. Not only does our study provide insight into SLD in the Italian university system, but it also contributes to expanding the current literature by integrating SRL with affective-motivational factors in learning. In particular, it adds to literature focusing on how SLD students navigate the academic transition to higher education, a phase marked by increased demands for autonomy and psychological resilience (Bonuomo et al., 2023; Casali et al., 2024; van der Zanden et al., 2018; Swellen et al., 2011). From a theoretical standpoint, the study emphasizes the importance of adopting a multidimensional and developmental approach to the complex relationship between SLD, SRL and affective-motivational factors in adulthood. Furthermore, our findings suggest that differences between students with SLD and their peers in learning goals and academic anxiety may be moderated by time since enrolment (Kampylafka et al., 2023). Although our research

design does not provide a critical test of changes in these constructs during university, it does compare different individuals at different times since enrolment. Future research should move toward longitudinal designs. Such studies could capture how SRL and affective-motivational factors change across different phases of the university path and how these trajectories interact with institutional support, identity development, and life satisfaction (Bonuomo et al., 2023; Feraco et al., 2025).

On the practical side, our results call for a broader rethinking of inclusive strategies in university contexts. While accessibility and compensatory resources remain essential, they should be accompanied by interventions aimed at enhancing SRL and affective-motivational factors involved in learning, that are often neglected in formal support services. Psychoeducational programmes and tutoring models that integrate emotional and motivational coaching (Casali et al., 2024; Ghisi et al., 2016) may be particularly effective in empowering students with SLD to reflect on their strengths, redefine their learning identities, and prevent academic disengagement. Moreover, the promotion of these competencies should not be confined to clinical or didactic settings alone. As shown in previous research (Feraco et al., 2022), informal experiences such as peer mentoring, volunteering, or participation in student associations can offer significant opportunities for developing academic self-efficacy and emotional regulation. Ultimately, fostering SRL, motivation, and emotional well-being is not only beneficial for students with SLD, but can improve the quality of learning for all students. Inclusive education, in this broader sense, becomes a framework not just for equity, but for pedagogical innovation and institutional transformation.

5 References

Ahmed, W. (2018). Developmental trajectories of math anxiety during adolescence: Associations with STEM career choice. *Journal of Adolescence*, *67*, 158–166. https://doi.org/10.1016/j.adolescence.2018.06.010

ANVUR. (2022a). *Rapporto annuale sull'andamento degli studenti con disabilità e DSA nei contesti universitari italiani.* Agenzia Nazionale di Valutazione del Sistema Universitario e della Ricerca. https://www.anvur.org.

ANVUR. (2022b). *Analisi sul successo accademico degli studenti con DSA: Rapporto annuale.* Agenzia Nazionale di Valutazione del Sistema Universitario e della Ricerca. https://www.anvur.org.

Baird, G. L., Scott, W. D., Dearing, E., & Hamill, S. K. (2009). Cognitive self-regulation in youth with and without learning disabilities: Academic self-efficacy, theories of intelligence, learning vs. performance goal preferences, and effort attributions. *Journal of Social and Clinical Psychology, 28* (7), 881–908. https://doi.org/10.1521/jscp.2009.28.7.881

Bandura, A. (1997). *Self-efficacy: The exercise of control*. W. H. Freeman.

Ben-Eliyahu, A. (2019). Academic Emotional Learning: A Critical Component of Self-Regulated Learning in the Emotional Learning Cycle. *Educational Psychologist*, *54*(2), 84–105. https://doi.org/10.1080/00461520.2019.1582345

Ben-Naim, S., Laslo-Roth, R., Einav, M., Biran, H., & Margalit, M. (2017). Academic self-efficacy, sense of coherence, hope and tiredness among college students with learning disabilities. *European Journal of Special Needs Education, 32(1),* 18-34. https://doi.org/10.1080/08856257.2016.1254973

Bonuomo, M., Marini, M., Vegni, N., Melogno, S., Torregiani, G., Livi, S., Filippo, G. D. (2023). Analysis of Psychological and Social Functioning in Undergraduate Students with a Specific Learning Disorder (SLD). *Brain Sciences*, *13*(7). https://doi.org/10.3390/brainsci13071020

Brunswick, N., Wilson, N. J., Kruger, I., Chamberlain, R., & McManus, I. C. (2025). The Prevalence of Specific Learning Difficulties in Higher Education: A Study of UK Universities Across 12 Academic Years. *Journal of Learning Disabilities*, *58*(3), 179–191. https://doi.org/10.1177/00222194241281479

Camia, M., Reho, M., Ferrari, E., Boni, C. D., Ferretti, V., Guaraldi, G., Genovese, E., Varallo, G., Benassi, E., Scarano, A., Baldini, V., Ciaramidaro, A., Scorza, M. (2025). Academic Burnout in University Students with Specific Learning Disorders: The Mediating Role of Anxiety in the Relationship Between Burnout and Depression. *Journal of Clinical Medicine*, *14*(18). https://doi.org/10.3390/jcm14186400

