



## Link Between Students' Neurodiversity and Learning Difficulties

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# LINK BETWEEN STUDENTS' NEURODIVERSITY AND LEARNING DIFFICULTIES

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## ABSTRACT

**Relevance.** The increasing number of neurodiverse students entering higher education institutions poses a shared and growing challenge for educators. Access to higher education should be seen as the first step towards social inclusion, for which recognition of learning difficulties, teachers' knowledge of how to work and communicate with this group of students is of great importance.

**Methods.** A quantitative research approach was used. Students' learning difficulties were assessed on 40 attributes. Four developmental and mental health disorders were presented to show the expression of neurodiversity: attention deficit hyperactivity disorder (ADHD), autism spectrum disorders (ASD), depression, anxiety. The survey was conducted among 485 students of Kauno kolegija Higher Education Institution. The following statistical methods were used: Factor analysis, Cronbach's alpha, ANOVA test and Spearman correlation.

**Results.** Among surveyed students, anxiety and depression emerge as the most commonly reported concerns, while ADHD and ADS are less prevalent. Students with or suspected of having ADHD are more likely to report a lack of attention in learning activities, engaging in conversation and extraneous work, lack of time and distractibility, as well as specific learning disabilities. Students with or suspected of having ASD are characterised by difficulties in group work and sensory sensitivity in learning activities, as well as specific learning disabilities. Students with anxiety disorders and depression or self-reported anxiety disorders and depression have attention deficits in learning activities, difficulties in group work and sensory sensitivity in learning activities and specific learning difficulties. Students with ADHD, anxiety, and depression reported a lower Grade Point Average (GPA) for the last semester.

**Conclusions.** Neurodiversity among students is a relevant phenomenon that is associated with learning difficulties that interfere with achieving good learning outcomes.

**Keywords**

Neurodiversity, attention deficit hyperactivity disorder (ADHD), autism spectrum disorders (ASD), depression, anxiety, higher education institution, students, learning difficulties.

**BACKGROUND**

The inclusion of underrepresented groups in higher education is on international and national policy agendas around the world (Claeys-Kulik et al., 2019). Governments are increasingly holding higher education institutions (HEIs) accountable for their performance in ensuring access to learning and equity (Pitman et al., 2020) (*in* Veidemane, Kaiser and Craciun, 2021). Thus, universities and colleges are becoming more open and accommodating to students' diverse backgrounds and learning needs.

An increasing number of students with different learning difficulties are progressing into higher education (HE) internationally (Pino and Mortari, 2014) (*in* Clouder, et al., 2020). The increasing number of neurodiverse students entering HE poses a shared and growing challenge internationally for teachers and institutional leaders (Clouder, et al., 2020).

Neurodiversity can be understood as naturally occurring variation in the ways that humans perceive, experience and interact with the world, encompassing neurodevelopmental differences (Clouder et al., 2020). The term neurodiversity refers to the diversity of all people with all neurotypes, but it is often used in the context of autism spectrum disorders (ASD), as well as other neurological or developmental conditions such as ADHD, learning disabilities or even some mental health conditions like depression, obsessive compulsive disorder (OCD), anxiety. Neurodiversity is an umbrella term, including dyspraxia, dyslexia, attention deficit hyperactivity disorder, dyscalculia, autistic spectrum disorders (Clouder et al., 2020).

Around 15-20 % percent of people are neurodivergent, characterised by autism, ADHD, dyslexia, or other patterns outside the neurotypical mainstream (Independent Educational Consultants Association). The World Health Organization (WHO) (2019) estimates that 1 in 160 children has ASD worldwide, although prevalence in many low- and middle-income countries is unknown (Clouder et al., 2020). The amount of students with known health disorders continues to rise, with 15% of students in the UK disclosing their disabilities (HESA2023) (*in* Shaw, 2023). It is reported that more than half of university students are seriously affected by mental health problems (Asif et al., 2020). The pervasiveness of anxiety has been increasing progressively over the years, becoming one of the most critical concerns among students (Tan et al., 2023).

Moreover, the number of children with mental and behavioural disorders in all age groups is increasing every year. According to the Institute of Hygiene, in 2022, the number of children aged 0-17 in Lithuania with a first diagnosis of mental and behavioural disorders was 24 681, 2 199 more than in 2021. In 2022, the number of children first diagnosed with mental and behavioural disorders per 100,000 children was 4 915, respectively 376 more than in 2021 (<https://osp.stat.gov.lt>). Some of them are likely to enrol in higher education.

