Effect of Online Learning on Mental Health and Academic Outcomes of Students with Intellectual Disabilities in Higher Education

M.K. Shreeharsha, P. Nagesh* and Sridevi kulenur

JSS Science and Technology University, Mysuru, Karnataka, India

Abstract: The COVID-19 pandemic shift to online learning has raised concerns regarding students' mental health and academic performance, particularly for students with intellectual disabilities.

Objective: This paper examines the effects of online learning on stress, anxiety, and social isolation and those factors on academic performance, Grade Point Average (GPA), and participation in online learning and engagement, particularly for students with intellectual disabilities (IDs).

Methods: The current study employed a quasi-experimental research design and targeted 500 participants, comprising both undergraduate and postgraduate students. Of these, 50 participants were identified as having intellectual disabilities (IDs) through self-reporting and institutional records. The remaining 450 participants were typically developing students selected through stratified random sampling to ensure proportional representation across academic levels and disciplines. The Perceived Stress Scale (PSS), Generalized Anxiety Disorder-7 (GAD-7), and UCLA Loneliness Scale were adopted from validated and widely used psychometric tools in mental health research. These instruments have been previously validated for reliability and applicability across diverse populations. Multiple linear regression and Pearson correlation coefficients (PPMC), which help identify associations and control for confounding factors, were used to examine the relationships and potential predictive effects between mental health variables and learning outcomes.

Pearson correlation coefficients were utilized to analyze the linear relationships between mental health variables (stress, anxiety, and social isolation) and academic performance (GPA). Additionally, multiple linear regression analysis was conducted to predict the impact of these mental health variables on academic performance while controlling for confounding factors such as age, gender, and degree level.

Results: Participants with IDs reported significantly higher levels of stress (PSS, M = 25.8), anxiety (GAD-7, M = 12.5), and social isolation (UCLA, M = 48.6) compared to the control group. Mental health variables had a significant negative relationship with GPA, with stress having a correlation coefficient of -0.51 and anxiety having a correlation coefficient of -0.48. In regression analysis, stress was found to have the largest effect on the outcome of GPA, seconded by anxiety and then social isolation.

Conclusion: A direct impact of mental health on learning is observed, particularly for students with IDs, implying the necessity of developing an individual mental health promotion program and ways of creating more effective online learning for students with IDs that help alleviate stress, anxiety, and isolation.

Keywords: Online learning, mental health, stress, anxiety, social isolation, academic performance.

INTRODUCTION

The COVID-19 epidemic drastically changed the higher education environment by accelerating the transition to online learning. Online education enables flexibility, but it also presents severe issues, especially for students' mental health. Increased stress, anxiety, and social isolation are common among students, and they have a detrimental effect on their academic performance. These problems persist in being insufficiently understood and need more research to completely understand their impacts and provide solutions, particularly for children with intellectual disabilities.

Online education is convenient, accessible, and affordable but has drawbacks. One of the most significant concerns is the impact of online learning on students' mental health [1]. Unlike traditional in-person learning, online students are often isolated, stressed, and anxious because of the lack of face-to-face interaction, unfamiliarity with digital learning tools, and the demands of self-regulated learning. Studies have suggested that the mental health of students has worsened due to the shift to online education with the rise of stress, anxiety, and loneliness [2,3]. Poor means of social support, which are often easy to come by in traditional learning environments, are exacerbated by the isolation that often accompanies online learning [4].

There is a long-established link between mental health and academic performance. Studies have shown that poor mental health negatively affects someone's cognitive function, motivation, and ability to concentrate—all factors necessary for academic success [1]. Stress and anxiety have a more clearly negative impact on the students in online learning as

*Address correspondence to this author at the JSS Science and Technology University, Mysuru, Karnataka, India; E-mail: pnagesh1973@jssstuniv.in

the feeling of belongingness and community for them is less significant [5]. To explore how mental health issues in online education affect the student's well-being and academic performance.

Academic performance is a key indicator of learning outcomes and is closely connected with students' mental health. Stress, anxiety, and social isolation, which are often intensified in online learning environments, negatively impact students' ability to concentrate, retain information, and engage with their studies. This is especially significant for students with intellectual disabilities, who face additional barriers in adapting to online education. Understanding the relationship between mental health challenges and academic performance, including aspects like GPA, participation, and course engagement, is crucial for addressing the broader effects of online learning on student success.

