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Digitally supported learning for students with specific learning difficulties in higher education

Abstract: Learning in higher education poses a particular challenge for students with specific learning difficulties (SLDs), as they encounter deficits in attention, memory, phonological processing, language expression, and executive functions. Higher education teachers who employ traditional teaching approaches—based on frontal teaching, memorisation, and standardised assessment—often fail to recognise the diversity of learning profiles, thereby creating barriers to equal participation for students with SLDs. This article highlights the role of digitally supported learning as a crucial element in overcoming these barriers and emphasises the importance of the concept of the universal design for learning (UDL), which promotes the flexibility, accessibility, and active involvement of all students in learning. The use of digital technologies—including artificial intelligence (AI)—opens up personalised learning pathways, provides varied presentation of content, and facilitates alternative forms of knowledge expression, thus enhancing efficiency and fairness in the learning process. However, despite the many benefits of the use of digital technologies, this article also discusses the challenges in their implementation—such as inadequate training of teaching staff, technical constraints, and the risk of overreliance on digital tools. While digital technologies do not provide immediate solutions, this study invites further reflection and research aimed at fostering systemic change in higher education through an analysis of the advantages and disadvantages of digitally supported learning.

Keywords: specific learning difficulties, digital technologies, universal design for learning, higher education, accessibility

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Introduction

This article is based on an analytical and theoretical research approach that highlights the complex challenges faced by students with specific learning difficulties (SLDs), such as dyslexia, dysgraphia, dyscalculia and dyspraxia, in higher education. Based on an analysis of both Slovenian and international literature, we highlight the key cognitive, emotional–motivational, and environmental factors that significantly influence the inclusion and academic performance of these students.

The aim of this article is not to provide a systematic literature review in the methodological sense but a problem-oriented interpretation and conceptual synthesis of existing knowledge, focusing on current issues. We identify the gap between traditional forms of instruction and the actual needs of students with SLDs, thereby emphasising the opportunities provided by digitally supported learning, modern learning technologies, and the concept of the universal design for learning (UDL) in this context. The paper discusses both the potential benefits of these approaches for enhanced individualisation, accessibility, and academic achievement, as well as their limitations and challenges in implementation, thereby opening avenues for further research and systemic improvements in higher education environments.

In recent decades, the participation of students with SLDs and other special needs, as well as students from disadvantaged backgrounds, in higher education has increased in Europe and beyond (Clouder et al. 2020; Jakšić Ivačič et al. 2020; Košak Babuder and Javornik 2022; Longobardi et al. 2019; Rebolj 2018). Efforts to increase access to higher education programmes are based on key strategic documents, such as the *Europe 2020 strategy* (EU 2020) or the *Strategic Framework for European Cooperation in Education and Training* (ET 2020) (Council conclusions of 12 May 2009 on a strategic framework for European cooperation in education and training (ET 2020), 2009), and the *UN Convention on the Rights of Persons with Disabilities* (2006), which emphasise the importance of inclusive and flexible education systems. Slovenia is committed to these goals within the framework of the *Council Resolution on a strategic framework for European coopera-*

tion in education and training towards the European Education Area and beyond (2021–2030) (2021) as well as the *Resolution on the National Higher Education Programme until 2030* (2022), which include equitable, inclusive, and high-quality education among their priorities. Further, the *Strategy for the Rights of Persons with Disabilities* 2021–2030 (2021–2030) (A Union of Equality: Strategy for the Rights of Persons with Disabilities 2021–2030, 2021) and the *Digital Education Action Plan 2021–2027* (ANDI 2023) further emphasise the importance of digital solutions, such as technological and digital aids, platforms, tools, or methods that support the learning process and enable more tailored, accessible, and effective education; universal accessibility; and individual support for students with different needs. The goal is that by 2030, at least 45% of young people aged 25–34 years will have completed tertiary education in an environment that fosters diversity and equal opportunities, which is comparable to the 47.9% already achieved in Slovenia in 2021, thus exceeding the EU average (explanatory notes to the 2025 budget: Policy 19 – Education and Sport 2024).