Entering higher education can be stressful for neurotypical people, but for neurodiverse ones, it can prove particularly challenging if there is inadequate or insufficient understanding of their needs. Neurodiverse students and those who face different learning difficulties are among those likely to withdraw from university and have lower degree outcomes (Langberg et al., 2014; Chevallier et al., 2019; Shaw, 2023; Hamilton and Petty, 2023). With implications extending towards poorer academic performance and overall student mental health, there is an urgent need to address this growing concern and to target the development of the support system (Tan et al., 2023; Johnson et al., 2018).

Students with learning difficulties are defined as those whose actual performance (measured by various achievement tests) falls short of their expected performance (measured by different mental capacity tests) in their academic endeavours due to various difficulties related to basic psychological processing functions (Mazurek and Kanne, 2010; Kenworthy et al., 2013; Korhonen, 2016). Podsiadlik (2024) notes that learning difficulties encompass writing, reading, time management and organisational skills.

Learning disabilities (LDs) refer to conditions where individuals struggle with acquiring and applying academic skills, performing below expected levels in reading, writing, and/or mathematics for their age. While LDs encompass various specific deficits, there are commonalities such as challenges with learning self-regulation and metacognition (Cerezo et al., 2020).

Students with specific learning difficulties may experience pressure in various learning environments (both at university and at home), especially during times of increased stress. Therefore, the difficulties they experience can become more noticeable when time is pressed (for example, during tests, exams), when the memory is overloaded due to the large amount of information received, it is difficult to absorb, process and select what is most needed in the study process.

Learning difficulties can be managed with the help of intensive educational intervention (Keyes and Brandon, 2011; Thomas and Whitten, 2012) (in AL-Qadri, et al., 2021). The key to eliminating learning difficulties is to identify the underlying causes. Once identified, a program can be designed to correct the inefficiencies and eliminate symptoms. Learning difficulties encompass various conditions that can hinder the acquisition, organisation, retention, comprehension, or application of verbal and/or nonverbal information. A crucial aspect of understanding learning

difficulties involves recognizing what they are not. In other words, individuals with learning difficulties typically have average or above-average intelligence but struggle with specific learning challenges (Dominguez and Carugno, 2024).

HEIs have to prioritise improved outcomes for neurodivergent students (Hamilton and Petty, 2023). The authorities of HEIs should create conditions to make higher education a more favourable context for neurodiversity, inclusive educational practices are required (Duncan & Bishop, 2020).

The complication is that neurodiversity and learning difficulties are not always outright noticeable, resulting in delayed support, assistance, and intervention (Deb et al., 2001; Emerson, 2003; Krumm et al., 2008) (in AL-Qadri, et al., 2021). Robust data on outcomes for neurodivergent students in higher education are not currently available (Hamilton and Petty, 2023). Many neurodivergent students do not disclose their diagnosis, and others may not have a formal diagnosis when they commence their studies (McLeod et al., 2019; Clouder et al., 2020) (Hamilton, Petty, 2023). Moreover, to conceal or dis-close their disability is a dilemma disabled students face, largely because 'labels' are useful in gaining the required accommodations but can create stigmatisation (Demetriou, 2022). For students with 'invisible' or 'hidden' disabilities, disclosure is an option (Evans, 2019; Moriña, 2022) (in Shaw, 2023).

Higher education can offer a context in which neurodiversity can be noticed and accepted (Hamilton and Petty, 2023). Evidence to date, which often relates specifically to autism, dyslexia and/or ADHD, suggests that academic attainment can be good, if students are well supported to complete their studies (Richardson, 2009; Fabri and Andrews, 2016; Richardson, 2017) (Hamilton and Petty, 2023). Moreover, success of studies represents 'degree' of social inclusion (Veidemane, Kaiser and Craciun, 2021).

Despite the positive developments at the macro level, it is still relevant to identify, analyse and understand the micro-level challenges of teaching and learning in a context of neurodiversity. Identifying the challenges and support needed to overcome them in the learning and other studying processes is a prerequisite for successful studies. However, there are no studies in Lithuania that would allow to disclose the link between neurodiversity and students' learning difficulties and reveal specific recommendations for their support and study process facilitation. Thus, the research question is how does neurodiversity of the students relate to their learning difficulties while studying at the institution of higher education?

## **METHODS**

### **Study design and participants**

A quantitative research approach was used. Students' learning difficulties were assessed on 40 attributes. A 5-point Likert scale was used, with 5 being the highest level of agreement and 1 the lowest.