Student mental health, which includes emotional, psychological, and social well-being, is crucial to academic success. Anxiety, stress, and depression, which are key aspects of mental health, can have serious negative effects on students' ability to concentrate, retain information, and actively participate in the learning process [6]. Excessive stress or anxiety experienced by students means that they tend to find it hard to process academic workloads, which may result in poor academic performance. Moreover, students' emotional well-being determines motivation, engagement, and how students interact with other students and their instructors. Social connection in a learning environment is a key determinant of academic success and mental health [7].

Mental health issues may be a bigger problem when studying online because students learn on their own and rarely interact socially. Without in-person contact with peers and instructors, students can feel disconnected and isolated, such that their mental health could suffer [3]. High stress, anxiety, and loneliness can also arise from not having immediate social support [4]. With the increasing number of online learners, it's important to know the link between mental health and academic outcomes in this modality of teaching and learning [8].

The difference between online learning environments and traditional face-to-face settings has been shown to have several implications for students' mental health. However, online courses tend to be less flexible and more isolating for students, who may feel lonely and disconnected [5]. Additionally, online students could face stressors that are different from in-person learners, such as individual scheduling responsibilities and learning on technology not known to them [2]. Since online education is on the rise, it is important to understand how online learning affects students' mental health and vice versa and how students' mental health meets academic performance [9].

Research Questions

In online learning environments, how do mental health factors like stress, anxiety, and social isolation affect the GPA of students with intellectual disabilities (IDs) in comparison to neurotypical (NT) students?

Are stress and anxiety stronger indicators of academic achievement among kids with IDs compared to their neurological disorders counterparts?

Hypotheses

Students with IDs are more affected than neurotypical students by the large negative correlation between mental health concerns (stress, anxiety, and social isolation) and GPA.

Especially for students with IDs, stress, and anxiety are stronger predictors of GPA than social isolation.

Objectives

1. This study examined the effect of online learning on students' stress, anxiety, and social isolation.

2. The study seeks to understand whether these mental health factors significantly influence students' academic performance, including their Grade Point Average (GPA) and participation in online activities.

MATERIALS AND METHODS

Study Design

This research employed a quasi-experimental design to evaluate the effects of online education on students' psychological and academic outcomes, with a particular focus on students with intellectual disabilities. Our research question was to seek out the way mental health problems such as stress, anxiety, and social isolation impact academic performance among neurotypical (NT) students with intellectual disabilities (IDs). Extra consideration was made to establish the

areas of difficulty that students with IDs experience while learning under the new education system, namely online classes. This research was about calculating correlations and identifying how specific mental health interventions could help prevent these difficulties for students with IDs.

Participants and Sampling

Respondents were undergraduate and postgraduate students in different universities who were taking online courses. A purposive sampling technique was used to specifically select students with intellectual disabilities (IDs) to ensure their adequate representation in the study. In parallel, stratified random sampling was employed to group participants based on age, gender, discipline of study, and level of education. This approach was designed to ensure that diverse subgroups were proportionally represented in the sample, enhancing the generalizability of the findings. The final sample consisted of 500 students, including 50 students with IDs, drawn from undergraduate and postgraduate programs. In order to ensure sufficient statistical power for analyzing the effects of mental health factors on learning outcomes across both neurotypical students and students with IDs, a power analysis was conducted to determine the appropriate sample size. The sample of the study, with the targeted sample of the 500 students (including 50 with intellectual disabilities), was carefully selected to ensure sufficient representation for analyzing the impact of mental health factors on learning outcomes in online education.

This subgroup was chosen to understand how mental health variables affected academic performance for students with learning disabilities, particularly in the context of online learning. A power analysis determined a sample size of 500 students, including 50 with intellectual disabilities, to ensure enough statistical power to assess the impact of mental health factors on learning outcomes for both neurotypical students and those with intellectual disabilities.

Population Inclusion and Exclusion Criteria

Selection criteria for this study included participants being 18 years of age and older (to ensure they met the legal and ethical requirements for providing informed consent without parental or guardian involvement), being enrolled in a fully or partially online course for at least one semester, and providing informed consent.

The participants with IDs were targeted to be selected to give the researcher a clear understanding of how mental health affects academic performance. Participants were excluded if they had other psychopathology apart from academic stress, such as PTSD, or if they had completed less than 80 percent of self-report measures. Through screening and data quality checks, participants with additional psychopathology (e.g., PTSD) or those who completed fewer than 80% of the self-report measures were found in order to test for exclusion criteria. Participants who did not satisfy the 80% completion criteria or who indicated other psychopathological problems were not included in the analysis of the self-report data.

Subsequent research will seek to enhance these conditions to assess the experiences of individuals with IDs within online learning environments.

