

Integrating Neurodiversity into Teacher Education: Vulnerability as a Pedagogical Resource

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Résumé :

L'étude montre comment l'ère numérique et la neurodiversité transforment ensemble l'apprentissage et la formation des enseignants. Les schémas cognitifs des natifs du numérique — attention fragmentée, rapidité de bascule, dominance visuelle — se rapprochent de ceux des personnes neurodivergentes, rendant indispensable une conception pédagogique inclusive. La neurodiversité est présentée comme une variation humaine naturelle, tandis que la vulnérabilité devient une ressource pédagogique favorisant la confiance et la sécurité émotionnelle. Le cours repensé intègre la ludification, le mouvement, la structuration visuelle et l'apprentissage par tests pour soutenir des profils cognitifs variés. Les retours étudiants indiquent une motivation accrue et une meilleure rétention. L'article conclut que la neurodiversité doit devenir un principe central de la formation enseignante.

Mots-clés: Neurodiversité, Natifs du numérique, Formation des enseignants, Vulnérabilité, Conception inclusive

Abstract:

The study explores how the digital age and neurodiversity jointly reshape learning and teacher education. It argues that the cognitive patterns of digital natives, fragmented attention, rapid shifting, and visual dominance, overlap with neurodivergent functioning, making inclusive design essential. Neurodiversity is presented as natural human variation rather than deficit, and vulnerability is reframed as a pedagogical strength that fosters trust, emotional safety, and authentic learning relationships. The author redesigns a teacher-education course using gamification, movement-based learning, visual structuring, and test-enhanced learning to support diverse cognitive profiles. Student feedback shows increased engagement, better retention, and stronger self-regulation. The paper concludes that neurodiversity should become a core organising principle of future teacher education, aligned with global inclusive-education trends.

Keywords: Neurodiversity, Digital natives, Teacher training, Vulnerability, Inclusive design

Introduction

Research on digital natives has, over the past two decades, become an independent and dynamically developing field of study. Bibliometric analyses (e.g., Dastane & Haba, 2023) show that the main thematic clusters of this research revolve around adaptation to educational technologies, digital competence, changes in learning preferences, social media use, and generational characteristics (Generation Z, net generation).

According to approaches that emphasize the interweaving of biological and socio-anthropotechnical evolution, technological development and the digital environment

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generate not only cultural adaptations but also modify the functioning of the nervous system: attentional patterns become fragmented, memory use is reorganized, learning processes shift increasingly toward rapid, visual information processing, and the dynamics of social interactions are transformed. The transition from a “book culture” to a “clip culture” creates the dominance of rapid, visual stimuli instead of linear, deep information processing, resulting in new forms of informational stress and cognitive load.

Homo informaticus can thus be interpreted as a transitional anthropological configuration in which the interaction between biological evolution and the technological environment generates new modes of human functioning (Petrova, 2022).

The latest research directions increasingly link the functioning of the digital generation to the issue of neurodiversity. Neurodivergent individuals, such as autistic or ADHD individuals, possess different attentional patterns, sensory sensitivities, and information-processing preferences, which appear particularly prominently in digital environments. Van den Heuvel, Ivkić and Riedl (2026) demonstrated that digital tasks and information overload elicit different physiological and behavioural responses in neurodivergent and neurotypical users, drawing attention to the disproportionate effects of the burdens imposed by digital culture. Other studies (e.g., Glazko et al., 2025) indicate that neurodivergent subgroups of digital natives develop distinctive technology-use strategies and often employ generative artificial intelligence for self-regulation, information processing, or managing social situations. Neurodiversity thus appears not merely as an individual difference but as a factor that fundamentally shapes the functioning of the digital generation, making new pedagogical and technological approaches necessary.

Achara (2026) investigates a completely new direction, examining how neurodivergent educators, particularly those with autism, ADHD, dyslexia, and other neurological characteristics, can be strengthened and supported in the rapidly digitalizing educational environment. According to the author, the digital society creates not only challenges but also unique opportunities for neurodivergent teachers: technology can compensate for certain difficulties (e.g., executive functions, sensory overload) while providing space for the unfolding of strengths (e.g., hyperfocus, pattern recognition, creative problem-solving). The study emphasizes that digital pedagogy becomes truly inclusive only when neurodiversity is understood not as a deficit but as a pedagogical resource. Achara highlights that the experiences of neurodivergent teachers are particularly valuable in supporting learners of the digital generation, as they respond more sensitively to attentional, sensory, and information-processing differences. According to the author’s conclusion, one of the keys to future educational systems is making neurodivergent educators visible, strengthening them professionally, and providing targeted support through digital tools.