However, achieving these goals also requires systematic support for groups of students who are particularly vulnerable during the transition to higher education. These include students with SLDs who have often successfully overcome learning difficulties in secondary education through adapted teaching methods and suitable compensatory strategies, but who face a less-structured learning environment, greater independence, and higher cognitive and linguistic demands in higher education (Del Tufo and Earle 2020). Problems that may have previously been compensated for or less noticeable become more evident in a learning environment characterised by complex, often foreign, language material and a heavier workload (Tops et al. 2012). Additionally, higher education demands greater skills in independent planning, maintaining focus, time management, and developing effective learning strategies, which require well-developed executive functions and strong self-efficacy (Košak Babuder and Javornik 2022; Vaknin-Nusbaum and Rachevski 2023; Troiano et al. 2010). However, these skills are often underdeveloped in students with SLDs, thereby increasing the risk of academic failure or early dropout, unless they have access to appropriate support mechanisms, such as individualised academic mentoring, assistive technologies (e.g. speech-to-text tools, digital planners), extended time on exams, structured learning materials, and access to counselling or peer support programmes.

Students with specific learning difficulties

SLDs are a group of neurobiologically based developmental disorders that cause persistent difficulties in learning and using academic skills despite average or above-average intellectual abilities (DSM-5 2013; ICD-11 2025; Magajna et al. 2015). The most common of these are dyslexia (reading difficulties), dysgraphia (writing difficulties), dyscalculia (difficulties with arithmetic operations), and dyspraxia (difficulties with movement coordination and activity planning). Reading difficulties manifest as inaccurate or slow reading of words and an inability

to comprehend written material, while writing and spelling difficulties include inaccurate spelling, grammatical or syntactical errors, and difficulties in organising the structure of writing. In arithmetic, these difficulties involve challenges in mathematical reasoning as well as in remembering and automating arithmetic facts and procedures, along with deficits in practical and social skills (DSM-5 2013; Magajna et al. 2015).

These difficulties are the result of deficits in essential cognitive function—such as attention, memory, reasoning, coordination, communication, social skills, and/or emotional development—which are caused by known or unknown neurological differences or disorders affecting central nervous system functioning (Magajna et al. 2015). These deficits substantially hinder an individual's ability to effectively process both linguistic and nonlinguistic information, impede the acquisition and automatic application of basic academic skills, and have lifelong impacts on learning and behaviour (Del Tufo and Earle 2020; Magajna et al. 2015). SLDs exist on a spectrum from mild to severe. They are characterised by co-occurrence, often appearing together with attention deficit and/or hyperactivity (ADHD), which further hinders academic performance and adaptation to the demands of the learning environment (Brunswick et al. 2024; Neurodiversity and Co-occurring Difficulties n.d.; What are Specific Learning Difficulties? n.d.).

Significant difficulties in cognitive functioning and the application of basic academic skills have a major impact on students with SLDs, as it affects their ability to handle a wider range of study demands, such as reading and understanding complex academic texts, writing structured assignments, taking notes during lectures, managing time effectively, preparing for exams, and participating in group discussions or presentations. Such students are more likely to encounter barriers when reading texts to find specific information, reviewing written material for errors, taking notes during lectures, listening, knowing and applying various test preparation strategies, and when taking exams. In addition, compared to their peers, students with SLDs have significantly more difficulty coping with anxiety, processing information effectively, and regulating their behaviour and emotions—such as managing frustration, maintaining attention, inhibiting impulsive reactions, and sustaining motivation during demanding academic tasks (Cole and Cawthon 2015; Reaser et al. 2007; Vaknin-Nusbaum and Rachevski 2023). Although the fundamental aspects of higher education—such as attending lectures, taking notes, writing essays and term papers, and organising and planning study commitments—often impose an additional cognitive load on students with SLDs that exceeds their typical learning effort (Mortimore and Crozier 2006; Wang and Chung 2024), participation in higher education can play a vital role in their personal development. It enhances their self-image, encourages economic independence, provides better employment opportunities, and increases social participation—all of which significantly support their active integration into the wider society.

Learning and teaching challenges for students with specific learning difficulties

Specific cognitive deficits as a cause for learning difficulties

Although SLDs are often addressed in primary and secondary education, their impact is even more significant in higher education, where greater independence, abstract thinking, organisation, and cognitive effort are required. Neurologically based deficits in information processing, attention, memory, and language skills pose a serious barrier to academic progress even for individuals with average or above-average intellectual ability (Magajna et al. 2015). However, research reveals that many people with SLDs develop specific strengths—such as creativity, divergent thinking, intuitive problem-solving, and imaginative expression—which, with appropriate support, can be cultivated into key academic and professional skills (Ademolu 2024; Košak Babuder et al. 2014; Taylor and Vestergaard 2022). Therefore, it is important to recognise the diversity of students' learning profiles[1] and provide supportive environments for them to attain their full potential.