Participants had to be 18 years of age or older, enrolled in a course that was entirely or partially online for at least one semester, and provide informed consent in order to be selected for this study. The purpose of selecting the participants with IDs was to give the researcher a good grasp of the relationship between academic success and mental health. Participants were eliminated if they fulfilled fewer than 80% of the self-report measures or if they had another disorder, such as PTSD, in addition to academic stress. Future studies will aim to improve these circumstances in order to better evaluate the experiences of people with IDs in online learning settings.

Data Collection Instruments

Mental Health Questionnaires: Mental health indices were assessed using standardized and validated psychometric tools. Stress was measured using the Perceived Stress Scale (PSS), anxiety was evaluated with the Generalized Anxiety Disorder Scale (GAD-7), and loneliness was assessed using the UCLA Loneliness Scale. These instruments have been widely validated for reliability and applicability across diverse populations, including students. While these tools were deemed suitable for the current study, subsequent research may explore adaptations or alternative versions specifically designed for students with intellectual disabilities (IDs) to enhance precision and inclusivity.

Academic Performance Metrics: Academic performance was evaluated using multiple indicators, including participants' Grade Point Average (GPA),

engagement in online class activities, assignment submission, and attendance records. These comprehensive metrics provided a robust framework for assessing the extent to which mental health variables, such as stress, anxiety, and loneliness, influenced academic outcomes.

Ethical Considerations

Ethical considerations were central to this study, particularly for participants with intellectual disabilities (IDs). Tools and measures were assessed for accessibility, and appropriate accommodations, such as simplified language and visual aids, were provided to ensure successful participation. Informed consent was obtained with tailored explanations of the study's goals, methods, and risks for participants requiring support; guardians or legal representatives were involved in the consent process to ensure voluntary and informed participation. The principle of volunteerism was emphasized, and participants were made aware that they could withdraw at any time without consequences. Efforts were made to provide a respectful and supportive environment, minimizing any risk of coercion or adverse effects.

Data Analysis Methods

Participants' demographic and mental health-related characteristics were compiled using descriptive statistics, which included metrics like means, standard deviations, and frequencies. Inferential statistics were used to investigate the connection between social isolation, stress, anxiety, and academic achievement. In particular, the link between the academic performance of students with intellectual disabilities (IDs) and neurotypical (NT) pupils was evaluated using Pearson correlation coefficients. An independent samples t-test was used to compare the mean GPA of stressed and non-stressed students to investigate stress's impact on GPA. Additionally, multiple linear regression analysis was used to examine the combined effects of stress, anxiety, and social isolation on GPA while adjusting for age, gender, and degree level.

Demographic and mental health-related variables were expressed by descriptive statistics. Since the research aimed at comparing the correlation between the academic performance of NT students and one of the students with IDs, the Pearson correlation coefficients were computed. Further, to compare the mean GPA of stressed students and non-stressed students, an independent samples t-test was conducted to determine the effect of stress, anxiety, and social isolation on GPA, controlling for gender, age, and degree level. Multiple linear regression analysis was used. This enabled us to estimate the differential effect of mental health on the academic performance of students with IDs and their peers without IDs. All statistical analyses were performed using the statistical package SPSS version 26.0, and the significance level was determined at $p < 0.05$.

RESULTS

Participant Demographics

The demographic characteristics of the participants are divided into two categories: the overall population of the study (N=500) and the sub-sample with IDs (N=50). Sex distribution was also in favor of males and females; a total of 45% of the participants were males, while 55% were females. Of the participants with IDs, 52% were male and 48% were female. By age, the largest group of participants was 18-22 years (42%), 39% were 23-27 years old, and the remaining 19% were 28 years or older. Of these, 44% were in the 18-22 years age group, 36% were in the 23-27 years group, and 20% were in the 28+ years age group. Concerning the degree level, 65% of the total sample consisted of undergraduates, while 35% had postgraduate level, as shown in Table **1**. Of the participants with IDs, 70% were undergraduates and 30% postgraduates. Of the participants, 24% were studying humanities, 30% were studying social science, 20% had engineering, and 26% were studying health sciences, and the same was found in the students with IDs.