The “*Apor Step*”, teaching grant of Apor Vilmos Catholic College, in response to changes in student characteristics, encourages the institution’s instructors to renew their methods and even their courses. Within the framework of this grant, I am redesigning my course on Atypical Development. Due to what is likely a mild, undiagnosed reading disorder and ADHD traits, I have long been conducting research in this field, and my higher-education courses are also connected to the domain of neuroatypical development. Thus, the situation is given: I can provide students with a learning environment in which, whether due to generational characteristics shaped by digital culture or due to neuroatypical development, these features do not constitute a disadvantage during their higher-education studies.

The Spectrum of Neurodiversity

The concept of neurodiversity is not associated with a single author but with autistic online communities. The term “neurological diversity” had already appeared in 1996–1997 (Botha et al., 2024). The concept has proven to be highly fluid. Helen McLennan and her colleagues, in their review *Thirty Years on from Sinclair* (2025), identified eight conceptual categories through the analysis of 46 studies, of which “natural variation” is the most dominant. The title refers to Jim Sinclair’s 1993 lecture, which presented neurological differences not as deficits but as valuable and valid modes of being, thereby giving a new direction to the discourse on autism.

According to the most widely accepted approach, neurodiversity is the natural variation of human neurological functioning. The concept of neurodiversity has by now moved beyond autism and has expanded to other neurominorities as well, such as ADHD and dyslexia. Since 2021, *The Lancet Psychiatry* has published analytical articles on the clinical and educational applicability of neurodiversity, with particular attention to autism and ADHD. In their commentary in the journal, Sonuga-Barke and Thapar (2021) examine the advantages and limitations that the concept of neurodiversity presents for clinical practice and scientific research. The authors acknowledge that the neurodiversity movement has played an important role in increasing the social acceptance of autistic and other neurominority individuals, strengthening self-advocacy, and critiquing deficit-based approaches.

At the same time, they emphasize that in clinical and research contexts there remains a need for the precise identification of functional difficulties, support needs, and heterogeneity, as these are indispensable for appropriate diagnostics, intervention, and scientific understanding. Development considered neuroatypical affects those elements of cognitive systems whose functioning is shaped by the maturation processes of the nervous system. The shared neurological characteristics underlying different developmental forms are responsible for establishing the foundations of the spectrum.

Autism is typically described as a spectrum condition, meaning that the syndrome may appear at very different levels and in very different forms. However, the same is true for learning difficulties, regulatory disorders, and even giftedness. For this reason, these too may be regarded as spectra.

At the same time, both internal and external factors may contribute to the emergence of cognitive divergences, which can manifest in various combinations and with differing degrees of severity across domains such as reading, numeracy, literacy skills, attentional and behavioural regulation, literal thinking arising from perceptual and information-processing characteristics, and even in the form of exceptional cognitive performance.

All forms of development considered neuroatypical are characterized by the fact that

- they are based on a variant of typical neurological functioning,
- they involve both advantages and disadvantages across the lifespan,
- they are independent of intelligence,
- and they are strongly dependent on the environment.

The latter characteristic explains why the manifestations of neuroatypical development have been particularly strongly influenced by the changes of the twenty-first century (Gyarmathy and Plosz, 2021). The learning, attention, hyperactivity, and autism spectra frequently appear together in mixed forms, and interpreting them not as deficits but as neurological variants enables the design of inclusive learning environments that treat divergent modes of functioning

as natural forms of human variation. Because neurodivergent characteristics often involve differences in executive functioning, the conscious support of learning organisation, the use of visual anchors, and the creation of predictable, structured environments acquire particular importance. Taking sensory sensitivities into account requires flexible use of space, advance signalling, and the reduction of sensory load so that learners' neurological burden remains optimal. All of this is interwoven with the quality of relationships among participants in the learning environment, which, through the emotional security, predictability, and co-regulation highlighted by Hamre and Pianta (2006), creates the stable foundation in which neurodivergence does not constitute a disadvantage.