Casali, N., Meneghetti, C., Tinti, C., Maria Re, A., Sini, B., Passolunghi, M. C., Valenti, A., Montesano, L., Pellegrino, G., & Carretti, B. (2024). Academic Achievement and Satisfaction Among University Students With Specific Learning Disabilities: The Roles of Soft Skills and Study-Related Factors. *Journal of Learning Disabilities*, *57*(1), 16–29. https://doi.org/10.1177/00222194221150786

Curran, P. G. (2016). Methods for the detection of carelessly invalid responses in survey data. *Journal of Experimental Social Psychology*, *66*, 4–19. https://doi.org/10.1016/j.jesp.2015.07.006

D'Agostino, A., Schirripa Spagnolo, F., & Salvati, N. (2022). Studying the relationship between anxiety and school achievement: Evidence from PISA data. *Statistical*

Methods & Applications, *31*(1), 1–20. https://doi.org/10.1007/s10260-021-00563-9

Daker, R. J., Gattas, S. U., Sokolowski, H. M., Green, A. E., & Lyons, I. M. (2021). First-year students' math anxiety predicts STEM avoidance and underperformance throughout university, independently of math ability. *npj Science of Learning*, *6*(1), 17. https://doi.org/10.1038/s41539-021-00095-7

De Beni, R., Zamperlin, C., Meneghetti, C., Cornoldi, C., Fabris, M., Tona, G. D. M., & Moè, A. (2014). *Test AMOS - Abilità e motivazione allo studio: prove di valutazione e orientamento per la scuola secondaria di secondo grado e l'università: Nuova edizione*. Erickson.

De Beni, R., Moè, A., Rizzato, C., & Cornoldi, C. (2015). *Studiare meglio e riuscire all'università*. Erickson.

Dent, A. L., & Koenka, A. C. (2016). The relation between self-regulated learning and academic achievement across childhood and adolescence: A meta-analysis. *Educational Psychology Review,* 28(3), 425–474. https://doi.org/10.1007/s10648-015-9320-8

Deshler, D. D. (2005). Adolescents with learning disabilities: Unique challenges and reasons for hope. *Learning Disability Quarterly, 28*(2), 122–124. http://dx.doi.org/10.2307/1593609

Doikou-Avlidou, M. (2015). The Educational, Social and Emotional Experiences of Students with Dyslexia: The Perspective of Postsecondary Education Students. *International journal of special education*, *30*(1), 132-145.

Du, C., Qin, K., Wang, Y., & Xin, T. (2021). Mathematics interest, anxiety, self-efficacy and achievement: Examining reciprocal relations. *Learning and Individual Differences*, *91*, 102060. https://doi.org/10.1016/j.lindif.2021.102060

Dumitru, C., Koulianou, M., & Mastrothanasis, K. (2024). Inclusion of students with specific learning disorders in higher education: A systematic literature review. *Journal of Educational Sciences & Psychology*, *14*(2), 46–64. https://doi.org/10.51865/JESP.2024.2.06

Elliot, A. J., & McGregor, H. A. (2001). A 2 × 2 achievement goal framework. *Journal of Personality and Social Psychology*, *80*(3), 501–519. https://doi.org/10.1037/0022-3514.80.3.501

Feraco, T., Pellegrino, G., Casali, N., Carretti, B., & Meneghetti, C. (2025). Social, emotional, and behavioral skills in students with or without specific learning disabilities. *Learning and Individual Differences*, *117*, 102581. http://dx.doi.org/10.1016/j.lindif.2024.102581

Gallegos, J., Langley, A., & Villegas, D. (2012). Anxiety, Depression, and Coping Skills Among Mexican School Children: A Comparison of Students With and Without Learning Disabilities. *Learning Disability Quarterly*, *35*(1), 54–61. https://doi.org/10.1177/0731948711428772

Ghisi, M., Bottesi, G., Re, A. M., Cerea, S., & Mammarella, I. C. (2016). Socioemotional Features and Resilience in Italian University Students with and without Dyslexia. *Frontiers in Psychology*, *7*. https://doi.org/10.3389/fpsyg.2016.00478

Givon, S., & Court, D. (2010). Coping strategies of high school students with learning disabilities: A longitudinal qualitative study and grounded theory. *International Journal of Qualitative Studies in Education*, *23*(3), 283-303. https://doi.org/10.1080/09518390903352343

Haft, S. L., Duong, P. H., Ho, T. C., Hendren, R. L., & Hoeft, F. (2019). Anxiety and attentional bias in children with specific learning disorders. *Journal of Abnormal Child Psychology*, *47*(3), 487–497. https://doi.org/10.1007/s10802-018-0458-y