Mental Health Findings

The mental health measures for neurotypical people and those with IDs. On the PSS, the neurotypical participants had a total mean of 21.5 (SD = 5.8), whereas the participants with IDs had a higher mean of 25.8 (SD = 6.2), recognizing that participants with IDs perceived high stress. The mean score of the Generalized Anxiety Disorder scale was higher among the participants with IDs compared to the neurotypical participants, 9.3 (SD = 4.2) and 12.5 (SD = 4.7), respectively, implying high levels of anxiety among participants with IDs. Regarding loneliness, the UCLA Loneliness Scale was 44.1 (SD = 10.3) for the neurotypical participants. In contrast, the ID participants had a higher mean score of 48.6 (SD = 10.8), implying that the ID participants had higher

Table 1: Participant Demographics

Characteristic	Total N (%)	Participants with IDs N (%)
Gender		
Male	225 (45%)	26 (52%)
Female	275 (55%)	24 (48%)
Age (years)		
18-22	210 (42%)	22 (44%)
23-27	195 (39%)	18 (36%)
28+	95 (19%)	10 (20%)
Degree Level		
Undergraduate	325 (65%)	35 (70%)
Postgraduate	175 (35%)	15 (30%)
Academic Discipline		
Humanities	120 (24%)	12 (24%)
Social Sciences	150 (30%)	15 (30%)
Engineering	100 (20%)	10 (20%)
Health Sciences	130 (26%)	13 (26%)

Table 2: Summary of Mental Health Measures

Mental Health Measure	Neurotypical Mean (SD)	IDs Mean (SD)
Perceived Stress Scale (PSS)	21.5 (5.8)	25.8 (6.2)
Generalized Anxiety Disorder	9.3 (4.2)	12.5 (4.7)
UCLA Loneliness Scale	44.1 (10.3)	48.6 (10.8)

levels of loneliness, as shown in Table **2**. These results identified significant disparities in mental health concerning the two groups.

Impact of Mental Health on Academic Outcomes

The study initially explored the relationships between mental health variables (MH) and GPA using Pearson correlation coefficients to understand the strength and direction of these associations. In neurotypical students, perceived stress measured by the PSS showed a moderate negative correlation with GPA (r = -0.42). Similarly, the GAD-7 scores revealed a negative and moderate relationship with GPA (r = -0.39), indicating that higher anxiety levels were associated with poorer academic performance. Social isolation exhibited a weaker negative correlation with GPA (r = -0.35), suggesting that greater feelings of isolation corresponded to slightly lower GPA scores.

In the group with intellectual disabilities (ID), the correlations were stronger. Perceived stress had a significant negative correlation with GPA (r = -0.51), followed by anxiety (r = -0.48) and social isolation (r = -

Table 3: Correlation between Mental Health Variables and GPA

Mental Health Variable	Neurotypical	IDs 're
Perceived Stress (PSS)	-0.42	-0.51
Anxiety (GAD-7)	-0.39	-0.48
Social Isolation	-0.35	-0.45

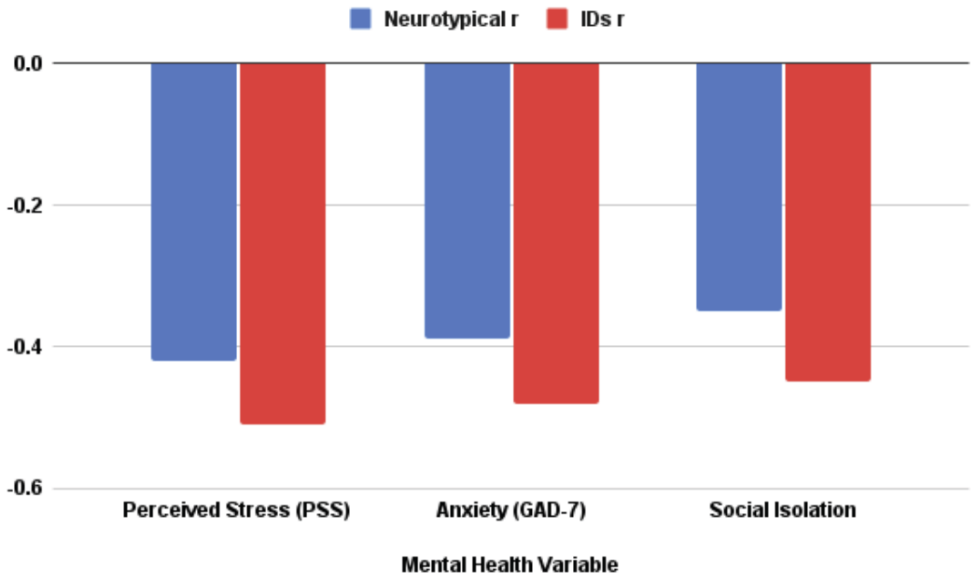

Figure 1: Correlation between mental health variables and GPA for neurotypical and individuals with Intellectual Disabilities (IDs).

0.45), as shown in Table **3**. While these correlations demonstrated the associations, the study employed multiple linear regression analysis to test further the predictive impact of these mental health variables on GPA, controlling for confounding factors such as age, gender, and degree level. These findings highlight that mental health variables were detrimental to GPA in both groups, with a greater impact observed among participants with IDs.

