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Learning mode, university students' mental health, and acculturative stress: A cross-sectional study of Chinese international students in Australia

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ABSTRACT: *This study examines the association between the learning mode and the mental health of Chinese international students (CIS) in Australia and the potential mediating role of acculturative stress. One hundred and twenty-two CIS were recruited through an online survey and assigned to either the in-person or hybrid learning group according to their mode of learning. Depression, anxiety, and acculturative stress were assessed using the Patient Health Questionnaire-9 (PHQ-9), the General Anxiety Disorder-7 (GAD-7), and the Acculturative Stress Scale for Chinese College Students (ASSCS), respectively. The results indicated*

that compared with participation in in-person learning, participation in hybrid learning was associated with higher levels of self-reported symptoms of depression and anxiety. Acculturative stress was found to play a mediating role in this association.

Keywords: Acculturative stress, Anxiety, Chinese international students, Depression, Hybrid learning, Online learning

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INTRODUCTION

Since 2020, universities have quickly shifted from in-person learning to online learning as a response to the unprecedented disruption in education due to pandemic-related lockdowns (García-Morales et al., 2021; Salama & Hinton, 2023; Warfvinge et al., 2022). Online learning, also referred to as e-learning, distance learning, remote learning, or web-based learning, enables teaching and learning via internet-supported platforms (Banson, 2022; Kearsley et al., 1995; Maddison et al., 2017). Over the past five years, despite posing challenges such as technical problems, social isolation, concentration issues, and Zoom fatigue (Bevens et al., 2024; García-Morales et al., 2021; Yosep et al., 2023), online learning has been positively received by many students and educators (Bashir & Lapshun, 2025; Evans et al., 2023; Turner et al., 2024). Many university leaders believe that online education provides new opportunities and institutional growth (Bayley & Yates, 2023). Universities have integrated online provisions with in-person instruction to develop hybrid learning models, including flipped classrooms, synchronous lectures and seminars, and on-campus practical sessions supported by online components (Fan et al., 2024; Forde et al., 2024; Salama & Hinton, 2023). While such models have been advanced in universities to enhance flexibility and engagement, the relationship between the learning mode and mental health has yet to be fully explored (Moore et al., 2022). International students, as key cohorts in higher education settings, remain understudied with respect to their mental health in online and hybrid settings. To provide updated

insights on this topic, our study draws on data collected in 2024 to examine the relationship between the learning mode and the mental health of Chinese international students (CIS), with acculturative stress included as a potential mediator. The research question is as follows: What is the association between the learning mode and the mental health of the CIS in Australia? This study aims to examine the possible association between learning mode and international students' mental health and the possible mediating role of acculturation in such an association.

LITERATURE REVIEW

Mental Health of University Students in Online Settings

Mental health problems can negatively impact cognitive functioning as well as academic performance (Di Malta et al., 2022; Fraiwan et al., 2025), and in severe cases, mental health problems may contribute to dropout or suicidal behavior (Javed & Munawar, 2021; Zając et al., 2024). Concerns about the mental health of university students increased during and after the pandemic. Multiple studies have reported elevated levels of depression and anxiety among university students (Pandya & Lodha, 2022; Riboldi et al., 2023; Ying et al., 2025; Zarowski et al., 2024). However, whether online and hybrid learning is related to university students' mental health in a positive or negative way remains unclear (Lister, Seale, et al., 2023; Moore et al., 2022). Moore and colleagues (2022) reviewed 45 studies and reported that more than half reported negative impacts of online learning on student mental health, one-third reported mixed impacts, and less than 10% reported positive impacts. Note that most studies did not adequately adjust for the broader impact of the pandemic, making it difficult to disentangle the effects of the learning mode itself (Moore et al., 2022). In addition, research on learning modes and university students' mental health was mostly conducted and published between 2020 and 2023, during the height of the COVID-19 pandemic.

Universities should approach the mental health of students, particularly international students, with greater caution in online and hybrid learning environments, as these learning modes reshape academic engagement and social interaction, potentially increasing psychological vulnerability (Nuryana et al., 2023). Students report a lack of academic support from their tutors as well as a sense of isolation when they learn online, and they note that their mental health can be better supported by strengthening communication with educators and their peers (Lister, Andrews, et al., 2023). Online learning also makes it more difficult for students, particularly first-year students, to establish new social connections and adapt to the university environment (Y. Wang, 2023). Moreover, compared with local students, international students in universities are more vulnerable to mental health problems, such as generalized and social anxiety symptoms (Riboldi et al., 2023), and are more likely to develop major depression (Russell et al., 2023). International students also report facing various challenges in online learning, including increased workload, technical issues, and a diminished sense of interpersonal connection (Almadadha et al., 2025). Accordingly, greater

institutional attention to student mental health is warranted (Nuryana et al., 2023), particularly for international students, to support successful navigation within online and hybrid learning environments.