Further, learning difficulties in students with SLDs are often linked to deficits in phonological processing, decoding, working memory, executive functions, attention, organisation, and self-regulation (Barkley 2015; Reid 2016; Snowling 2019; Wang and Chung 2024). These deficits make it challenging to process and understand linguistically demanding academic content and hinder learning from extensive written material. The difficulties are particularly pronounced in students with dyslexia, as deficits in phonological processing make it difficult to link sounds with written symbols and consequently impair fluent reading, spelling, writing, and pronunciation. This can be particularly challenging in a foreign language, as the differences in the phonological system coincide with limited orthographic and lexical knowledge (Bruck 1992; Del Tufo and Earle 2020; Hatcher et al. 2002; Lindgren and Laine 2011; Shaywitz and Shaywitz 2020; Wilson and Lesaux 2001). Reading and writing texts demand higher cognitive effort because they require the simultaneous integration of multiple functions, the lack of which impairs fluency, comprehension, and analytical thinking (Snowling 2019; Shaywitz and Shaywitz 2020). Problems also arise with decoding and rapid word recognition (Lindgren and Laine 2011), thereby adversely affecting the understanding of specialised texts and academic writing. Further, foreign language material frequently encountered in higher education programmes necessitates a high level of phonological awareness, flexibility, and memory-areas in which students with SLDs often exhibit weaknesses (Kormos 2017).

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1 A learning profile is an individual's preferred approach to learning, which is shaped by their thinking style, intelligence, cultural background, gender, and other factors, such as socio-economic status, prior educational experiences, language proficiency, motivation, and possible learning or sensory difficulties (Tomlinson 2001). The knowledge of learning profiles enables teachers to select appropriate approaches, strategies, and teaching methods that are tailored to the individual.

These challenges are also linked to limitations in working and short-term memory and retrieving information from long-term memory, which hampers the ability to retain and use grammatical structures, vocabulary, and sentence patterns (de Jong and van der Leij 2003; Jones et al. 2015; Wilson and Lesaux 2001; Wolff and Lundberg 2003). In addition to the obstacles to decoding and understanding complex educational texts, these limitations also affect the use of metacognitive strategies and the regulation of the learning process. (Barkley 2015; Wang and Chung 2024). Consequently, the high linguistic complexity of academic materials often exceeds their ability to process and effectively recall specific terms, thereby resulting in increased cognitive load and reduced comprehension of content (de Jong and van der Leij 2003; Wilson and Lesaux 2001).

Further, students with attention deficit hyperactivity disorder (ADHD) also struggle to sustain attention and manage cognitive load, which impacts their comprehension, organisation, and written expression (Barkley 2015; Isa 2023; Yeung 1999). Consequently, their writing is often unclear and poorly structured. In contrast, among students with dyspraxia, the difficulties mainly appear in motor coordination and movement sequences, thus making it challenging to write, take notes, edit, and structure texts (Kirby and Drew 2003).

Due to all of the above-mentioned problems, students with SLDs often experience frustration, higher levels of anxiety and academic stress (Carroll and Iles 2006; Riddick et al. 1999), as well as lower self-esteem and academic self-efficacy (Vaknin-Nusbaum and Rachevski 2023). This can result in decreased persistence in their studies and a diminished ability to successfully adapt to the higher education environment.

Moreover, the success of students with SLDs also relies on the characteristics of individual degree programmes, particularly the differences between theory and practice-based programmes and the number of adaptations available. Therefore, it is essential to develop flexible teaching methods that consider the diverse cognitive profiles of students with SLDs and provide support tailored to their specific needs within each programme.

Traditional approaches to teaching and their limitations

In higher education—where independent work, mastery of complex written materials, and effective use of language and abstract concepts are required—traditional teaching approaches present a serious obstacle for students with SLI. These approaches are mostly based on face-to-face teaching focused on memorisation, language skills, and auditory processing of information—the very areas in which students with SLDs most frequently exhibit weaknesses (Gathercole and Alloway 2008; Mortimore and Crozier 2006; Schneider and Crombie 2003).