The results showed that there were overall negative and moderate to strong correlations between mental health variables and the GPA of both the neurotypical participants as well as the participants with IDs. Stress, anxiety, and social isolation demonstrated a significantly higher negative correlation with GPA in the ID group, with coefficients of -0.51, -0.48, and -0.45, respectively. In neurotypical participants, these correlations were also negative but less strong, with coefficients of -0.42 for stress, -0.39 for anxiety, and -0.35 for social isolation, as shown in Figure **1**. These results suggested that mental health had a greater influence on academic achievement for students with IDs than for students without IDs.

Multiple Regression Analysis

Multiple regression analysis outcomes to predict GPA for NT and IDs. In the neurotypical group, perceived stress was negatively correlated with GPA, as determined by the regression coefficient (-0.25). Anxiety (GAD-7) was also negative, with an estimate of -0.20, implying that an increase in anxiety impaired GPA. Similar to the previous hypothesis, social isolation had a negative coefficient of -0.15, suggesting that feelings of loneliness were not very strong determinative of GPA. The regression coefficient for perceived stress was significantly negative (-0.08) and more negative in the ID group (-0.31). Anxiety (GAD-7) had a coefficient of -0.28, and social isolation had a coefficient of -0.25, both pointing to a moderate negative correlation with GPA, as shown in Table **4**. These results underlined that stress and anxiety explained the academic outcomes, with the overall decline in academic performance in both groups being stronger in participants with ID.

An analysis of the regression results revealed that stress, anxiety, and social isolation were significant predictors of GPA for the NT participants and

Table 4: Multiple Regression Predicting GPA

Variable	Neurotypical BBB	IDs BBB
Perceived Stress	-0.25	-0.31
Anxiety (GAD-7)	-0.20	-0.28
Social Isolation	-0.15	-0.25

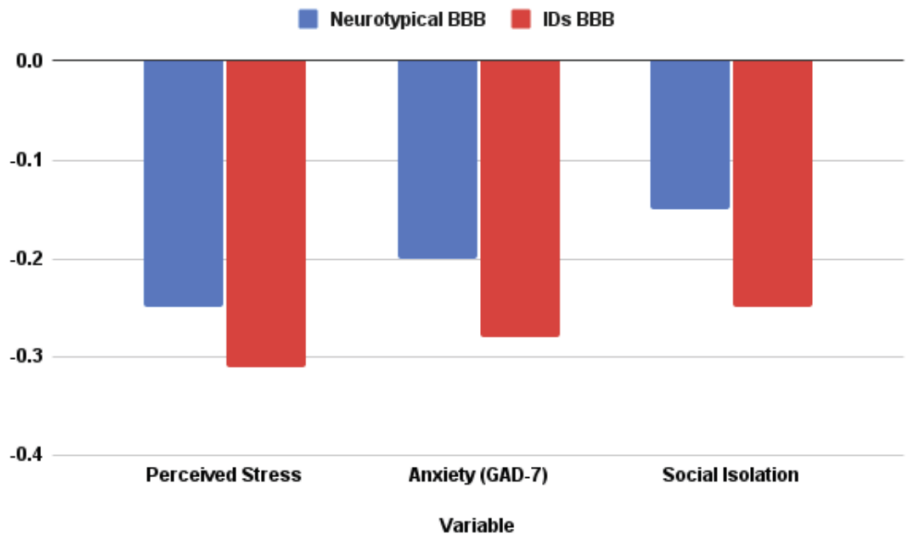

Figure 2: Multiple regression coefficients predicting GPA for neurotypical and individuals with Intellectual Disabilities (IDs).

participants with IDs. Lower stress (B = -0.31), anxiety (B = -0.28), and social isolation (B = -0.25) were associated with GPA than the neurotypical group, though the coefficients were -0.25, -0.20, and -0.15, respectively, as shown in Figure **2**. These results pointed out that the mental health factors influenced the academic performance of the students with IDs more significantly.