Experiences of Acculturation and Mental Health

International students also face unique challenges stemming from acculturation that are not typically experienced by local students. Acculturation refers to the process of cultural change experienced when an individual or a group of people from one culture are in contact with another culture (Berry, 2006). In acculturation research, international students are categorized as sojourners who travel to another country for a specific purpose and plan to return home upon accomplishment (Safdar & Berno, 2016). According to Berry's framework, acculturation occurs at both the cultural level and the psychological level. Changes arising from cultural contact can generate a range of psychological responses, from behavioral shifts to more severe outcomes such as depression and anxiety, particularly when acculturative stress intensifies (Berry, 2006). Acculturative stress refers to the multifaceted challenges encountered by an individual during acculturation. For example, international students face a variety of acculturative stresses, including language barriers, discrimination, lower levels of social support, and academic difficulties (Safdar & Berno, 2016). Increased acculturative stress is associated with an increased likelihood of depressive symptoms among international students (Amlashi et al., 2024; Çimşir & Ünlü Kaynakçı, 2024). Among CIS across different countries, acculturative stress is positively associated with symptoms of depression and anxiety (Ma et al., 2021; Singh & Xue, 2025; Xiong et al., 2025; Yan & Berliner, 2011; Zhao et al., 2023; Zuo et al., 2025). Given the well-documented association between acculturative stress and mental health, it is essential to include acculturative stress when international students' mental health is being evaluated.

Learning Modes and Acculturative Stress

Research has indicated that the shift from in-person to online or hybrid learning alters students' experiences of learning and socializing (Gudoniene et al., 2025; L. Wang, 2023), and these factors are considered key contributors to acculturative stress among international students (Safdar & Berno, 2016). For example, international students often experience decreased learning efficiency in online settings, as they struggle to concentrate without the structure and social contacts that occur in a physical classroom (Chen, 2023; Han et al., 2021). They are easily distracted by web pages and other digital content while completing assignments on the computer (L. Wang, 2023). Access to instructors also becomes more restricted, with interactions largely confined to email rather than face-to-face office visits (Han et al., 2021). The transition from in-person to digital environments further complicates international students' adaptation to a new educational system, particularly for students who speak a different language (Han, 2023). Participating in group discussions via Zoom can increase language anxiety

and communication stress (L. Wang, 2023). They are less likely than domestic students are to initiate or actively engage in collaborative activities (Han, 2023). Additionally, students are disappointed by a lack of connection with professors and classmates and feel a sense of isolation and helplessness (Chen, 2023; L. Wang, 2023). Together, these findings suggest that online settings may exacerbate academic and language-related stress and inhibit social interaction, all of which correspond to the academic, linguistic, and social dimensions of acculturative stress encountered by international students.

CIS constitute the largest international student group in Australia and many other host countries (Department of Education Australian Government, 2024). However, to the best of our knowledge, research to date has not examined the association between the learning mode and mental health of CIS or whether acculturative stress might play a role in this relationship. This study therefore aims to examine the relationship between learning mode and mental health among CIS in Australia, with a particular focus on the potential mediating role of acculturative stress.

METHOD

Study Setting

This study was conducted at a large university in Australia between April 19th and May 19th, 2024. Ethics approval was obtained from the university's Human Research Ethics Committee (Ref. No. 2024-27526-53340-5).

Participants and Recruitment

Eligible participants were CIS aged 18 years or older who were enrolled at the university with a valid student visa at the time of the survey. Students were recruited through multiple channels: posters with QR codes linked to an online survey were displayed in main buildings across the campus; advertisements with survey links were published fortnightly on the official university platform; and digital posters were circulated through student associations, clubs, and social media groups for the CIS. The invitation to participate was also disseminated via WeChat groups. Survey respondents were also encouraged to share the survey link with peers. Participation was voluntary, with no incentives provided. A plain language statement (PLS) was presented at the start of the survey outlining the study aims and procedures. Informed consent was obtained electronically prior to participation, and respondents who declined consent were directed to a final page containing information and resources for mental health support.

Survey Design

The survey was developed and administered using Qualtrics XM (2024). It included six sections: demographic characteristics, online learning experiences, self-efficacy in online learning, mental health, acculturation, and the use of university counseling and psychological services. Four open-ended questions

were included in the survey. Each item was presented in both English and simplified Chinese. Skip logic was applied where relevant. Before the survey was launched, two postgraduate students and two graduate researchers pilot tested the survey for readability, length, and logical flow. One-on-one feedback discussions with the first author followed, leading to minor amendments. The estimated completion time for the final survey ranged from 10–12 minutes.