Hatcher, J., Snowling, M. J., & Griffiths, Y. M. (2002). Cognitive assessment of dyslexic students in higher education. *British Journal of Educational Psychology*, *72*(1), 119–133. https://doi.org/10.1348/000709902158801

Hellendoorn, J., & Ruijssenaars, A. J. (2000). Personal experiences and adjustment of Dutch adults with dyslexia. *Remedial and Special Education, 21*(4), 227–239. https://doi.org/10.1177/074193250002100405

Hen, M., & Goroshit, M. (2014). Academic Procrastination, Emotional Intelligence, Academic Self-Efficacy, and GPA: A Comparison Between Students With and Without Learning Disabilities. *Journal of Learning Disabilities*, *47*(2), 116–124. https://doi.org/10.1177/0022219412439325

Honicke, T., & Broadbent, J. (2016). The influence of academic self-efficacy on academic performance: A systematic review. *Educational research review*, *17*, 63-84. https://doi.org/10.1016/j.edurev.2015.11.002

Kampylafka, C., Polychroni, F., & Antoniou, A. S. (2023). Primary school students with reading comprehension difficulties and students with learning disabilities: Exploring their goal orientations, classroom goal structures, and self-regulated learning strategies. *Behavioral Sciences*, *13*(2), 78. https://doi.org/10.3390/bs13020078

Johnson, E., Masser, J. S., & Spears, L. (2023). Self-regulated learners: A comprehensive, translational framework for students with learning disabilities. *Exceptionality*, *31*(1), 52-68. https://doi.org/10.1080/09362835.2021.1938063

Iaia, M., Vizzi, F., Carlino, M. D., Turi, M., Marinelli, C. V., & Angelelli, P. (2024). Specific learning disabilities and associated emotional-motivational profiles: a study in Italian university students. *Frontiers in Psychology*, *15*, 1365980. https://doi.org/10.3389/fpsyg.2024.1365980

Lackaye, T. D., & Margalit, M. (2006). Comparisons of Achievement, Effort, and Self-Perceptions Among Students With Learning Disabilities and Their Peers From Different Achievement Groups. *Journal of Learning Disabilities*, *39*(5), 432–446. https://doi.org/10.1177/00222194060390050501

Linnenbrink, E. A. (2005). The dilemma of performance-approach goals: The use of multiple goal contexts to promote students' motivation and learning. *Journal of educational psychology*, *97*(2), 197-213. https://doi.org/10.1037/0022-0663.97.2.197

Longobardi, C., Fabris, M. A., Mendola, M., & Prino, L. E. (2019). Examining the selection of university courses in young adults with learning disabilities. *Dyslexia*, *25*(2), 219–224. https://doi.org/10.1002/dys.1611

MacCullagh, L., Bosanquet, A., & Badcock, N. A. (2017). University students with dyslexia: A qualitative exploratory study of learning practices, challenges, and strategies. *Dyslexia, 23(1),* 3-23. https://doi.org/10.1002/dys.1544

Marsh, H. W., Pekrun, R., Parker, P. D., Murayama, K., Guo, J., Dicke, T., & Arens, A. K. (2019). The murky distinction between self-concept and self-efficacy: Beware of lurking jingle-jangle fallacies. *Journal of Educational Psychology*, *111*(2), 331–353. https://doi.org/10.1037/edu0000281

Martin, A. J. (2013). Academic buoyancy and academic resilience: Exploring ‘everyday’ and ‘classic’ resilience in the face of academic adversity. *School Psychology International*, *34*(5), 488–500. https://doi.org/10.1177/0143034312472759

Mega, C., Ronconi, L., & De Beni, R. (2014). What makes a good student? How emotions, self-regulated learning, and motivation contribute to academic

achievement. *Journal of Educational Psychology, 106(1),* 121–131. https://doi.org/10.1037/a0033546

Ministry of Education (2011). *Linee Guida per il Diritto allo Studio degli Alunni e degli Studenti con Disturbi Specifici di Apprendimento* [Guidelines on the Right to Education for Pupils and Students with Specific Learning Disorders].