DISCUSSION

The research question of the present study was to establish how stress, anxiety, and social isolation, which are aspects of mental health, affect the academic performance of university students, particularly those with IDs. This research shows mental health issues, including stress, anxiety, and social isolation, harm academic performance in both typical students and students with intellectual disabilities yet affect the ID students more severely. Stress and anxiety show stronger links to academic success than social isolation, especially for students with IDs. The data shows that mental health problems affect academic performance more strongly for students with IDs than for typical students. The research shows that students with IDs need help dealing with stress and anxiety to achieve better academic results in online learning. According to the results, stress (-0.510, $p<0.001$), anxiety (-0.480, $p<0.001$), and social isolation (-0.450, $p<0.001$) were more strongly related to GPA in students with IDs than in students without IDs (stress, -0.420, $p<0.001$; anxiety, -0.390, $p<0.001$; social isolation, -0.350, $p<0.001$). Such findings show that students with IDs are affected more negatively regarding academic outcomes because of those mental health factors. Stress, anxiety, and social isolation stood out as strong predictors of GPA for both groups, although these factors impacted more on the IDs group.

The findings of this study support the emerging research that associates mental health difficulties with achievement. Stress, anxiety, and social isolation were identified as predictors for lower GPAs, and the strength of these relationships was higher for students with IDs [10]. The study implies that the establishment of students with IDs experience a range of multiple stressors in the context of e-learning, which deepens stress and anxiousness, overall worsening the achievement of students with IDs [11]. These findings align with earlier findings that stress and anxiety are detrimental to any learning process in normal and abnormal brains. Moreover, the study highlights the difficulties of students with IDs, especially in the current situation when the main part of the learning process is conducted online, and students cannot communicate face-to-face with other people [12].

This work is in concord with other studies that postulated that stress and anxiety have a way of pulling down performance in class. Past research has shown how stress associated with learning inside a classroom, especially in an online class, has adverse effects on learners' mental health [13]. For example, a study has found that stress influences concentration and learning effectiveness and, thus, academic performance. In the same way, this research also supports other research studies' conclusion that isolation is one of the leading causes of poor academic performance [14]. However, the present study goes further with these findings since

it targets students with ID, a group that is under-represented in the existing literature. It extends prior research that has posited that learners with IDs have higher levels of mental health issues, including stress and anxiety, as a result of learning disabilities and integration concerns exacerbated by online learning [15]. The current research also shows that the presence of learning disabilities makes tasks harder when learning in an online environment, and stressors such as technology and social interaction are higher, hence having a greater negative effect on the student's performance [16].

The results of this study suggest several directions for further research. The subject that requires more research is the possibility of the creation of stress, anxiety, and social isolation reduction programs for students with IDs [17]. Subsequent research could be directed at determining certain diagnostic classification systems and therapeutic approaches relevant to students with ID [18]. It is for this reason that these interventions could be in the form of stress management programs, anxiety-reducing therapies, and social integration activities in light of the social exclusion that this group undergoes [19]. Further, more longitudinal research could also be used to assess whether various mental health struggles progress through a student's academic journey and how such mental health issues affect the academic outcomes later in students' lives [20]. It would also be interesting to review if technology emphasizes or mitigates mental health issues in the context of online learning. Other aspiring studies could build on the role of promoting online communities for students with IDs, as well as mental health, peer mentoring, or other technologies that might consider the needs of these learners [21].

Although this study has brought certain insights into the link between student's psychological well-being and their tended performance in ID classes, some limitations must be noted. First, because the study was conducted on a group of learners who were in a particular stage of their learning, it was difficult to establish cause-and-effect relationships between mental health variables and learners' performance [22]. More longitudinal studies should be conducted to determine the relationship direction and temporal changes in the context of these associations [23]. Also, it is noted that the study sample involved only university students, and therefore, it cannot be exclusively generalized to other students with IDs or students in a different learning environment [24]. Further research should comprise students of different origins and educational levels to increase the external validity of the results.

Furthermore, the findings are based on participant's self-rating of mental health, which might have responded erroneously. The issues of the reporting of mental health experiences by students with IDs are likely to be distorted due to poor expression and self-understanding. Future research could use other types of measures of mental health, such as physiological data (stress hormone cortisol) or more rigorous diagnostic tools to overcome this shortcoming [25]. Also, the study does not reveal how online education especially affects students with IDs, for example, through the use of technology and lack of face-to-face support [26]. One direction for future research would be to investigate more specifically how the design of online learning environments can be changed to accommodate the needs of learners with ID. Last, the manuscript did not address the ethical considerations involving access and inclusion. Future studies should explore how the principles of ethical frameworks can be utilized to provide students with IDs with comparable quality educational opportunities that are available to neurotypical students, especially in online learning, where accessibility might be a major concern [27]. Altogether, this research brings important findings in the association between mental health and academic achievement based on students with learning disability [28]. This underlines the need to mainstream quality mental health care for this demographic to improve academic performance, especially in online classes [29]. Subsequent studies should focus on certain approaches, diagnostic models, and ethical issues to help this population and facilitate their successful learning process.