Four developmental and mental health disorders were presented to show the expression of neurodiversity: attention deficit hyperactivity disorder (ADHD), autism spectrum disorders (ASD), depression and anxiety. Students had the possibility to decide on one of the following options: a) none; b) self-identified; c) professionally approved. Learning achievements were assessed by asking for the average of the last semester.

The survey was conducted among students of Kauno kolegija Higher Education Institution (further on referred to as Kauno kolegija HEI), one of the largest Lithuanian higher education institutions, studying at the faculties of medicine, arts and education, business and technology. In total, 4449 students were studying at Kauno kolegija HEI during the study period. It was planned to survey at least 384 students (sample size was determined according to the Paniotto sampling formula with a statistical error of 5%). 485 students of Kauno kolegija HEI participated in the study.

The students in this survey represent all four faculties of Kauno kolegija HEI: Faculty of Medicine 41.2% (n=200), Faculty of Arts and Education 30.5% (n=148), Faculty of Business 18.1% (n=88), Faculty of Technology 10.1% (n=49). As the duration of all study programmes is 3 years, 38.8% students (n=188) were in the first year, the second year 30.3% (n=147), the third year 25.2% (n=122). Nursing and midwifery studies take 3.5 years, so only 5.8% (n=28) of students in the fourth year participated at the lowest rate. The gender distribution of the students participating in the survey was as follows: 84,1 % female (n=408), 12.6% male (n=61) and 3.3% (n=16) did not want to disclose.

### **Data collection**

An online link to fill in the questionnaire was sent to all Kauno kolegija HEI students. The introductory part of the questionnaire provided information about the survey, invited students to participate in the survey (to fill in the questionnaire), explaining that they belong to the target group of the survey and /that each of their opinions is important for the purpose of the survey. The questionnaire was placed on the Kauno kolegija HEI online system "Limesurvey" <http://apklausos.kaunokolegija.lt/index.php/113639?token=pazurpcIAr826Ge&lang=lt>. The survey was carried out on 1-29 February 2024.

### **Data analysis**

Statistical analysis of the data was performed using SPSS 21 (Statistical Package for the Social Sciences) and Windows Microsoft office software. A factor analysis method was used to reduce the

variables into factors reflecting common characteristics: the Kaiser-Meyer-Olkin (KMO) was 0.881, approx. Chi-Square 8491.065, df 780, sig. 0.000.

Factor analysis (based on VARIMAX rotation of the principal components) was used to identify areas of learning difficulties of Kauno kolegija HEI students. A total of five factors were identified, most of which fulfilled the condition  $L \geq 0.6$ .

Cronbach's alpha was used to validate the reliability of the questionnaire on learning difficulties. The 5 scales, which consisted of 40 items, had a high internal consistency. A high Cronbach's alpha coefficient of 0.948 was found. All 5 scales had internal consistency coefficients above 0.9.

A normal (Gaussian) distribution was used to assess and select the appropriate statistical analysis of the data using Skewness and Kurtosis. Skewness is a measure of symmetry and Kurtosis is a measure of whether the data are heavy-tailed or light-tailed compared to a normal distribution. Kurtosis. Skewness ranges from (-)1 to (+)1. It can therefore be said that the distribution is normal.

For the correlation analysis, the Spearman's correlation coefficient (R<sub>2</sub>), a statistical measure of the strength and nature of the relationship, was used, which is a rank correlation coefficient that assesses the direct (positive) or indirect (negative) relationship between variables. The closer the value of the Spearman correlation coefficient to -1 or 1, the stronger the relationship between the variables.

ANOVA test was used to assess statistically significant differences between means of quantitative parameters of independent groups. A statistically reliable relationship is considered when the p-value is  $\leq 0.05$

### **Ethical aspects**

The approval of the Kauno kolegija HEI Applied Research Ethics Compliance Review Committee was obtained for the study (Protocol No. 13-14 of 29 January 2024). It was stated that the survey is anonymous and participation is voluntary. The introductory part of the questionnaire provided the survey participant with the name and email address of the study leader, who could be contacted in case of any questions, as well as the e-mail address of the Applied Research Ethics Review Committee. The individual's consent to participate in the study was integrated into a questionnaire distributed online.