Vulnerability as a Resource

The concept of vulnerability has undergone significant transformation in recent decades: in psychological and pedagogical discourse it increasingly appears not as a weakness but as a human and professional resource. Brené Brown's (2012) research fundamentally shaped this perspective, demonstrating that embracing vulnerability is one of the most important sources of courage, authenticity, connection, and creativity.

Vulnerability therefore does not signify a loss of control, but rather the recognition that the depth and quality of human relationships are built precisely through openness, the acceptance of uncertainty, and mutual trust. This is particularly relevant in pedagogical practice, as the quality of the teacher-student relationship determines the emotional and cognitive framework of the learning process.

Robert Pianta (1999) emphasized that a teacher's vulnerability, such as acknowledging mistakes, sharing uncertainties, or demonstrating authentic emotional presence, creates a relational space that strengthens trust and increases students' sense of emotional safety.

The pedagogical significance of vulnerability extends beyond the relational dimension: it becomes one of the key factors in learning and developmental processes. Research in trauma-informed pedagogy indicates that recognising and accepting vulnerability creates a learning environment that is safe, predictable, and compassionate, and in which students are able to regulate their emotional states and actively participate in the learning process (Brunzell, Stokes, & Waters, 2016). When students themselves embrace vulnerability, such as taking the risk of making mistakes, asking questions, or seeking help, this is directly linked to learning motivation, creativity, and perseverance.

According to Carol Dweck's (2006) "Growth Mindset" model, the essence of a development-oriented mindset lies precisely in the individual's capacity to tolerate uncertainty and the possibility of failure, which are natural components of growth and learning.

Critical neurodiversity research also highlights that vulnerability is not an individual deficit but the result of environmental and social interactions: an individual becomes "vulnerable" when the environment does not align with their neurological characteristics (Chapman, 2019). In this sense, the pedagogical interpretation of vulnerability shifts attention away from individual shortcomings and toward environmental responsibility, encouraging the creation of learning environments that support diverse modes of neurological functioning.

The Intersection of the Digital Generation and Neurodiversity

There is a demonstrable and well-documented increase in the number of students in higher education who exhibit characteristics that diverge from the norm due to neurodevelopmental disorders. The international narrative synthesis conducted by Clouder and colleagues (2020), based on research from 22 countries, concluded that the number of neurodivergent students is increasing worldwide. The most common diagnoses are dyslexia, ADHD, and autism. The rise is attributable partly to increased diagnostic awareness and partly to a genuine growth in need.

The multitasking culture, informational overload, and attentional fragmentation characteristic of the digital age place functional demands on the same cognitive systems that are inherently vulnerable in neurodevelopmental disorders. For this reason, there is a strong and empirically substantiated intersection between the two phenomena.

In digital environments, multitasking and information overload significantly reshape attentional patterns, particularly in the developing nervous system. Large-scale longitudinal studies indicate that 77% of adolescents use multiple digital devices simultaneously, and 85% engage in multitasking while studying, which increases working-memory load and the frequency of attentional shifts (Forsström et al., 2025). Media multitasking is significantly associated with weaker executive functions and reduced inhibition (Uncapher & Wagner, 2018), as well as with the emergence of ADHD-like symptoms (Ra et al., 2018).

These findings indicate that the overlaps between digital culture and neurodivergent information processing are not merely of theoretical significance but have direct implications for higher education and teacher training. A learner profile has emerged in which attentional fragmentation, visuospatial dominance, rapid shifting, and non-linear learning pathways become everyday and normative.

This dual trend, the increasing number of neurodivergent students and the normalization of the cognitive characteristics of the digital generation, necessitates a new kind of pedagogical sensitivity and methodological repertoire.

Neurodiversity and the Learning Environment

Transforming the learning environment with attention to neurodiversity places our understanding of learning, development, and human difference on entirely new foundations. This transformation does not designate a specialised sub-area but represents a broader shift in perspective that affects the whole of education: it conveys that differences among learners are not disturbances but natural and valuable components of the learning environment. In this way, the concept of neurodiversity can become one of the key notions of pedagogical thinking, as it simultaneously interrogates the boundaries of normality, the plurality of learning pathways, and new forms of pedagogical responsibility.

Integrating a neurodiversity-informed perspective allows us to interpret the learning process not as a linear but as a plural phenomenon: multiple attentional rhythms, multiple motivational dynamics, and multiple information-processing routes exist, and all are legitimate.