CONCLUSION

Therefore, this current research highlights the importance of a link between mental health and academic achievement with references to students with IDs in an online learning context. The study shows that students with IDs have poorer mental health than their peers with no IDs; stressing, anxious, and more socially isolated. These mental health factors are highly related to lower academic performance as measured by GPA, course engagement, and completion. These factors included stress, and the results showed that stress had the highest correlation with students' academic performance for those with IDs. The effects of stress anxiety and social isolation were even more pronounced in online learning because students with

IDs are more isolated and lack direct social interactions. On this basis, it could be inferred that online education is a challenge for students with IDs. Hence, the a need to design specific intervention programs that will address their specific needs. Such may include counseling services, learning support plans, and peer support services, which embrace buddy services to minimize the effects of mental health issues. However, there is a lack of research in identifying specific diagnostic tools and therapeutic approaches to mental health disorders of the population. Further, there is a need to enhance the ethical elements of online education systems by proposing ways that will allow students with IDs to continue learning. The current study should be followed up by future research exploring research-based practice and evaluating the impact of mental health services on students' academic performance.

REFERENCES

[1] Bolatov AK, Seisembekov TZ, Askarova AZ, Baikanova RK, Smailova DS, Fabbro E. Online-learning due to COVID-19 improved mental health among medical students. Med Sci Educ 2020; 31(1): 183-192. https://doi.org/10.1007/s40670-020-01165-y

[2] Butnaru GI, Haller AP, Dragolea LL, Anichiti A, Tacu Hârşan GD. Students' well-being during transition from onsite to online education: are there risks arising from social isolation? Int J Environ Res Public Health 2021; 18(18): 9665. https://doi.org/10.3390/ijerph18189665

[3] Pelaez A, Jacobson A, Trias K, Winston E. The turing teacher: Identifying core attributes for AI learning in K-12. Front Artif Intell 2022; 5: 1031450. https://doi.org/10.3389/frai.2022.1031450

[4] Cook DA, Artino AR Jr. Motivation to learn: an overview of contemporary theories. Med Educ 2016; 50(10): 997-1014. https://doi.org/10.1111/medu.13074

[5] Tedeschi MN, Hose TM, Mehlman EK, Franklin S, Wong TE. Improving models for student retention and graduation using Markov chains. PLoS One 2023; 18(6): e0287775. https://doi.org/10.1371/journal.pone.0287775

[6] Wang Y. The research on the impact of distance learning on students' mental health. Educ Inf Technol (Dordr) 2023; 1-13.

[7] Mazzeo SE, Weinstock M, Vashro TN, Henning T, Derrigo K. Mitigating harms of social media for adolescent body image and eating disorders: A review. Psychol Res Behav Manag 2024; 17: 2587-2601. https://doi.org/10.2147/PRBM.S410600

[8] Jones B, Reuber M, Norman P. Correlates of health-related quality of life in adults with psychogenic nonepileptic seizures: A systematic review. Epilepsia 2016; 57(2): 171-81. https://doi.org/10.1111/epi.13268

[9] Mitsea E, Drigas A, Skianis C. Digitally assisted mindfulness in training self-regulation skills for sustainable mental health: A systematic review. Behav Sci (Basel) 2023; 13(12): 1008. https://doi.org/10.3390/bs13121008

[10] Aloufi MA, Jarden RJ, Gerdtz MF, Kapp S. Reducing stress, anxiety, and depression in undergraduate nursing students: Systematic review. Nurse Educ Today 2021; 102: 104877. https://doi.org/10.1016/j.nedt.2021.104877

[11] Pouessel G, Couvreur M, Deschildre A; collaborateurs du groupe de travail 'Allergie en milieu scolaire' de la Société francaise d'allergologie. Prise en charge des allergies alimentaires en milieu scolaire en France: projet d'accueil individualisé et adrénaline [Food allergy at school: Personalized healthcare project and adrenaline]. Ann Pharm Fr 2022; 80(3): 239-247. French. https://doi.org/10.1016/j.pharma.2021.07.006

[12] Pearce E, Birken M, Pais S, Tamworth M, Ng Y, Wang J, *et al*. Associations between constructs related to social relationships and mental health conditions and symptoms: an umbrella review. BMC Psychiatry 2023; 23(1): 652. https://doi.org/10.1186/s12888-023-05069-0

[13] Guo Y, Bender M, Rousseau J, Kehoe P, Lee JA, Pimentel P, *et al*. Relationships within MOMS Orange County care coordinated home visitation perinatal program. Public Health Nurs 2020; 37(2): 215-221. https://doi.org/10.1111/phn.12689