Traditional lectures based on one-way knowledge transfer create a passive learning environment in which students with SLDs have difficulty sustaining attention as well as effectively engaging and processing information (Klein et al. 2023; Schmidt et al. 2015). As they are reliant on conveying large amounts of

information in a short period of time, this often leads to cognitive overload, which makes comprehension and long-term memorisation even more difficult (Yeung 1999). Problems with working memory and attention are also evident when listening, note-taking, and learning independently from textbooks and written sources, which usually include complex terminology and require rapid information processing (Callens et al. 2014; MacCullagh et al. 2017; Regmi 2012; Shaywitz and Shaywitz 2020; Snowling 2019).

An additional obstacle is traditional assessment, which emphasises essay writing and memorisation, as it is not aligned with the cognitive profiles of students with SLDs. These students face long-term difficulties with spelling, grammar, planning, and coherence of written expression (Barkley 2015; Sehlström et al. 2023); thus, these forms of assessment do not necessarily reflect their knowledge but their limitations related to memory and language.

The inflexibility of the higher education environment, reflected in standardised forms of teaching and assessment, further exacerbates the learning difficulties of students with SLDs (Košak Babuder and Javornik 2022) and contributes to greater anxiety, lower self-esteem, poorer academic performance, and the risk of dropping out (Carroll and Iles 2006; Mortimore and Crozier 2006; Nelson and Harwood 2011). As higher education requires a certain level of linguistic and cognitive ability that students with SLDs are often unable to achieve without appropriate provision, it is crucial that higher education institutions provide support, flexible teaching approaches, and the effective use of technology (Vaknin-Nusbaum and Rachevski 2023). Although early intervention can reduce the severity of certain deficits (Callens et al. 2014), such as difficulties in reading fluency, spelling accuracy, phonological processing, and retrieval of verbal information from long-term memory, the complex demands of higher education-particularly in processing written and foreign language academic material-remain a major challenge that can only be overcome with targeted and comprehensive support.

To overcome these challenges, it is essential to introduce flexible teaching methods that incorporate multiple modalities (visual, auditory, and practical), utilise technology, provide tutoring, offer clear instructions, and employ alternative forms of assessment (e.g. projects and presentations) (Burkšaitienė and Teresevičienė 2008; Crogman et al. 2023). In this context, the UDL is emerging as a crucial conceptual and pedagogical framework that enables the proactive planning of a learning environment tailored to the diverse learning profiles of students from the outset.

The role of the universal design for learning (UDL) in higher education

Since higher education expects a high degree of independence, abstract thinking, efficient management of complex information, and the ability to work within often standardised and less flexible structures, students with SLDs frequently encounter numerous systemic barriers. Therefore, the UDL is being increasingly recognised as a crucial approach that enables learning environments to

be intentionally designed to be accessible, flexible, and inclusive from the outset (Universal Design for Learning Guidelines 2024; Vasinda and Pilgrim 2022).

The UDL is based on the assumption that the learning environment is not neutral and that diversity among students is not a deviation but the norm (Universal Design for Learning Guidelines 2024). Therefore, learning strategies based on the UDL include multiple ways of accessing content, diverse ways to motivate students to engage, and different ways of demonstrating knowledge during the planning stage. This approach reduces the need for subsequent individual adjustments and promotes equal opportunities for the learning success for all students (Bradshaw 2020; Cumming and Rose 2022).

The principles of the UDL are grounded in current research in neuroscience and learning networks and relate to (1) multiple ways of presenting learning content, (2) multiple ways of motivating engagement, and (3) multiple ways of expressing knowledge (Bradshaw 2020). These principles are organised into 9 guidelines and 31 checkpoints based on best practises from the literature (Universal Design for Learning Guidelines 2024). The guidelines can be implemented in various ways and at different levels (e.g. in educational settings, curricula, and instruction, as well as digital tools and online environments) (Cumming and Rose 2022).

The first principle, which refers to different forms of presentation, highlights the importance of multimodal information transfer. This involves delivering content in verbal, audio, visual, or symbolic forms to support learning based on students' cognitive abilities. Personalised perception, diverse expression methods, and explicit instruction in language structures, terminology, and symbols are particularly vital in higher education, where abstract and complex texts are common (Knight et al. 2025). Such strategies notably reduce the cognitive load for students with SLDs and enhance their understanding and engagement in their studies.

The second principle concentrates on different forms of engagement, with motivation playing a key role. Emotional reactions to the learning material as well as a sense of purpose and belonging, are important—particularly for students with lower academic self-esteem or who are at higher risk of anxiety. The main strategies include selecting appropriate tasks, collaborative learning, setting goals, and gradually increasing difficulty to foster a sense of progress and competence (Universal Design for Learning Guidelines 2024).