### **RESULTS**

This part presents the results of the study representing Kauno kolegija HEI students' distribution by neurodiversity (Table 1), link of students' learning difficulties with ADHD (Table 2), link of students' learning difficulties with ASD (Table 3), link of students' learning difficulties with

anxiety (Table 4), link of students' learning difficulties with depression (Table 5), correlation of learning difficulties with the GPA for the last semester (Table 6).

**Table 1. Distribution of students by neurodiversity (N=485)**

Disorders	Don't have		I suspect myself		Identified and approved	
	n	%	n	%	n	%
<b>Attention Deficit Hyperactivity Disorder (ADHD)</b>	368	75,9	107	22,1	10	2,1
<b>Autism spectrum disorders (ASD)</b>	460	94,8	22	4,5	3	0,6
<b>Depression</b>	381	78,6	86	17,7	18	3,7
<b>Anxiety</b>	230	47,4	213	43,9	42	8,7

In terms of neurodiversity, anxiety is found to be the most prevalent among the students of Kauno kolegija HEI (Table 1). Almost one in two students associate their mental health with this syndrome. A more detailed analysis shows that 43.9% suspect themselves of having anxiety and 8.7% have already been diagnosed with this disorder. Depression is suspected by 17.7% of students and 3.7% have already been diagnosed with this disorder. 4.5% of students consider themselves to have an autism spectrum disorders, while 0.6% indicate that this disorder is confirmed. 22.1% of the students suspect themselves of having ADHD, while 2.1% indicate that this disorder has already been confirmed for them.

The first factor "Attentional difficulties in learning activities" consists of 9 variables, 3 of which meet the condition  $L \geq 0.6$ . The variables in this scale reflect attributes such as lack of attention during lectures, listening to lecturers, watching videos, using virtual study environments, and being quickly distracted by any stimulus. This scale also includes the variable assessing the use of mobile phones by students, which is not related to the learning process but simply to focusing on the phone.

The second factor "Difficulties in group work and sensory sensitivity in learning activities" consists of 8 variables, 4 of which meet the condition  $L \geq 0.6$ . The variables reflecting the negative psychosocial sphere are related to group work problems, when students find it difficult to work in groups, when they are annoyed by other students and by extraneous stimuli such as light and sound. This scale includes a statement related to difficulties in maintaining attention during practical work. Unlike lecturing or independent learning, practical work focuses on the development of practical skills in socially realistic and simulated professional situations, which are solved in interaction with other students. This is very closely linked to the challenges of communication in group work.



The third factor, “Impulsiveness and involvement in extraneous work during learning activities”, consists of 6 variables, of which 5 have a high factorial weight and the condition  $L \geq 0.6$  is met. Interfering in and interrupting lecturers’ and students’ conversations, engaging in extraneous activities such as listening to music, snacking during lectures, and being late for lectures due to extraneous activities are the statements that represent this scale.

The fourth factor, “Difficulty in completing tasks on time”, consists of 7 factors, of which 4 have a high factorial weight ( $L \geq 0.6$ ). This scale indicates the possible difficulties students may have in managing their time when starting tasks on time, managing their time when completing both independent work and other tasks, and finishing them on time. This scale is also biased by the variable indicating that students are likely to make errors of inattention due to rushing, which implies a possible lack of time management skills.

The fifth factor, "Specific learning difficulties", is one of the largest, consisting of 10 variables, of which as many as half have a high factor weight ( $L \geq 0.6$ ). Students’ specific learning difficulties include a lack of verbal and public speaking skills, difficulties in comprehending and interpreting text, problems with writing and numeracy. For more detailed information see Annex 1.

Two outliers were found when checking the normality of the resulting subscale distributions, and were therefore removed from the data in order to bring the scale distributions closer to a normal distribution. Therefore, groups mean differences and correlational analyses are presented using responses from 483 students.

**Table 2. Link between students' learning difficulties and ADHD (N=483)**

Scales	ADHD	n	Mean	Std. Deviation	Sig.
<b>Lack of focus in learning activities</b>	I don't have	367	-0,09	1,00	<b>0,001</b>
	I suspect myself	106	0,32	0,94	
	Yes, this is confirmed	10	0,08	1,04	
Group work difficulties and sensory sensitivity in learning activities	I don't have	367	-0,06	0,95	0,27
	I suspect myself	106	0,08	0,98	
	Yes, this is confirmed	10	0,28	1,03	
<b>Interference and extraneous works</b>	I don't have	367	-0,04	0,99	<b>0,032</b>
	I suspect myself	106	0,08	0,96	
	Yes, this is confirmed	10	0,75	1,51	
<b>Lack of time and distraction</b>	I don't have	367	-0,06	0,98	<b>0,032</b>
	I suspect myself	106	0,20	1,06	
	Yes, this is confirmed	10	0,37	0,71	
	I don't have	367	-0,07	0,99	