Morosini, G., Cuder, A., Bortolotti, E., Bologna, V., Lonciari, I., Passolunghi, M. C., ... & Pellizzoni, S. (2025a). University students with specific learning disabilities: Insights from instrumental, neuro-psychological and study-related profiles. *British Journal of Special Education*, *52(3)*, 310-321. https://doi.org/10.1111/1467-8578.70009

Morosini, G., Cuder, A., Košak Babuder, M., Lonciari, I., Bortolotti, E., Passolunghi, M. C., & Pellizzoni, S. (2025b). Non-cognitive predictors of self-regulated learning skills in university students with specific learning disorders. *European Journal of Special Needs Education*, 1-12. https://doi.org/10.1080/08856257.2025.2500138

Mortimore, T., & Crozier, W. R. (2006). Dyslexia and difficulties with study skills in higher education. *Studies in Higher Education, 31* (2), 235–251. https://doi.org/10.1080/03075070600572173

Mugnaini, D., Rapposelli, S., & Catania, A. (2009). Internalizing correlates of dyslexia. *World Journal of Pediatrics*, 5, 255–264. https://doi.org/10.1016/j.ridd.2009.04.003

Nelson, J. M., & Harwood, H. (2011). Learning disabilities and anxiety: A meta-analysis. *Journal of Learning Disabilities*, *44*(1), 3-17. https://doi.org/10.1177/0022219409359939

Olofsson, Å., Ahl, A., & Taube, K. (2012). Learning and study strategies in university students with dyslexia: Implications for teaching. *Procedia-Social and Behavioral Sciences*, *47*, 1184-1193. https://doi.org/10.1016/j.sbspro.2012.06.798

Pellegrino, G., Casali, N., Meneghetti, C., Tinti, C., Anna, M. R., Sini, B., Passolunghi, M. C., Valenti, A., Montesano, L., & Carretti, B. (2023). Universal and Specific Services for University Students with Specific Learning Disabilities: The Relation to Study Approach, Academic Achievement, and Satisfaction. *Learning Disabilities Research & Practice*, *38*(4), 274–284. https://doi.org/10.1111/ldrp.12323

Pino, M., & Mortari, L. (2014). The inclusion of students with dyslexia in higher education: A systematic review using narrative synthesis. *Dyslexia, 20*(4), 346–369. https://doi.org/10.1002/dys.1484

Punch, R., Duncan, J., & Talbot-Stokes, R. (2025). Experiences and challenges of students with disability in Australian universities: A scoping review. *International Journal of Inclusive Education*, 1–19. https://doi.org/10.1080/13603116.2025.2526009

Spielberger, C. D. (1980). *Preliminary professional manual for the test anxiety inventory*. Consulting Psychologists Press.

Stein, B., Hoeft, F., & Richter, C. G. (2024). Stress, resilience, and emotional well-being in children and adolescents with specific learning disabilities. *Current Opinion in Behavioral Sciences*, *58*, 101410. https://doi.org/10.1016/j.cobeha.2024.101410

Swanson, H. L., & Hsieh, C. J. (2009). Reading disabilities in adults: A selective meta-analysis of the literature. *Review of educational Research*, *79*(4), 1362-1390. https://doi.org/10.3102/0034654309350931

Sweller, J., Ayres, P., & Kalyuga, S. (2011). Measuring Cognitive Load. In J. Sweller, P. Ayres, & S. Kalyuga (Eds.), *Cognitive Load Theory* (pp. 71–85). Springer. https://doi.org/10.1007/978-1-4419-8126-4_6

Tabassam, W., & Grainger, J. (2002). Self-Concept, Attributional Style and Self-Efficacy Beliefs of Students with Learning Disabilities with and without Attention Deficit Hyperactivity Disorder. *Learning Disability Quarterly*, *25*(2), 141–151. https://doi.org/10.2307/1511280

Tervo-Clemmens, B., Calabro, F. J., Parr, A. C., Fedor, J., Foran, W., & Luna, B. (2023). A canonical trajectory of executive function maturation from adolescence to adulthood. *Nature Communications*, *14*(1), 6922. https://doi.org/10.1038/s41467-023-42540-8

Theobald, M. (2021). Self-regulated learning training programs enhance university students' academic performance, self-regulated learning strategies, and motivation: A meta-analysis. *Contemporary Educational Psychology*, *66*, 101976. https://doi.org/10.1016/j.cedpsych.2021.101976

van der Zanden, P. J. A. C., Denessen, E., Cillessen, A. H. N., & Meijer, P. C. (2018). Domains and predictors of first-year student success: A systematic review. *Educational Research Review*, *23*, 57–77. https://doi.org/10.1016/j.edurev.2018.01.001

Wiener, J., & Schneider, B. (2002). A multisource exploration of the friendship patterns of children with and without learning disabilities. *Journal of Abnormal Child Psychology*, *30*(2), 127–141. https://doi.org/10.1023/A:1014701215315

World Health Organization (WHO) (2019). *International Statistical Classification of Diseases and Related Health Problems (ICD-11)* (11a ed.). World Health Organization https://icd.who.int/

Zimmerman, B. J. (2002). Becoming a self-regulated learner: An overview. *Theory into Practice, 41*(2), 64–70. https://doi.org/10.1207/s15430421tip4102_2

General discussion

The present doctoral dissertation aimed to deepen the understanding of SLDs in university students, a population still largely underrepresented within the international and Italian literature despite its steady numerical increase and growing institutional relevance. Across five studies, the present work investigated complementary dimensions of the cognitive profile and motivational factors during academic experience of students with SLDs offering an updated, multidimensional, picture of the challenges and resources characterizing this group.