The third principle of the UDL emphasises different forms of knowledge expression and self-regulation. Students can also demonstrate their knowledge through oral presentations, multimedia products, concept maps, and other alternative methods that may be equally challenging but more accessible to students with SLDs, such as video recordings, podcasts, digital storytelling, illustrated journals, interactive posters, annotated slideshows, or even role-play and simulation activities. Higher-education teachers can encourage active participation by providing real-life examples, offering a choice of activities, or providing clear instructions and supporting materials for information management. In this manner, they not only support students with SLDs but also promote active participation for all (Chodock and Dolinger in Cumming and Rose 2022).

The effective implementation of the UDL implies that students often do not need extra support or disclose their difficulties, as they have access to appropriate accommodations from the outset (Cumming and Rose 2022). This approach has also proven particularly effective for online courses, where including support features—such as introductory videos with instructions, subtitles, transcripts, and texts adapted for screen readers—enhances the accessibility of content for all students (Singleton et al. in Cumming and Rose 2022). Further, modern digital technologies play a key role in implementing the UDL by enabling adapted access methods such as readers, synchronised notes, interactive materials, and tools for planning and organising studies. As these tools are now widely accessible, their use not only supports students with SLDs but also enhances overall pedagogical inclusivity (Universal Design for Learning Guidelines 2024; Vasinda and Pilgrim 2022). Therefore, the UDL is not merely a set of accommodations for individuals with SLDs but a comprehensive approach to designing the learning environment that values diversity and fosters conditions for the successful participation of all students in higher education.

Although the concept of the UDL is increasingly being internationally recognised as an effective approach to designing inclusive higher education, its presence in the Slovenian context cannot (yet) be systematically traced. Individual elements of the UDL are probably already being integrated into the teaching practise of certain university teachers, but there is currently no comprehensive analysis or research that examines the implementation of this framework in Slovenian higher education. Existing efforts—such as the Guidelines for the Preparation of Open Access Materials for Higher Education Teachers (Dizdarević and Brudar 2024)—represent an important step towards greater accessibility of learning content; however, they still primarily focus on the technical and formal aspects of OA rather than the broader concept of the UDL as a pedagogical approach.

A few projects and initiatives are moving in this direction. For example, the Pedagogical Network of the University of Maribor (Pedagoška mreža UM 2021) is developing competences for inclusive and interdisciplinary teaching, with a focus on training university teachers to work with students with special needs and developing didactic guidelines for inclusive teaching approaches. The CMEPIUS monograph Improving the Quality of Teaching and Learning (Aškerc et al. 2016) also emphasises the importance of student-centred methods, project-based and blended learning, and the UDL as the basis for accessible and inclusive higher education. The University of Ljubljana is also strengthening accessibility and equal opportunities for all students by establishing an Office for Equality and Inclusion (Enakost in vključevanje n.d.) and introducing the principles of universal design for learning into pedagogical practice.

This opens space for reflection on the need for systematic research and promotion of universal design for learning in the Slovenian higher education environment, particularly in the context of ensuring equal opportunities, inclusive education, and comprehensive support for students with specific learning difficulties and other special needs, such as sensory impairments (e.g. visual or hearing loss),

physical disabilities, long-term health conditions, mental health challenges, and neurodevelopmental disorders (e.g. ADHD, autism spectrum conditions).

Digitally supported learning for students with specific learning difficulties

In higher education, digitally supported learning is increasingly vital for ensuring equal opportunities, particularly for students with SLDs. Research indicates that adaptive learning technologies significantly help bridge the gap between traditional teaching approaches and the diverse needs of students with SLDs. Intelligent learning systems facilitate greater individualisation of the learning experience based on the student's strengths and weaknesses (Desmur and Haehn 2022), prior knowledge, interests, and learning goals, thereby resulting in more personalised and effective learning (Navas-Bonilla et al. 2025). Learning technologies that incorporate personalised teaching methods and real-time feedback have been shown to assist students, particularly those with ADHD, in motivated, focus, and active engagement in the learning process (du Plooy et al. 2024; Sharma 2024; Singh et al. in Sharma 2024).