The pedagogical significance of neurodiversity is therefore twofold. On the one hand, it is critical: it challenges the hidden norms that render some learners, invisible or disadvantaged. On the other hand, it is constructive: it supports pedagogical practices that interpret diversity not as a problem to be managed but as a resource for the learning community.

This is not merely about integrating new content but about redefining the foundations of pedagogy. The future teacher is not merely a transmitter of knowledge but a sensitive observer, reflective analyst, and adaptive designer of learning environments. A learning environment that is suitable for neurodivergent students teaches future teachers not to align learning processes with normative patterns but to shape them dynamically according to learners' needs.

Understanding neurodivergent patterns in teacher education initiates methodological innovations (e.g., sensory-aware design, attention management, executive-function support) that enhance the learning effectiveness of the entire student population. Neurodiversity is therefore not a “special topic” but one of the defining organising principles of the future of teacher education.

Connection to International Trends in Inclusive Education

The neurodiversity-based perspective embedded in teacher education aligns closely with global trends in inclusive pedagogy, which over the past decade have shown three prominent shifts:

1. Moving beyond the deficit model: International literature (UNESCO, OECD, European Agency for Special Needs and Inclusive Education) clearly emphasises the recognition of diverse ability profiles. Neurodiversity radicalises this paradigm: the focus shifts from “compensating for deficits” to transforming cognitive diversity into a pedagogical asset.
2. Universal Design for Learning (UDL): The integration of neurodiversity naturally connects to the principles of Universal Design for Learning, which support diverse learning pathways, tools, and forms of assessment. Understanding neurodivergent patterns helps ensure that the learning environment is designed to be inclusive from the outset.
3. The central role of student wellbeing and mental health: International trends increasingly highlight psychological safety as a prerequisite for learning. The pedagogical integration of neurodiversity reinforces this perspective: understanding students' modes of functioning reduces stigma, increases engagement, and supports resilience.

Vulnerability as a Source of Pedagogical Hope and Justice

The pedagogical interpretation of neurodiversity casts new light on the concept of vulnerability. Vulnerability is not a weakness but an opportunity for connection, one that opens pathways to mutual understanding and justice within the learning space. The experiential exploration of neurodivergent modes of functioning (simulations, reflective exercises) reveals that we all carry cognitive and emotional vulnerabilities. This recognition dismantles the artificial boundaries between “normal” and “different.”

Embracing vulnerability creates space for the belief that the learning environment is shapeable, and that it is possible to create a space in which every learner can feel competent, visible, and valued. The pedagogy of hope is not optimism but action: the teacher's active commitment to creating an inclusive environment.

The integration of neurodiversity approaches justice not through equal treatment but through equitable access, that is, through building on diverse possibilities. The pedagogical acknowledgement of vulnerability means designing the learning environment so that it is accessible to everyone, not through retroactive compensation but through anticipatory planning.

In this sense, vulnerability is not an obstacle but one of the most important sources of pedagogical humanism.

Challenges and New Opportunities in Teacher Education

According to international statistics, the proportion of students with disabilities in higher education typically ranges between 1–6%, with substantial variation across countries. In the United States, data from the National Center for Education Statistics (NCES) indicate that 19% of students report some form of disability, but only 4–6% make use of official academic accommodations (NCES, 2023). In Australia, the 2022 report of the Ministry of Education records a proportion of around 7%. In Europe, based on Eurydice and national reports, the proportion of affected students is 3–6% in Western European countries and 1–3% in Central and Eastern Europe (Eurydice, 2020; European Commission, 2022). These differences stem partly from divergent definitions, diagnostic practices, and cultural norms surrounding the disclosure of disability.

However, special educational needs and their official statistics represent only the tip of the iceberg; far more students struggle with characteristics that make learning and integration difficult in an environment as minimally inclusive as higher education.

The lack of inclusivity in higher-education environments is no longer an isolated issue but a systemic phenomenon that appears in the structure of learning environments, in pedagogical culture, and in institutional functioning. The diverse neurological functioning of students often remains invisible because higher-education institutions are still organised around the image of the “normative student.” Rigid academic requirements, large lecture formats, standardised assessment practices, and limited differentiated learning support all contribute to making higher education more burdensome for neurodivergent students, not only academically, but also psychologically and administratively. The lack of inclusivity thus appears not as an individual difficulty but as a structural barrier that restricts access, participation, and success.