A coherent and multidimensional picture emerges regarding the academic functioning of university students with Specific Learning Disorders. Although each study addressed different facets, taken together, the results converge toward a unified interpretation: SLDs persist into adulthood in domain-specific ways (Hatcher et al., 2002; Swanson & Hsieh, 2009; Casali et al., 2024), and their impact on university adaptation depends on the cognitive vulnerabilities, motivational and emotional resources, and the institutional environment.

First of all, a central finding concerns the academic experience and support landscape encountered by students with SLDs. Participants reported heterogeneous use of compensatory tools, frequent inconsistencies in how accommodations are implemented across lecturers, and a general perception that university services and faculty preparedness vary widely. While compensatory tools were often described as helpful, they also elicited ambivalent emotions, sometimes linked to stigma, the need to negotiate their use, or the feeling of being insufficiently understood. Interest in emerging technologies, including AI-based tools, highlights a search for autonomy and

more flexible forms of support. These experiential insights underscore a misalignment between existing guidelines and their practical application (CNUDD, 2024), establishing the contextual backdrop for interpreting the cognitive and non-cognitive findings.

Within this environment, we observed in two different studies that instrumental and neurocognitive difficulties persist into adulthood, albeit alongside notable strengths. Students consistently exhibited lower performance in instrumental abilities such as reading accuracy and speed, arithmetic facts, (Casali et al., 2024; Del Tufo & Earle, 2020; Peng & Fuchs, 2016). At the same time, visuospatial abilities were preserved or enhanced (Operto et al., 2021), and verbal comprehension appeared intact when tasks did not impose time constraints (Del Tufo & Earle, 2020). These results reinforce the understanding of SLDs as circumscribed, domain-specific impairments rather than generalized deficits.

Importantly, by jointly examining instrumental skills and neurocognitive functioning, the present dissertation adds to the literature by clarifying how these domains interact in adulthood. While prior research has often addressed instrumental performance or cognitive functioning in isolation, the present findings highlight that persistent difficulties in decoding, arithmetic, and working memory coexist with preserved higher-level abilities, shaping heterogeneous and adaptive cognitive profiles. This integrated perspective strengthens the conceptualization of SLDs as circumscribed, domain-specific disorders and underscores the importance of moving beyond deficit-based models toward a more nuanced understanding of strengths, compensatory mechanisms, and functional adaptation in higher education contexts.

However, a particularly salient vulnerability concerned metacognitive aspects of studying: despite reporting study strategies and learning goals similar to normative

samples, students demonstrated weaker abilities in planning, monitoring, and regulating their learning—skills that are foundational in higher education and closely tied to academic autonomy (Casali et al., 2024). The present findings extend previous evidence by showing that this vulnerability does not reflect a lack of strategies per se, but rather a difficulty in coordinating and flexibly deploying them in highly autonomous learning contexts. This dissociation suggests that metacognitive regulation represents a critical bottleneck for university students with SLDs, emerging at the intersection of cognitive demands and motivational–emotional resources, and thus constitutes a key target for intervention beyond traditional compensatory measures.

The role of motivational and emotional factors emerged as equally critical. In line with established theoretical frameworks, academic self-efficacy and mastery-oriented goals were confirmed as the strongest predictors of self-regulated learning (Butler & Schnellert, 2015; Mega et al., 2014; Usher & Schunk, 2017), reinforcing the view that motivational resources play a central role in shaping how cognitive abilities are translated into effective academic behavior. The present findings therefore corroborate previous evidence indicating that students who believe in their academic capabilities and who pursue mastery-oriented goals are more likely to engage in adaptive self-regulatory processes, persist in the face of difficulty, and actively manage their learning.

Beyond this confirmation, the present work extends the literature by situating these motivational processes within the specific context of university students with SLDs. In this population, motivational resources appear to function as critical modulators of vulnerability, helping to explain why students with comparable cognitive and instrumental profiles may show markedly different levels of academic adaptation. Academic resilience emerged as a more distal factor, contributing indirectly to self-

regulated learning, likely through its influence on self-beliefs and motivational orientations (Hossain et al., 2022; Stein et al., 2024). This finding refines existing models by suggesting that resilience alone may not directly sustain self-regulatory behaviours unless it is translated into concrete motivational beliefs, such as self-efficacy and mastery goals.