[14] Miu AC, Szentágotai-Tătar A, Balázsi R, Nechita D, Bunea I, Pollak SD. Emotion regulation as a mediator between childhood adversity and psychopathology: A meta-analysis. Clin Psychol Rev 2022; 93: 102141. https://doi.org/10.1016/j.cpr.2022.102141

[15] Alvi T, Kumar D, Tabak BA. Social anxiety and behavioral assessments of social cognition: A systematic review. J Affect Disord 2022; 311: 17-30. https://doi.org/10.1016/j.jad.2022.04.130

[16] Aloufi MA, Jarden RJ, Gerdtz MF, Kapp S. Reducing stress, anxiety, and depression in undergraduate nursing students: Systematic review. Nurse Educ Today 2021; 102: 104877. https://doi.org/10.1016/j.nedt.2021.104877

[17] Iyer RB, Vadlapudi S, Iyer L, Kumar V, Iyer L, Sriram P, *et al*. Impact of the Heartfulness program on loneliness in high schoolers: Randomized survey study. Appl Psychol Health Well Being 2023; 15(1): 66-79. https://doi.org/10.1111/aphw.12360

[18] Bączek M, Zagańczyk-Bączek M, Springer M, Jaroszyński A, Wożakowska-Kapłon B. Students' perception of online learning during the COVID-19 pandemic: A survey study of Polish medical students. Medicine (Baltimore) 2021; 100(7): e24821. https://doi.org/10.1097/MD.0000000000024821

[19] Elmer T, Mepham K, Stadtfeld C. Students under lockdown: Comparisons of students' social networks and mental health before and during the COVID-19 crisis in Switzerland. PLoS One 2020; 15(7): e0236337. https://doi.org/10.1371/journal.pone.0236337

[20] Lemay DJ, Bazelais P, Doleck T. Transition to online learning during the COVID-19 pandemic. Comput Hum Behav Rep 2021; 4: 100130. https://doi.org/10.1016/j.chbr.2021.100130

[21] Gonzalez T, de la Rubia MA, Hincz KP, Comas-Lopez M, Subirats L, Fort S, *et al*. Influence of COVID-19 confinement on students' performance in higher education. PLoS One 2020; 15(10): e0239490. https://doi.org/10.1371/journal.pone.0239490

[22] Huckins JF, DaSilva AW, Wang W, Hedlund E, Rogers C, Nepal SK, *et al*. Mental health and behavior of college students during the early phases of the COVID-19 pandemic: Longitudinal smartphone and ecological momentary assessment study. J Med Internet Res 2020; 22(6): e20185. https://doi.org/10.2196/20185

[23] Kecojevic A, Basch CH, Sullivan M, Davi NK. The impact of the COVID-19 epidemic on the mental health of undergraduate students in New Jersey, cross-sectional study. PLoS One 2020; 15(9): e0239696. https://doi.org/10.1371/journal.pone.0239696

[24] Kumar P, Kumar N, Aggarwal P, Yeap JAL. Working in lockdown: The relationship between COVID-19 induced work stressors, job performance, distress, and life satisfaction. Curr Psychol 2021; 40(12): 6308-6323. https://doi.org/10.1007/s12144-021-01567-0

[25] Mheidly N, Fares MY, Fares J. Coping with stress and burnout associated with telecommunication and online learning. Front Public Health 2020; 8: 574969. https://doi.org/10.3389/fpubh.2020.574969

[26] Odriozola-González P, Planchuelo-Gómez Á, Irurtia MJ, de Luis-García R. Psychological effects of the COVID-19 outbreak and lockdown among students and workers of a Spanish university. Psychiatry Res 2020; 290: 113108. https://doi.org/10.1016/j.psychres.2020.113108

[27] Prowse R, Sherratt F, Abizaid A, Gabrys RL, Hellemans KGC, Patterson ZR, *et al*. Coping with the COVID-19 pandemic: Examining gender differences in stress and mental health among university students. Front Psychiatry 2021; 12: 650759. https://doi.org/10.3389/fpsyt.2021.650759

[28] Son C, Hegde S, Smith A, Wang X, Sasangohar F. Effects of COVID-19 on college students' mental health in the United States: Interview survey study. J Med Internet Res 2020; 22(9): e21279. https://doi.org/10.2196/21279

[29] Sundarasen S, Chinna K, Kamaludin K, Nurunnabi M, Baloch GM, Khoshaim HB, *et al*. Psychological impact of COVID-19 and lockdown among university students in Malaysia: Implications and policy recommendations. Int J Environ Res Public Health 2020; 17(17): 6206. https://doi.org/10.3390/ijerph17176206

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