All of this is particularly critical in teacher education, where students are not only learners but also the future teachers. The modelling role of higher-education institutions means that students carry forward the pedagogical culture they experience during their training. If the system does not provide adequate support, does not recognise neurodiversity as a value, and does not employ flexible, accessible approaches to learning design, then future teachers will not regard such practices as natural.

For this reason, supporting students at both the individual level (e.g., academic accommodations, flexibility in learning organisation, mental-health support) and the institutional level (e.g., inclusive curricula, universal design for learning, awareness-raising training) is not merely a matter of equity but a fundamental condition for the quality and social responsibility of teacher education. The inclusivity of higher education therefore shapes not only the success of current students but also the culture of future schools.

Redesigning the Learning Environment from a Neurodiversity Perspective

The topic of the course we are working to renew is highly engaging for students in teacher education, as they already perceive the challenges associated with atypical neurological development and recognise that this is an area requiring attention. Nevertheless, the course is not simple, as it requires the integration and understanding of a large amount of information.

We identified three major problems that are not only characteristic of the course *Understanding Atypical Development* but represent general challenges for students:

1. A heavy theoretical workload;
2. Students' short attentional span and limited long-term retention;
3. Fragmented learning material.

Apor Vilmos Catholic College announced a methodological innovation grant for instructors. The support awarded through this grant enabled us to begin integrating new possibilities. The aim was to formulate and test in practice potential responses to the problems listed above.

The conceptual framework of the solution was that the vulnerability associated with neurodivergent development can also serve as a resource in teacher education if students' learning environments are methodologically aligned with inclusivity, where neurodiversity is not a disadvantage but an opportunity.

The main characteristics of such a learning environment are that it

- provides clear structure while offering substantial autonomy;
- presents problem situations that can be experienced through one's own practice;
- segments long learning periods through activity and movement, supporting conceptual understanding;
- offers both textual and visual, both detailed and overarching representations of the learning material;
- maintains motivation through gamification elements.

We applied several components of this learning environment over the course of one year, across both modules of the course, and evaluated the changes based on student feedback and our own experiences in our program evaluation.

Support for Self-Directed Learning Through Gamification

To ensure that students are granted the greatest possible autonomy, we provided opportunities for self-directed learning. We sought to regulate the learning framework through a points-based system. Points could be earned by completing various predefined tasks, as well as through continuous Redmenta self-testing related to the course content. According to the rules of the points system, students were required to achieve 100 points for semester completion, but at minimum 80 points. In the latter case, they could receive supplementary points from their peers.

The points system provides freedom regarding the pace and mode of learning. At the same time, it also functions as an assessment system, as students receive points based on their performance in the test-enhanced learning tasks. If they retake a test and achieve a better result, their score increases by the amount corresponding to the improvement in their test performance.

The points system ensures individual progression, yet it also enables collaborative learning, as tasks and tests could be completed together, and the possibility of transferring points to one another enriched the social dimension of the learning process.

Learning Through Testing

A central element of self-directed learning is *test-enhanced learning*. The essence of the method is that the development of durable knowledge is ensured not by passive rereading but by the practice of active retrieval. Research findings (Roediger & Karpicke, 2006) clearly

demonstrate that regular, low-stakes retrieval opportunities not only improve retention but also facilitate the flexible application of knowledge, as retrieval itself constitutes a learning act. The continuously accessible, time-pressure-free Redmenta tests used in the course support this mechanism and form the basis of the points system, which students have found motivating both previously and in the current iteration.

However, not all students made use of the opportunity for regular practice. Students typically used self-testing, and the points system in two distinct ways:

1. Continuous, regular progression: self-regulated learners, characterised by planning and consistency, for whom the method results in better long-term retention.
2. End-of-semester “all tests at once”: procrastinators or deadline sprinters, characterised by postponement and activated primarily by time pressure, resulting in weaker deep learning.

Students’ patterns of self-testing and use of the points system thus delineate two characteristic learning profiles, which align with research findings on self-regulated learning and procrastination (Zimmerman, 2000).

Regular, mid-semester testing is typical of “self-regulated” learners who employ distributed practice (Dunlosky et al., 2013), whereas end-of-semester mass completion follows the procrastinating, “deadline-driven” pattern (Tuckman, 1991).