Importantly, the results also highlight the role of emotional factors, showing that academic anxiety does not exert a uniform effect but interacts with gender, with female students displaying greater vulnerability to its impact on self-regulation (von der Embse et al., 2018). This pattern adds nuance to previous findings by indicating that emotional risk factors may operate selectively within subgroups, rather than uniformly across the SLD population. Overall, these results underscore the relevance of adopting a multidimensional perspective, in which motivational and emotional resources are not treated as secondary correlates of cognitive functioning, but as central mechanisms shaping academic engagement and persistence in higher education.

Further analyses of cognitive functioning revealed considerable heterogeneity and the amplifying role of comorbidity. Students with multiple SLD diagnoses showed more pronounced difficulties in writing and mathematics (Willcutt et al., 2020; Soares et al., 2018), suggesting that the accumulation of impairments can significantly intensify academic challenges. Processing speed and visuospatial abilities, by contrast, were generally comparable to normative samples, possibly a sign of compensatory strategies acquired over time (Chamberlain et al., 2018).

A further aspect analysed regards a comparative analyses including students without SLDs highlighted temporal dynamics within the university trajectory. In the thesis we show that Self-regulated learning difficulties remained stable across years

(Casali et al., 2024), indicating a persistent vulnerability. However, mastery goals tended to decline and academic anxiety increased as students progressed through their studies (Morosini et al., 2025b), suggesting that unresolved challenges may accumulate, heightening the risk for disengagement, dissatisfaction, or dropout (Cappa & Giulivi, 2012, cited in Aquino, 2022b). In contrast, self-efficacy and resilience remained comparable to peers, pointing to robust personal resources that could be strategically leveraged through targeted support.

Taken together, these findings reveal that the challenges faced by university students with SLDs are not merely continuations of childhood symptoms, nor are they reducible to isolated deficits. Instead, they emerge at the intersection of persistent domain-specific weaknesses, heightened demands for autonomy and self-regulation, and institutional environments that vary widely in their capacity to provide structured, consistent, and psychologically informed support. A multidimensional approach, integrating cognitive, motivational, emotional, and contextual factors, is therefore essential for understanding and supporting the academic trajectories of adults with SLDs.

Limitations and future directions

Although this dissertation provides a multidimensional contribution to the understanding of Specific Learning Disorders in adulthood and within the university context, several limitations should be acknowledged in order to properly contextualize the findings and outline meaningful paths for future research.

A first limitation concerns the nature and composition of the samples included across the studies. Participation was voluntary and restricted to students who had already chosen to disclose their diagnosis and engage with university support services. This raises the possibility of a selection bias, whereby individuals who

experience the most severe difficulties, the highest levels of stigma, or the greatest reluctance to disclose their condition may remain underrepresented. Given that nondisclosure rates among university students with SLDs appear substantial according to recent Italian and international data (Aquino, 2022b), future research should aim to reach less visible or less-engaged subgroups, including students who avoid seeking accommodations or who discontinue their studies prematurely. Longitudinal tracking of disclosed and non-disclosed students could provide valuable insights into dropout dynamics and barriers to inclusion (Cappa & Giulivi, 2012, cited in Aquino, 2022b).

A second limitation concerns the reliance on cross-sectional designs of the studies. Although these designs allowed for an extensive mapping of cognitive, instrumental, motivational, and emotional dimensions, they also limit the interpretation of causal and developmental trajectories, particularly with regard to the temporal fluctuations observed in learning goals and academic anxiety (Morosini et al., 2025b). Longitudinal methodologies, ideally spanning the entire university trajectory, would allow researchers to examine how motivational resources evolve, how students adapt or fail to adapt to increasing academic demands, and which protective factors most effectively buffer the cumulative impact of cognitive and emotional load.

A further limitation relates to the measurement tools adopted. While the use of standardized neuropsychological and instrumental tests ensures comparability with normative data, these instruments may not fully capture how students deploy compensatory or adaptive strategies in authentic academic contexts (Casali et al., 2024). Similarly, the non-cognitive constructs (e.g., self-efficacy, goals, anxiety, resilience) were assessed through self-report questionnaires, which, although validated, remain vulnerable to social desirability, self-awareness limitations, and

contextual fluctuations. Future research would benefit from complementing self-report instruments with behavioural measures, ecological momentary assessment, digital learning analytics, or performance-based tasks aimed at capturing study behaviours and emotional responses in real time. Mixed-method approaches, including qualitative interviews or focus groups, could further illuminate aspects of university life that do not emerge from quantitative tools alone.

Additionally, although several studies addressed the role of motivational and emotional factors, the dissertation did not directly examine how institutional variables, such as faculty training, departmental policies, accessibility of course materials, or variability between universities, shape the experience of students with SLDs. Given the heterogeneity of implementation practices across Italian universities (CNUDD, 2024), future work should consider multi-site designs and incorporate institutional-level indicators, thereby allowing researchers to explore how policy environments interact with cognitive and non-cognitive profiles to influence academic outcomes.