<b>Specific learning difficulties</b>	I suspect myself	106	0,25	1,05	<b>0,016</b>
	Yes, this is confirmed	10	-0,06	0,71	

Statistically significant differences were found in how neurodiversity related to students' learning difficulties (Table 2). Students who self-suspect or already have ADHD are more likely to experience attention deficits in learning activities than those who do not ( $F=7.214$ ;  $p=0.001$ ). Students in this group are also more likely to interfere in other people's conversations and to engage in extraneous work ( $F=3.459$ ;  $p=0.032$ ). Students who self-identify as ADHD or are diagnosed with ADHD are also more likely to experience time management problems in learning activities and to be distracted than those who do not have the syndrome ( $F=3.480$ ;  $p=0.032$ ). Specific learning difficulties are also more common among students with ADHD ( $F=4.191$ ;  $p=0.016$ ).

**Table 3. Link between students' learning difficulties with ASD (N=483)**

Scales	ASD	n	Mean	Std. Deviation	Sig,
Lack of focus in learning activities	I don't have	458	0,00	1,00	0,909
	I suspect myself	22	-0,02	1,02	
	Yes, this is confirmed	3	-0,24	1,12	
<b>Group work difficulties and sensory sensitivity in learning activities</b>	I don't have	458	-0,06	0,94	<b>0,000</b>
	I suspect myself	22	0,69	1,11	
	Yes, this is confirmed	3	0,88	0,69	
Interference and extraneous works	I don't have	458	-0,01	0,98	0,424
	I suspect myself	22	0,26	1,29	
	Yes, this is confirmed	3	0,27	1,22	
Lack of time and distraction	I don't have	458	-0,01	1,01	0,436
	I suspect myself	22	0,27	0,91	
	Yes, this is confirmed	3	0,04	0,58	
<b>Specific learning difficulties</b>	I don't have	458	-0,04	0,99	<b>0,001</b>
	I suspect myself	22	0,78	0,88	
	Yes, this is confirmed	3	0,43	0,87	

The study showed that ASD is associated with learning difficulties (Table 3). The statistically significant differences obtained suggest that students who self-report or are diagnosed with ASD are more likely to report being disturbed by group work ( $F=7.934$ ;  $p=0.000$ ). Students who self-report ASD are also more likely to experience specific learning difficulties ( $F=7.566$ ;  $p=0.001$ ).

**Table 4. Link between students' learning difficulties and anxiety (N =483)**

Scales	Anxiety	n	Mean	Std. Deviation	Sig,
<b>Lack of focus in learning activities</b>	I don't have	230	-0,23	1,01	<b>0,000</b>
	I suspect myself	212	0,19	0,92	
	Yes, this is confirmed	41	0,30	1,05	
<b>Group work difficulties and sensory sensitivity in learning activities</b>	I don't have	230	-0,13	0,89	<b>0,035</b>
	I suspect myself	212	0,06	1,02	
	Yes, this is confirmed	41	0,21	0,92	
Interference and extraneous works	I don't have	230	0,07	1,05	0,405
	I suspect myself	212	-0,06	0,94	
	Yes, this is confirmed	41	-0,04	1,03	
Lack of time and distraction	I don't have	230	-0,10	0,97	0,087
	I suspect myself	212	0,09	1,03	
	Yes, this is confirmed	41	0,16	0,94	
<b>Specific learning difficulties</b>	I don't have	230	-0,19	0,93	<b>0,000</b>
	I suspect myself	212	0,15	1,04	
	Yes, this is confirmed	41	0,27	1,01	

The data in Table 4 show that anxiety is related to difficulties in learning and cooperating in a group, lack of time, distraction and specific learning difficulties ( $p \leq 0.05$ ). Students who suspect or have a history of anxiety syndrome are more likely to experience a lack of attention in learning activities ( $F=12.487$ ;  $p=0.000$ ), as well as reluctance to work in social groups ( $F=3.385$ ;  $p=0.035$ ). Also, students who suspect or are diagnosed with anxiety syndrome are more likely to experience specific learning difficulties ( $F=8,273$ ;  $p=0,000$ ).