Movement and Physical Activity

Movement is one of the most powerful neurocognitive supports of learning: regular physical activity increases neurotrophic processes, stimulates neurogenesis and brain plasticity (Di Liegro et al., 2019), and improves memory and executive functions (de Sousa Fernandes et al., 2020).

The attentional and self-regulatory benefits of movement are also significant: rhythmic, coordination-based activities develop attentional networks (Posner, Rothbart & Tang, 2015), and learning environments that incorporate movement measurably enhance cognitive performance (Silva et al., 2022). In the case of neurodivergent development, strengthening cognitive harmony is of even greater importance than usual.

A movement task is not a “break” from learning but an integrated part of it, enhancing the nervous system’s sensitivity to learning and the efficiency of information processing. For this reason, during instruction I connected the theoretical material with the practical activities that students previously completed separately in the second semester.

Thus, already in this semester, students tried out movement-development tools during class sessions and participated in movement-based playful tasks. In certain activities, they had to respond through movement, for example in true/false tasks. All of this provides a model for how knowledge-deepening repetition can be linked to movement. Questionnaire feedback revealed that these activities were very important and useful for the students.

Games and Simulation

Playful and simulation-based learning creates a motivating environment in which students acquire new knowledge as active participants who are emotionally engaged: clear goals, immediate feedback, and gradually increasing challenges foster deeper understanding through the experience of competence (Adipat et al., 2021), while the cycle of risk-free experimentation and error constitutes a core mechanism of effective learning.

Following the logic of experiential learning (Yardley, Teunissen & Dornan, 2012), knowledge becomes truly applicable when the learner constructs it through their own decisions and experiences. Simulations are particularly valuable because they model realistic, complex situations in which multiple possible solutions must be considered, thereby developing practical skills, divergent thinking, and reflective analysis (Zach & Ophir, 2020).

All of this is of particular importance in teacher education, as students encounter situations in which there is no single correct answer, yet the consequences of their decisions create deep learning opportunities. Feedback was unequivocally positive; the playful elements explicitly supported the acquisition of concepts as well.

Clear guidelines and curriculum

Teachers, students, and instructors often hesitate to use experiential teaching situations because the learning content is not explicit and its underlying logic becomes difficult to follow amid the many playful and simulation-based elements.

Clear structures help everyone, but they are particularly essential in the context of neurodiversity, where clear rules and algorithms support the processing of large amounts of information and activity. To address this need, we introduced two effective methods: the glossary and the Mind Map technique.

The glossary is a list of the concepts learned on a given instructional day, accompanied by definitions. Students received this in Classroom at every session. We began the following class with a three-group game, the “concept game.” Each student had the glossary in front of them, and one group would say a concept; the group from which a student stood up the fastest and read the definition received a point. Thus, each class began with the retrieval of previously learned information.

The Mind Map served to summarise the learning material, indicating the main branches and the clusters of information associated with them. The Mind Map technique is one of the most effective learning tools for students with learning difficulties, but it supports all students in gaining an overview of the material.

The training elements, exercises, and simulations used

The methodological changes introduced during the course explicitly built on the strengths of neurodivergent modes of functioning: individual pacing, movement-based and experiential learning, holistic and integrative thinking, and the anxiety-reducing effect of clear rules. Through these elements, students were able to experience the advantages of neurodivergent functioning. However, there are certain areas of difficulty that inevitably require attention. These include sensory overload and executive functions.

In the sensory-overload experiential exercise, students had to solve simple arithmetic tasks while various noises and movements appeared around them, creating a multitude of stimuli. In another simulation, they had to answer questions about a text while the screen displayed numerous distracting details and sounds, and buzzing interfered with their thinking. Students reported increasing tension, attentional distraction, and confusion, experiences that a sensory-sensitive individual may encounter. Some students who themselves struggle with such difficulties shared that for them, every moment feels like this.

Executive functions were revisited through Go-No Go games requiring inhibition, and students were introduced to these activities as potential classroom-based developmental tools. For working-memory tasks, they had to observe a multi-element sequence at one end of the room and reproduce it by drawing at the other end. Students also tried the N-Back game, which is commonly used to assess working memory. Challenges requiring cognitive flexibility were modelled through changing rules.

It became clear that the majority of students struggle with weaknesses in executive functions. They found the working-memory tasks particularly demanding. They were also able to identify the disadvantages of these weaknesses in their own everyday situations, recognising that the effectiveness of executive functions is crucial not only for learning but also for life management.