Finally, although several findings point toward the potential of emerging technologies, including artificial intelligence-based support tools, the studies did not directly test the efficacy, feasibility, or ethical implications of such innovations. Future research should examine how technological tools can enhance metacognition, reduce cognitive load, or compensate for reading and writing difficulties within academic environments. Intervention studies could evaluate whether AI-based systems strengthen self-regulated learning, mitigate anxiety, or support students in tasks requiring high executive control. These investigations should be accompanied by ethical analyses addressing privacy, autonomy, and the risk of overreliance on digital tools.

Despite these limitations, the dissertation provides a solid foundation upon which future research can build. By expanding methodological approaches, diversifying samples, and evaluating emerging support tools, future studies can deepen our understanding of SLDs in adulthood and contribute to the development of more equitable and scientifically grounded university inclusion policies.

In conclusion, the findings of this dissertation collectively underscore the necessity of moving beyond a narrow focus on deficits toward a comprehensive understanding of how adults with SLDs navigate the demands of higher education. By recognizing the complex interplay of cognitive vulnerabilities, motivational resources, emotional regulation, and institutional structures, universities can better promote inclusive, equitable, and sustainable academic pathways. This multidimensional approach not only reflects the empirical evidence presented across the five studies but also aligns with the broader societal commitment to ensuring that all students, regardless of their learning profile, have the opportunity to thrive within the academic environment and beyond.

Educational implications and proposals for university policy and services

The evidence produced across the five studies points to a clear conclusion: effective support for university students with SLDs cannot be reduced to the availability of compensatory tools or the formal recognition of the diagnosis. Instead, inclusion requires a coordinated set of actions that simultaneously address persistent domain-specific vulnerabilities (e.g., reading fluency/accuracy, arithmetic facts, verbal working memory); the metacognitive and self-regulatory bottleneck that becomes especially salient in higher education, and the institutional discontinuity that forces students to “self-manage” accommodations through repeated negotiation with lecturers. In

practical terms, universities need to move from a mainly reactive and case-by-case approach to a structured, proactive, and evidence-informed model that reduces variability across courses and supports students longitudinally, as emphasized by research on inclusive higher education and faculty preparedness (Moriña, 2017; Moriña, 2025).

The results of this dissertation indicate that university students with SLDs often present mixed profiles, combining persistent instrumental markers, specific neurocognitive vulnerabilities, and reduced metacognitive regulation. These findings suggest that support services should not rely solely on diagnostic documentation but should incorporate a brief multidimensional intake process mapping instrumental skills, selected neurocognitive functions relevant to academic load, and self-regulated learning needs. Research on students with disabilities in higher education highlights the importance of early identification of self-regulatory needs to guide targeted support and prevent cumulative difficulties across the academic trajectory (Aydan, 2025).

Across studies, self-regulated learning emerged as a stable vulnerability and a key mechanism through which motivational resources translate into effective academic behaviour. This finding has direct practical implications: universities should offer structured programs explicitly targeting planning, monitoring, and adaptive strategy use under high cognitive load. Empirical work in higher education demonstrates that self-regulated learning interventions can significantly enhance academic engagement and autonomy in students with disabilities when delivered through structured workshops or guided coaching formats (Aydan, 2025; Campbell, 2024). Such interventions should therefore be considered a core component of university support services rather than optional add-ons.

The present findings also confirm that motivational resources, particularly self-efficacy and mastery-oriented goals, are central to academic functioning, while emotional factors such as anxiety exert differentiated effects across subgroups. This pattern suggests that university services should integrate motivational enhancement and anxiety management components into support programs, particularly through longitudinal monitoring rather than one-time interventions. Reviews of academic coaching and support services indicate that sustained, professionally guided interventions are more effective than short-term or informal approaches in promoting persistence and adaptive coping (Campbell, 2024).

Last but not least, faculty lectures represent a critical interface through which institutional policies are translated into practice. The present findings, together with international evidence, highlight the need for systematic faculty training focused on inclusive teaching, assessment design, and awareness of SLD-related functional profiles. Research on inclusive higher education consistently shows that structured training programs grounded in Universal Design for Learning principles improve instructors' competence and attitudes toward disability and inclusion (Moriña, 2017; Moriña, 2025).

References

Almgren Bäck, G., Lindeblad, E., Elmqvist, C., & Svensson, I. (2024). Dyslexic students' experiences in using assistive technology to support written language skills: A five-year follow-up. Disability and Rehabilitation: Assistive Technology, 19(4), 1217–1227.https://doi.org/10.1080/17483107.2023.xxxxxx

Aydan, S., & Mamas, C. (2025). Self-regulated learning and students with disabilities: A mini review. Frontiers in Education, 10, Article 1600744. https://doi.org/10.3389/feduc.2025.1600744

Butler, D. L., & Schnellert, L. (2015). Success for students with learning disabilities: A guide to inclusive practice. Guilford Press.