Such technologies improve the accessibility of content and contribute to better learning outcomes for all students, not merely those with SLDs (du Plooy et al. 2024; Singh et al. in Sharma 2024; Šterman Ivančič 2024), as they enable the learning process to be adapted to the individual needs and pace of each student. Simultaneously, digital tools support various learning approaches and provide greater flexibility and adaptability in learning (Sharma 2024), which is essential for the successful inclusion of students with SLDs in higher education.

Online learning platforms further contribute to students being able to establish their own pace of work and method of accessing content (Desmur and Haehn 2022), which is particularly beneficial for students with SLDs who need more time or specific conditions to learn effectively. Organised online materials, interactive activities, and digital assessment tools reduce the cognitive load and facilitate the acquisition of complex information by enabling gradual, structured, and visually supported information processing. Clearly structured texts and materials prevent unnecessary searching for information, interactive activities enable immediate consolidation and transfer of knowledge into practical tasks, and digital assessment tools provide immediate feedback. All of this relieves the burden on working memory, as students do not have to process large amounts of unrelated information at the same time and can focus their attention on essential content and gradually build their understanding (Mayer 2021). Further, extant research indicates that students who utilise digital learning platforms often achieve better learning outcomes and retain the content for longer periods (du Plooy et al. 2024; Sharma 2024).

With their ability to accommodate different learning profiles and specific challenges, adaptive learning technologies can significantly contribute to creating an inclusive and effective learning environment for students with SLDs

(Sharma 2024). AI-powered adaptive learning platforms are particularly useful for understanding more challenging language content. They analyse the user's performance, identify areas of weakness, and provide targeted exercises that enable progress along an individually tailored learning path. This approach reduces feelings of overload and lowers stress and anxiety levels when faced with complex tasks, while encouraging self-monitoring and greater perseverance (du Plooy et al. 2024; Vaughn et al. 2021). However, it is important to emphasise that the educational benefits are not limited to advanced AI platforms. Everyday digital tools also make learning much easier. These include commonly used applications such as presentation software (e.g. PowerPoint, Prezi), word processors (e.g. Microsoft Word, Google Docs), educational platforms (e.g. Moodle, Google Classroom), and text-to-speech or speech recognition tools, which support various aspects of learning and communication. In a study by Savvaidou and Loizides (2016), students with neurodevelopmental differences, including those with SLDs, highlighted the positive effects of using presentations (e.g. PowerPoint, Prezi) in lectures, as these helped them follow key information with the aid of audiovisual content. In addition, to enhance reading comprehension and reduce reading effort, dyslexia-friendly digital texts with suitable font choices, increased spacing between letters or words, and larger font sizes have proven useful. Research reveals that wider word spacing and larger letters improve the understanding of text (Galliussi et al. 2020; Krivec et al. 2019; Price-Mohr and Price 2024), although the impact of letter spacing is less significant (Galliussi et al. 2020) as excessive spacing between letters can disrupt word recognition and slow down reading by interfering with the natural chunking of letters into words. With regard to font design, Rello and Baeza-Yates (2013) discovered that sans serif, uniform, and roman fonts boost reading efficiency, while Krivec et al. (2019) observed no clear preference among individuals with dyslexia. Furthermore, fonts specifically designed for people with dyslexia have not demonstrated a proven effect on reading speed (Galliussi et al. 2020; Kuster et al. 2017).

Interactive digital tools that encourage active student participation during lectures (e.g., Kahoot, Mentimeter, etc.) also have a positive impact on higher education. Such tools have been shown to increase the motivation to learn (Savvaidou and Loizides 2016), but it is equally important that they are student-friendly and familiar, as a familiar and manageable digital environment contributes to greater self-confidence in learning among students with SLDs (Liontou 2019; Savvaidou and Loizides 2016).

Digital assistive technologies and artificial intelligence applications further expand the possibilities of inclusive education by providing greater accessibility, customisation, and effectiveness of learning content. Moreover, assistive technologies developed to help people with disabilities include various digital tools—such as text-to-speech software, interactive learning modules, and flexible digital solutions—that make it easier for students with dyslexia, ADHD, and SLDs to understand and retain information (Vaughn et al. 2021). In this manner, they assist students in overcoming cognitive and language barriers and improve access to content.

Text-to-speech tools help students with dyslexia process language more effectively, thereby improving their reading comprehension, increasing reading speed, and reducing distractibility (Hecker et al. 2002). Speech-to-text tools enables students with writing difficulties to dictate their answers. Liu et al. (2019) found that these tools help users with SLDs to produce longer, more complex, and grammatically correct texts that contain longer words and fewer errors than when writing by hand. Although they are initially slower, their efficiency significantly improves with regular use (ibid.).