These are aspects of neurodivergence that require careful attention, as they can lead to significant disadvantages. In addition, emotional and social effects are highly important, as they also pose substantial challenges for neurodivergent students.

During the course, several students spoke about their own learning disorders, about shame, low self-esteem, and the demotivation that had developed as a result of repeated failures. In the learning-disorder simulation, everyone was able to experience these feelings, for example, when one half of the group had to write a dictated text with their non-dominant hand, or when, in a puzzle activity, some students were given pieces that did not fit, and others looked at them with confusion, wondering why they could not complete the task. In both situations, students reported frustration, loss of motivation to continue the task, and the unpleasant feeling of falling behind their peers and worrying about what others might think of them.

Use of AI

All students use some form of AI-based large language model, most commonly ChatGPT and Copilot. Therefore, in addition to self-testing, we were able to build the extra tasks around this. The AI-based tasks were the following:

- Ask the AI to conduct an interview about neurodivergence, responding as if it were the parent of a child with special educational needs.
- Write a story about neurodiversity with the help of the AI.
- Ask the AI to explain neurodiversity to a first-grade child.

In discussing the tasks with the students, we analysed, on the one hand, how realistic and appropriate the AI's responses were, and on the other hand, what modifications would be needed to make the outputs genuinely effective. Through this, we aimed to help students practise synthesising their own ideas with the results generated by the AI.

Methodological changes, evaluation of new solutions

Thematic Analysis of Student Feedback

According to student feedback, the course rests on strong foundations, and with appropriate fine-tuning it can align even more closely with diverse learner profiles and the needs of higher education. Students particularly appreciated tasks requiring active participation and interactive, engaging methods such as discussion, case analysis, and trying out various tools. Group tasks,

methodological workshops, and experiential activities were also mentioned among the effective methods.

The qualitative feedback collected across two semesters was analysed using an inductive thematic approach. The responses reveal five overarching themes that characterise students' experiences of the course:

1. cognitive load and temporal structure,
2. experiential engagement,
3. conceptual difficulty,
4. support needs and learning conditions,
5. assessment and motivation.

These themes reflect both the strengths of the redesigned learning environment and areas requiring further refinement.

1. Cognitive Load and Temporal Structure

A dominant theme concerns the impact of block-scheduled sessions on students' cognitive and physical endurance. While students appreciated the *rapid progress* enabled by longer sessions, they consistently reported fatigue, concentration loss, and information overload as significant challenges. The tension between efficiency and cognitive sustainability suggests that the temporal structure of the course plays a crucial role in learning quality.

"The long blocks were tiring; I lost focus after a while."

"Too much information at once, not enough breaks."

Students' suggestions for shorter, more frequent sessions indicate a preference for distributed learning, aligning with research on cognitive load and attention regulation.

2. Experiential Engagement and Active Learning

The most consistently positive theme relates to experiential, interactive, and embodied learning elements. Students highlighted a wide range of activities as particularly meaningful:

- group tasks
- hands-on tool use
- experiential exercises
- juggling and rhythm-based tasks
- music-making
- concept games
- clear, structured materials

These elements fostered engagement, enjoyment, and deeper understanding, demonstrating the effectiveness of multimodal, embodied pedagogy—especially in a course centred on neurodiversity.

"I loved trying out the tools and experiencing everything myself."

"The structure was clear, and the activities helped me understand the concepts."

This theme underscores the value of active participation in developing empathy and insight into neurodivergent functioning.

3. Conceptual Difficulty and Cognitive Challenge

Students identified several topics as particularly demanding, including:

- neurophysiological and psychological foundations
- developmental ability profiles
- executive functions

These areas require high levels of abstraction and integration, which may explain why some students felt the 60-hour module insufficient for the complexity of the content.

“The brain-related topics were the hardest for me.”

The theme suggests a need for additional scaffolding, such as visual summaries, repeated retrieval, and optional deep-dive materials.

4. Support Needs and Learning Conditions

Students expressed a clear desire for individual consultation, indicating that personalised guidance enhances comprehension and confidence. They also reported good alignment with prior knowledge and appreciated the variety of methods, which supported different learning preferences.

“I would have liked more one-on-one consultation.”

This theme highlights the importance of flexible, learner-centred support structures, especially in a course addressing diverse cognitive profiles.