**Table 5. Link between students' learning difficulties and depression (N =483)**

Scales	Depression	n	Mean	Std. Deviation	Sig.
Lack of focus in learning activities	I don't have	380	-0,01	1,02	0,060
	I suspect myself	85	-0,05	0,88	
	Yes, this is confirmed	18	0,54	0,97	
<b>Group work difficulties and sensory sensitivity in learning activities</b>	I don't have	380	-0,10	0,88	<b>0,001</b>
	I suspect myself	85	0,25	1,17	
	Yes, this is confirmed	18	0,45	1,08	
Interference and extraneous works	I don't have	380	0,00	1,01	0,549
	I suspect myself	85	0,07	1,00	
	Yes, this is confirmed	18	-0,21	0,79	

<b>Lack of time and distraction</b>	I don't have	380	-0,07	0,97	<b>0,002</b>
	I suspect myself	85	0,24	1,10	
	Yes, this is confirmed	18	0,52	0,94	
<b>Specific learning difficulties</b>	I don't have	380	-0,10	0,97	<b>0,000</b>
	I suspect myself	85	0,40	1,04	
	Yes, this is confirmed	18	0,24	1,03	

Students who self-report as depressed or who are diagnosed with depression have more social, time management and distraction challenges, and have more specific learning difficulties than those who are not depressed (Table 5). Reluctance to work in a group ( $F=7.108$ ;  $p=0.001$ ), lack of time and distraction ( $F=6.089$ ;  $p=0.002$ ) are associated with depression. Students with or suspected of having depression are also more likely to experience learning difficulties than those without depression ( $F=9.667$ ;  $p=0.000$ ).

**Table 6. Correlation of learning difficulties with grade point average (GPA) for the last semester (N =483)**

GPA for the last semester	Correlation	Lack of focus in learning activities	Group work difficulties and sensory sensitivity in learning activities	Interference and extraneous works	Lack of time and distraction	Specific learning difficulties	ADHD	ASD	Anxiety	Depression
	Coefficient (R)		<b>-0,111*</b>	,040	<b>-0,126**</b>	<b>-0,179**</b>	<b>-0,161**</b>	<b>-,0130**</b>	-0,071	<b>-,0138**</b>
Sig. (2-tailed)		<b>0,015</b>	0,381	<b>0,006</b>	<b>0,000</b>	<b>0,000</b>	<b>0,004</b>	0,117	<b>0,002</b>	<b>0,015</b>

Spearman correlation shows a statistically significant weak and moderate negative correlation between the GPA for the last semester and the following scales: “Lack of attention in learning activities”, “Interference and extraneous work”, “Lack of time and distraction”, and “Specific learning difficulties”. In all cases, the level of statistical significance is  $p<0.05$ . These statistically significant differences suggest that students, who experience more difficulties in maintaining attention and working in groups, tend to interfere in other people’s conversations and engage in extraneous activities, have difficulties in planning their own learning activities and completing assignments, and have specific learning difficulties, gain lower learning achievement and report a lower GPA for the last semester than students who do not identify these difficulties (Table 6).

There is also a moderate to weak negative correlation between activity and attention deficit disorder, anxiety and students' final semester performance. Students with ADHD, anxiety, and

depression reported lower average final semester scores than students without these disorders. The level of statistical significance is  $p < 0.05$  (Table 7).

Spearman correlation showed that the expression of neurodiversity does not depend on the faculty students are studying at ( $p \geq 0.05$ ). According to the results of this study, it can be stated that students with ADHD, ASD, anxiety, and depression can study at the faculties of medicine, technology, arts, education and business.

## **DISCUSSIONS**

The findings presented in this study shed light on the prevalence of various neurodiverse conditions among students at Kauno kolegija HEI, offering valuable insights into their impact on learning experiences and academic performance. Among the neurodiverse conditions assessed, anxiety emerges as the most prevalent, with a significant portion of students either suspecting themselves of having anxiety or already diagnosed with the disorder. This aligns with broader trends in neurodiversity research, where anxiety disorders are frequently reported among student populations worldwide.

Comparing these results with existing literature, several parallels can be drawn. Numerous studies conducted in diverse educational settings have highlighted the high prevalence of anxiety disorders among students, often attributing it to academic pressures, social stressors, and personal challenges. For instance, research by Johnson et al. (2018) found similar rates of self-reported anxiety among college students, emphasising the need for targeted interventions to support mental health on campuses.