Further, language programmes for predicting and improving sentence structures (e.g. Grammarly, Instatext) also assist students with SLDs and help produce richer texts with more suitable language structures and less cognitive effort. The use of these programmes has a positive effect on performance, feelings of competence, and motivation among students (Jiang et al. 2022). Speech recognition and pronunciation tools are essential for developing speech and language skills, as they provide real-time feedback and assist users in improving their pronunciation, fluency, and phonological accuracy. Such functionalities enabled by AI can notably speed up progress in the aforementioned areas (Fang et al. 2024).

Apart from technologies related to language expression, applications that support learning strategies are also vital for students with SLDs. Colour coding and the use of mind maps have proven to be particularly effective in enabling students with ADHD and other learning difficulties to organise their thoughts and structure their written and spoken language. Various apps facilitate the creation of these structures, which promotes a more systematic approach to learning. The motivational aspect is successfully addressed by interactive language apps-such as Duolingo, Memrise, and Quizlet-which include elements of games and repetitive practise. These apps enable students with SLDs to learn vocabulary and grammar in a manner that avoids cognitive overload while promoting regular use (Savvaidou and Loizides 2016). A key advantage of these apps is also their ability to adapt the difficulty level of learning to individual progress, which significantly enhances internal motivation and persistence. They have a particularly pronounced effect when learning foreign languages, where repeated practise, segmented teaching of content, and a visually supported presentation facilitate the acquisition of more complex grammatical structures and vocabulary and simultaneously increase the student's sense of achievement.

Thus, the digital solutions highlighted above not only improve performance but also reduce stress and feelings of overload, which is crucial for students with SLDs.

Barriers to the implementation of digital tools for students with specific learning difficulties

Despite the numerous benefits of digitally supported learning and the use of technology in higher education, its implementation faces various challenges. The most common obstacles include technical issues, such as software and hardware

incompatibility, high costs of assistive technologies, and limited access to digital resources at individual universities (Botelho 2021; Fernández-Cerero 2024). It is particularly important to ensure that digital tools are accessible to all students, including those with SLDs, regardless of their socio-economic background.

Another significant barrier is the lack of training among higher education teachers in integrating technology into teaching students with SLDs (Fernández-Cerero 2024; Sharma 2024; Šterman Ivančič 2024). Due to a lack of digital and pedagogical competences, higher education teachers are often unable to appropriately adapt teaching tools and approaches, which reduces the effectiveness of inclusion (Montenegro-Rueda and Fernández-Batanero 2024), or they are unwilling to use them (Šterman Ivančič 2024).

Although digital tools significantly contribute to improving the quality and accessibility of learning experiences, excessive use of technology can have a negative impact on the development of critical thinking and problem-solving skills among students (Zhai et al. 2024). When students over-rely on AI dialogue systems—particularly those with generative models—for academic research and learning, it impairs their cognitive processes, including decision-making, critical thinking, and analytical reasoning (ibid.).

Furthermore, not all students possess the same skills to effectively integrate technology into the learning process, which can lead to frustration, decreased motivation, and poorer learning outcomes. Students with SLDs often encounter difficulties even with basic skills, such as typing on a computer, which has become a fundamental means of academic expression, particularly in tests and seminar papers (Abecassis et al. 2023). As an activity that requires the synchronisation of linguistic, sensory-motor, and perceptual processes, typing often presents an additional barrier for students with SLDs (Rosenberg-Adler and Weintraub 2020).

In this regard, an important but often overlooked area is digital literacy in online searches. Research by Berget and Sandnes (2019) reveals that students with dyslexia face greater challenges in forming and utilising meaningful and accurate search terms. Poor decoding skills affect the length and spelling of search terms, while weaker short-term memory impacts search efficiency and increases the need for repetition. The use of alternative tools, such as conversational search engines (e.g. ChatGPT or Copilot), can help reduce these barriers as they are less sensitive to typing errors.

Thus, to successfully implement digitally supported learning in higher education, it is crucial to systematically eliminate the barriers above-mentioned. Focused training for higher education teachers and suitable support for students with SLDs—who need to develop the skills to effectively use digital tools to support their learning—are vital in this process.