5. Assessment, Motivation, and Self-Regulation

The points-based assessment system was widely perceived as motivating, though some students felt it occasionally encouraged over-focus on point accumulation rather than learning.

Self-testing and workshop activities were considered highly useful, and satisfaction with the glossary and playful exercises was unanimous.

“The point system motivated me, but sometimes I focused too much on points.”

This theme reflects the dual role of gamified assessment: it can enhance engagement but requires careful calibration to maintain intrinsic motivation.

Implications for Course Development

Across themes, several integrative patterns emerge:

- Students value experiential, embodied, and interactive learning, which supports both engagement and conceptual understanding.
- Cognitive load management is essential; long blocks strain attention and reduce retention.
- Complex theoretical content requires additional scaffolding and opportunities for personalised support.
- Gamified assessment is effective but must be balanced to avoid point-driven behaviour.

The course successfully creates a supportive, structured, and multimodal learning environment, aligning with principles of neurodiversity-oriented pedagogy.

Overall, the course was evaluated positively and effectively supported the development of students' professional knowledge. For the further development of the course, the following groups of feedback are of particular importance:

- establishing a flexible yet well-structured learning environment is essential, as it makes learning easier;
- providing individual learning pathways helps significantly in avoiding failure, but there is a strong need for intermediate deadlines and supportive structures;
- the methods introduced mitigate the attentional load caused by block-scheduled classes, yet it remains difficult to maintain attention during theoretical segments;
- students welcome the integration of supportive but critical use of AI.

Conclusions and Recommendations

The future of education does not lie in the homogenisation of learners but in recognising cognitive diversity as a value. Both teacher education and the broader educational system require a shift in perspective that interprets neurodivergent modes of functioning not as deficits but as enriching elements of the learning community. Our methodological inquiry highlights three key areas: a value-based approach to neurodiversity (1), structural and methodological renewal in teacher education (2), and the identification of future research directions (3).

1. Neurodiversity is not a deficit but a value

The neurodiversity perspective fundamentally challenges the dominance of the deficit model. Different neurological modes of functioning do not represent “deviations from the norm” but alternative cognitive pathways that bring new attentional patterns, creative forms of thinking, and unique problem-solving strategies into the learning space. For pedagogical practice, this means that learner diversity is not a disturbance to be managed but a resource that enriches the learning process and increases the adaptability of the community.

A value-based approach to neurodiversity is also an ethical stance: pedagogical justice does not mean striving for uniformity but ensuring equitable access. A learning environment becomes just when it is capable of accommodating diverse modes of functioning, when it does not attempt to adapt learners to the system, but instead optimally adapts the system to the learners.

2. Structural and methodological changes in teacher education

A neurodiversity-informed perspective requires not merely the introduction of new courses or modules but a rethinking of the entire training structure. Particularly significant areas:

- Conceptual transformation: Teacher education must convey a foundational stance that views diversity as a natural part of the learning process. This perspective applies not only to students with special educational needs but to the entire student population.
- Methodological innovation: Understanding neurodivergent modes of functioning necessitates pedagogical tools such as flexible learning design, activity-based and movement-integrated learning, experiential tasks, and the consistent application of Universal Design for Learning principles.
- Experiential and reflective learning: In teacher education, first-hand experiential learning becomes essential, through simulations, sensitising exercises, reflective writing, and collaborative learning situations. These practices not only foster empathy but also deepen understanding of pedagogical decision-making.

3. Future research directions

Future research can help ensure that neurodiversity becomes not merely a topic of pedagogical discourse but a driving force in transforming teacher education and educational systems more broadly.

- The pedagogical integration of neurodiversity opens numerous avenues for further research.
The following areas appear particularly promising:
- Exploring the higher-education experiences of neurodivergent students: How do they experience the learning environment? What barriers and resources do they encounter? Which forms of support prove effective?
- Evaluating experiential methods used in teacher education: To what extent do these methods enhance understanding of neurodivergence, empathy, professional sensitivity, and reflective thinking? How do they influence later pedagogical practice?
- The relationship between neurodiversity and digital learning environments: How do the cognitive patterns of digital culture reinforce or overlap with neurodivergent modes of functioning? How can digital learning spaces be designed to support diverse attentional and information-processing profiles?
- Equity and vulnerability: How can equity be conceptualised in light of neurodiversity? What systemic changes are necessary to achieve inclusive higher education?

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