Furthermore, the study's identification of specific factors contributing to learning difficulties and group cooperation provides nuanced insights into the complex interplay between neurodiversity and academic functioning. Factors such as attentional difficulties, sensory sensitivities, impulsiveness, and time management challenges underscore the multifaceted nature of neurodiverse experiences in educational contexts. Similar dimensions have been explored in prior research, with studies highlighting the impact of executive functioning deficits, sensory processing differences, and social communication difficulties on academic performance and social interaction among neurodiverse persons (Mazurek & Kanne, 2010; Kenworthy et al., 2013).

The association between neurodiverse conditions and academic outcomes, as evidenced by lower final semester scores among students with ADHD, anxiety, and depression, resonates with findings from longitudinal studies examining the long-term educational trajectories of individuals with neurodevelopmental disorders (Langberg et al., 2014; Chevallier et al., 2019). These studies underscore the importance of early identification and intervention to mitigate academic challenges and promote academic success among neurodiverse students.

Moreover, the survey explores faculty-independent expression of neurodiversity challenges prevailing assumptions about the distribution of neurodiverse conditions across academic disciplines. While certain fields may be perceived as more accommodating or challenging for neurodiverse students, the findings suggest that neurodiversity is not confined to specific faculties but rather cuts across disciplinary boundaries. This nuanced understanding aligns with recent calls for inclusive educational practices that recognize and accommodate the diverse needs of all students, regardless of their field of study (Duncan & Bishop, 2020).

In conclusion, the present survey contributes valuable insights into the prevalence, correlates, and academic implications of neurodiversity among students at Kauno kolegija HEI. By contextualising these findings within the broader landscape of neurodiversity research, it underscores the importance of adopting a holistic approach to support the diverse needs of students in higher education settings. Future research endeavours should further explore the efficacy of targeted interventions and inclusive practices aimed at fostering academic success and well-being among neurodiverse students across diverse educational contexts.

## **CONCLUSIONS**

1. Neurodiversity is a common phenomenon among the students who participated in the survey, with anxiety and depression being the most prevalent conditions. Attention deficit hyperactivity disorder and autism spectrum disorders were less frequently reported. The prevalence of neurodiversity among students is found to be consistent across different study fields.

2. Students with or suspected of having attention deficit hyperactivity disorder are more likely to report a lack of attention in learning activities, engaging in conversation and extraneous work, lack of time and distractibility, as well as specific learning disabilities.

3. Students with or suspected of having autism spectrum disorders are characterised by difficulties in group work and sensory sensitivity in learning activities, as well as specific learning disabilities.

4. Students with anxiety disorders or self-reported anxiety disorders have attention deficits in learning activities, difficulties in group work and sensory sensitivity in learning activities and specific learning difficulties. On the other hand, students with or suspecting depression also show reluctance to work in groups, specific learning difficulties, lack of time and distractibility.

5. Students with ADHD, anxiety, and depression reported a lower Grade point average (GPA) for the last semester.

## **CONTRIBUTORS**

All the authors conceptualised and wrote the first draft of the manuscript, contributed to manuscript revision, read, and approved the submitted version.

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## **COMPETING INTERESTS**

The authors declare that the survey was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

## **AVAILABILITY OF DATA**

Data are available upon reasonable request to the corresponding author.

## **DISCLAIMER**

The authors alone are responsible for the views expressed in this article and they do not necessarily represent the views, decisions, or policies of the institutions with which they are affiliated.

## **LIMITATIONS**

While interpreting the survey results, certain limitations have to be kept in mind for consideration. Firstly, the students' neurodiversity was focused on ADHD, ASD, depression and anxiety. The rest of the prevalent mental health problems were not examined in the current student population. Secondly, students' neurodiversity was identified by students' own opinions. Survey participants may have provided inaccurate or biased information about their neurodiversity and learning difficulties due to social desirability bias or lack of self-awareness. Thirdly, the survey covered only one Lithuanian higher education institution, therefore the results can not be applied to the population of students in Lithuania in whole.