Campbell, A. L., & Mogashana, D. (2025). Assessing the effectiveness of academic coaching interventions for student success in higher education: A systematic review. Innovations in Education and Teaching International, 62(4), 1325–1347. https://doi.org/10.1080/14703297.2024.

Casali, N., Meneghetti, C., Tinti, C., Re, A. M., Sini, B., Passolunghi, M. C., Valenti, A., Montesano, L., Pellegrino, G., & Carretti, B. (2024). Academic Achievement and Satisfaction Among University Students With Specific Learning Disabilities: The Roles of Soft Skills and Study-Related Factors. Journal of Learning Disabilities, 57(1), 16–29. https://doi.org/10.1177/00222194221150786.

Chamberlain, R., Brunswick, N., Siev, J., & McManus, I. C. (2018). Scratching the surface of dyslexia: Are there sensory and motor deficits? Trends in Cognitive Sciences, 22(5), 352–364. https://doi.org/10.1016/j.

CNUDD. (2024). Linee guida per l'inclusione degli studenti con disabilità e DSA nelle università. Conferenza Nazionale Universitaria dei Delegati per la Disabilità.

Del Tufo, S. N., & Earle, F. S. (2020). Working memory limitations in adults with dyslexia. Journal of Learning Disabilities, 53(5), 381–395. https://doi.org/10.1177/0022219420916218

Hatcher, J., Snowling, M. J., & Griffiths, Y. (2002). Cognitive assessment of dyslexic students in higher education. British Journal of Educational Psychology, 72(1), 119–136. https://doi.org/10.1348/000709902158801

Mega, C., Ronconi, L., & De Beni, R. (2014). What makes a good student? How emotions, self-regulated learning, and motivation contribute to academic achievement. Journal of Educational Psychology, 106(1), 121–131. https://doi.org/10.1037/a0033546

Moriña, A., & Carballo, R. (2017). The impact of a faculty training program on inclusive education and disability. Evaluation and Program Planning, 65, 77–83. https://doi.org/10.1016/j.evalprogplan.2017.06.007

Moriña, A., Carballo, R., & Doménech, A. (2025). Transforming higher education: A systematic review of faculty training in UDL and its benefits. Teaching in Higher Education, 30(7), 1722–1739. https://doi.org/10.1080/13562517.2025.2465994

Operto, F. F., Pastorino, G. M. G., Stellato, M., et al. (2021). Visuospatial abilities in developmental dyslexia: A systematic review. Children, 8(10), 839. https://doi.org/10.3390/children8100839

Peng, P., & Fuchs, D. (2016). A meta-analysis of working memory deficits in children with learning difficulties. Journal of Learning Disabilities, 49(1), 3–20. https://doi.org/10.1177/0022219414521667

Soares, N., Evans, T., & Patel, D. R. (2018). Specific learning disability in children: A review. Journal of Pediatric Neurosciences, 13(4), 376–384. https://doi.org/10.4103/jpn.JPN_168_17

Svensson, I., Nordström, T., Lindeblad, E., Gustafson, S., Björn, M., Sand, C., & Nilsson, S. (2021). Effects of assistive technology for students with reading and writing disabilities. Disability and Rehabilitation: Assistive Technology, 16(2), 196–208. https://doi.org/10.1080/17483107.2019.1642391

Swanson, H. L., & Hsieh, C. J. (2009). Reading disabilities in adults: A selective meta-analysis of the literature. Review of Educational Research, 79(4), 1362–1390. https://doi.org/10.3102/0034654309350931

Usher, E. L., & Schunk, D. H. (2017). Sources of self-efficacy for learning. In D. H. Schunk & J. A. Greene (Eds.), Handbook of self-regulation of learning and performance (pp. 215–229). Routledge.

Von der Embse, N., Jester, D., Roy, D., & Post, J. (2018). Test anxiety effects, predictors, and correlates: A meta-analysis. Educational Psychology Review, 30, 163–191. https://doi.org/10.1007/s10648-017-9428-3

Willcutt, E. G., McGrath, L. M., Pennington, B. F., et al. (2020). Comorbidity of reading disability and math disability: Concurrent psychopathology, functional impairment, and neuropsychological correlates. Journal of Learning Disabilities, 53(6), 401–414. https://doi.org/10.1177/0022219420932804

UNIVERSITÀ
DEGLI STUDI
DI TRIESTE

La borsa di dottorato è cofinanziata con risorse dell'Unione europea, NextGeneration EU - Piano Nazionale di Ripresa e Resilienza, Missione 4 – Componente 1 – Investimento 4.1 CUP J92B22000920007