Conclusion

This article highlighted the complexity of the study process for students with SLDs in higher education, emphasising the importance of digitally support-

ed learning as a tool to overcome systemic, cognitive, and emotional–motivational barriers. Research indicates that specific deficits in phonological processing, working memory, executive functions, and organisation are extremely stressful for students with SLDs, particularly within the demanding (Barkley 2015; Reid 2016; Snowling 2019; Wang and Chung 2024) and often rigid context of higher education (Mortimore and Crozier 2006; Schneider and Crombie 2003). Traditional pedagogical approaches to teaching, based on uniform forms of knowledge delivery and assessment—such as frontal teaching, one-way transfer of information, and standardised written tests—often fail to consider the diversity of learning profiles, which reduces the likelihood of academic success for students with SLDs and increases the risk of exclusion.

In this context, the concept of the UDL is emerging as a promising solution. It is based on the design of an inclusive learning environment and offers alternative ways of accessing and expressing knowledge and motivation. The implementation of UDL principles, supported by the use of digital and AI technologies, provides the foundation for developing flexible, responsive, and student-centred teaching methods that not only reduce the need for individual adjustments but also promote greater equity and efficiency in the educational process for all.

Despite the clear benefits of digitally supported learning, this article also highlighted key challenges, such as unequal access to technology, insufficient training of higher-education teachers, and overreliance on AI tools, which can diminish students' independent cognitive engagement. Therefore, it is essential that higher education institutions systematically develop support environments that include high-quality didactic and technical assistance, digital literacy, and targeted training for teaching staff.

To achieve the goals of inclusive higher education outlined in European strategy documents (ANDI 2023; Council Resolution on a Strategic Framework for European Cooperation in Education and Training Towards the European Education Area and Beyond (2021–2030) 2021), the gap between the potential of modern technologies and their actual application in teaching practise must be bridged. For this, comprehensive institutional support is essential—based on recognising diversity as a normative foundation—thus providing students with SLDs not only formal access to higher education programmes but also genuine opportunities for a successful and independent educational journey. Nevertheless, the limitations of this study—such as its theoretical nature, lack of empirical data, and absence of direct student perspectives—highlight the need for further research. Future studies should focus on evaluating the practical implementation of UDL principles, exploring the lived experiences of students with SLDs, and assessing the effectiveness of digital and AI-supported learning strategies in diverse higher education contexts.

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DIGITALNO PODPRTO UČENJE ŠTUDENTOV S SPECIFIČNIMI UČNIMI TEŽAVAMI V VISOKOŠOLSKEM IZOBRAŽEVANJU

Povzetek: Učenje v visokošolskem izobraževanju predstavlja za študente s specifičnimi učnimi težavami (SUT) poseben izziv, saj se soočajo s primanjkljaji na področjih pozornosti, pomnjenja, fonološkega procesiranja, jezikovnega izražanja in izvršilnih funkcij. Visokošolski učitelji, ki uporabljajo tradicionalne pristope k poučevanju, ki temeljijo na frontalnem poučevanju, pomnjenju in standardiziranem ocenjevanju, s takim načinom pogosto ne prepoznajo raznolikosti učnih profilov ter s tem ustvarjajo ovire za enakovredno sodelovanje študentov s SUT v izobraževalnem procesu. Prispevek osvetljuje vlogo digitalno podprtega učenja kot ključnega elementa pri premostitvi teh ovir ter poudarja pomen koncepta univerzalne zasnove učenja, ki spodbuja fleksibilnost, dostopnost in aktivno vključevanje vseh študentov. Uporaba digitalnih tehnologij, vključno z umetno inteligenco, omogoča individualizirane učne poti, prilagojene načine predstavitve vsebin ter alternativne oblike izražanja znanja, kar prispeva k večji učinkovitosti in pravičnosti študijskega procesa. Kljub številnim prednostim prispevek opozarja tudi na izzive pri implementaciji, kot so pomanjkljiva usposobljenost pedagoškega kadra, tehnične omejitve ter nevarnost pretiranega zanašanja na digitalna orodja. Prispevek ne ponuja neposrednih izhodišč, temveč skozi analizo prednosti in slabosti digitalno podprtega učenja odpira prostor za nadaljnji razmislek in raziskovanje, s ciljem spodbuditi sistemske spremembe v visokošolskem prostoru.

Ključne besede: specifične učne težave, digitalne tehnologije, univerzalno zasnovano učenje, visokošolsko izobraževanje, dostopnost.

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