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Annex 1. Factor analysis of students' learning difficulties

Statements	Factor I Attentional difficulties in learning activities	Factor II Group work difficulties and sensory sensitivity in learning activities	Factor III Impulsiveness and involvement in extraneous work during learning activities	Factor IV Difficulties in completing tasks on time	Factor V Specific learning difficulties
I find it difficult to maintain attention while listening to lectures (without slides or other visual material)	0,626	0,075	0,002	0,204	0,167
I am quickly distracted by any extraneous stimuli when doing study tasks at home	0,610	0,174	-0,098	0,182	0,086
I find it difficult to keep attention on slides with lots of information (diagrams, text)	0,605	0,151	-0,081	0,185	0,160
I browse on my phone during class	0,585	-0,072	0,454	0,004	0,036
I find it difficult to sit still for long periods of time during class	0,567	0,032	0,299	0,109	0,217
I am quickly distracted by any extraneous sound or sight during class	0,517	0,371	-0,144	0,242	0,189
I find it difficult to concentrate and start study tasks at home	0,517	-0,019	0,131	0,324	0,120
I find it difficult to keep my attention while watching videos during class	0,381	0,304	0,243	0,156	0,183
I find it difficult to maintain attention when searching for learning material in Moodle	0,355	0,319	0,175	0,324	0,093
I don't like and find it annoying to work in a group with other group members	0,033	0,718	0,089	-0,067	0,150
I find it difficult to stay focused when working in a group	0,153	0,682	0,156	0,216	0,108

I don't like sharing learning materials with other students	-0,031	<b>0,637</b>	0,307	-0,021	0,103,
I find it annoying to sit or stand next to another student	0,019	<b>0,606</b>	0,306	0,023	0,214
I find it difficult to maintain attention in practical/laboratory work		<b>0,596</b>			
Extraneous noises make me feel stressed during the lecture	0,344	<b>0,537</b>	-0,191	0,102	0,071
I find it difficult to follow instructions in practical tasks	0,122	<b>0,521</b>	0,289	0,326	0,218
The extremely bright light annoys me and makes it difficult to concentrate	0,409	<b>0,435</b>	-0,044	0,092	0,204
I tend to interfere and interrupt the lecturer when he/she is speaking	-0,182	0,272	<b>0,719</b>	0,131	-0,039
I tend to intervene and interrupt other students when they are talking	-0,208	0,170	<b>0,695</b>	0,151	0,005
I listen to music with headphones during class	0,065	0,169	<b>0,691</b>	-0,008	0,114
I like to snack and chew gum during class	0,153	0,057	<b>0,644</b>	0,048	0,120
I talk to my classmates during class, interfering with their listening	0,373	-0,101	<b>0,632</b>	0,098	-0,040
It is difficult to be punctual and to arrive on time for classes	0,135	0,248	<b>0,570</b>	0,105	0,025
I don't have enough time to complete my independent work tasks	0,219	-0,033	0,020	<b>0,800</b>	0,095
I don't manage to complete all the tasks during the sessions	0,040	0,087	0,049	<b>0,729</b>	0,203
I don't have enough time to prepare for exams	0,166	0,079	0,066	<b>0,722</b>	0,125
I find it difficult to start and finish my independent work assignments on time	0,390	0,124	0,154	<b>0,606</b>	0,164

<b>I find it difficult to finish a task I have started</b>	0,347	0,234	0,195	<b>0,502</b>	0,173
<b>I make a lot of careless mistakes in my homework tasks</b>	0,205	0,131	0,162	<b>0,483</b>	0,273
<b>I find it difficult to concentrate and start my study tasks during my classes</b>	0,217	0,354	-0,009	<b>0,459</b>	0,157
<b>I find it difficult to formulate an idea and express it verbally</b>	0,240	0,189	0,025	0,196	<b>0,671</b>
<b>I'm feeling shy about speaking in public</b>	0,049	0,081	-0,211	0,195	<b>0,665</b>
<b>I find it difficult to understand the main idea of a text when reading it</b>	0,266	0,132	0,195	0,136	<b>0,628</b>
<b>I don't like public speaking in front of an audience</b>	0,067	0,074	-0,235	0,148	<b>0,623</b>
<b>I find it difficult to describe the visual material in words</b>	0,276	0,160	0,087	0,064	<b>0,614</b>
<b>I find it difficult to read small text or sophisticated writing</b>	0,145	0,141	0,026	0,078	<b>0,541</b>
<b>I don't like to use dictionaries, reference books, text markers</b>	0,261	0,077	0,173	-0,057	<b>0,499</b>
<b>Many people think my writing is messy, unreadable</b>	-0,094	0,079	0,230	0,098	<b>0,459</b>
<b>I make grammatical mistakes in my writing</b>	-0,084	0,033	0,243	0,246	<b>0,452</b>
<b>I have difficulties with calculation tasks</b>	0,142	0,223	-0,017	0,168	<b>0,317</b>

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization. a. Rotation converged in 11 iterations.