Measures

Demographics

Participants were screened by asking, “Do you hold a valid student visa?” Those who responded “no” were excluded from further participation. Data were collected on age, gender, hometown, faculty, course and year level, length of stay in Australia, relationship status, sleep duration, commute time, and financial difficulties. Financial difficulties were defined as “yes” to either of two items: having run out of food in the past 12 months or being unable to afford medicine in the past 12 months.

Learning mode

Participants were categorized as “in-person” or “hybrid” learners according to their response to the following question: “Are you taking any subjects online/hybrid this semester?”

Learning experiences and preferences

The participants reported the number of subjects taken in one semester and the number completed in each delivery mode (fully online, hybrid, or fully in person). They rated their satisfaction with the learning modes they had experienced on a scale from 0 to 7 (0=extremely dissatisfied, 7=extremely satisfied), with optional free-text comments. The participants also ranked their preferred learning mode (in-person, online, or hybrid) and provided further comments if desired.

Online Learning Self-Efficacy (OLSE)

The 22-item OLSE Scale (Zimmerman & Kulikowich, 2016) was used to measure perceived self-efficacy related to online learning. This scale has been validated in university student samples in the United States (Zimmerman & Kulikowich, 2016) and has been preliminarily validated in Turkey, Iran, and China (Ahmadipour, 2022; Ma et al., 2024; Yavuzalp & Bahçivan, 2020). It contains three subscales—Learning, Time Management, and Technology—with items rated from 1 (“not confident”) to 6 (“very confident”). Example items include “Navigate online course materials efficiently” and “Use the library’s online resources efficiently”. Total scores range from 22 to 132, with higher scores indicating greater self-efficacy in online learning.

Acculturative Stress

The 32-item Acculturative Stress Scale for Chinese Students (ASSCS) (Bai, 2016) was used to measure acculturative stress. It contains 32 items that form five subscales: Language Insufficiency, Social Isolation, Perceived Discrimination, Academic Pressure, and Guilt Toward Family. Each item is rated from 1 to 7, resulting in a total score of 32–224, with higher scores indicating greater stress. This scale was developed and validated among a sample of CIS in the United States (Bai, 2016).

Depression

The 9-item Patient Health Questionnaire (PHQ-9) (Spitzer et al., 1999) was used to assess depressive symptoms. Each item is rated from 0 to 3, yielding a total score of 0–27, with higher scores indicating greater severity of depression. The PHQ-9 has been validated among Chinese-speaking populations in the United States and among university students in China (Yin et al., 2022; Zhang et al., 2013).

Anxiety

The 7-item Generalized Anxiety Disorder Questionnaire (GAD-7) (Spitzer et al., 2006) was used to assess anxiety symptoms. Each item is rated from 0 to 3, resulting in a total score of 0–21, with higher scores indicating greater anxiety. The GAD-7 has been validated among Chinese university students (Zhang et al., 2021).

Sample size

To detect a minimal clinically important difference of 1 unit in depression/anxiety scores between hybrid learning and in-person learning (Bi et al., 2023; Han et al., 2013), assuming a standard deviation of 3.8 units for depression/anxiety equal across both groups (Han et al., 2013), for 80% power and a two-sided significance level of 0.025 (conservative Bonferroni adjustment for two primary outcomes), with equal group sizes and allowing for 10% missing data, a total sample size of 614 participants is needed.

Statistical Analysis

Participant characteristics were summarized by learning mode, using the mean (standard deviation, SD) for symmetrically distributed numerical data, the median (interquartile range, IQR; 25th–75th percentile) for nonsymmetrically distributed numerical data, and the frequency (percentage) for categorical data.

The primary analysis was guided by Figure 1a (see Appendix A. Figure 1), which was developed from the literature and identified age, gender, financial difficulty, and OLSE as potential confounders of the association between learning mode and mental health (Ke et al., 2023; Wang et al., 2022). First, unadjusted

linear regression models were fitted using complete case data to explore the associations between learning mode and each of the mental health outcomes, depression and anxiety. Models were then adjusted for age, gender, financial difficulty, and OLSE and subsequently further adjusted for acculturative stress. We also explored unadjusted associations between acculturative stress and mental health outcomes. Owing to the nonsymmetrical distribution of the data, depression and anxiety were log-transformed prior to the analysis. An exploratory causal mediation analysis, guided by Figure 1b (see Appendix A. Figure 1), was conducted using complete case data to explore whether acculturative stress mediated the association between learning mode and mental health outcomes, adjusting for age, gender, financial difficulty, and OLSE. Given the cross-sectional design and exploratory nature of this study, no causal inferences are drawn from these analyses.

Missing mental health outcome, acculturative stress, and OLSE data were handled using multiple imputation by chained equations (MICE) with linear regression models. The imputation model included all the variables in the analysis model, as well as participant characteristics that appeared to differ between those with and without missing data, including length of stay, relationship status, and commute time (see Appendix B. Table 1). Thirty imputations were performed to account for approximately 26% of the missing data. The imputed datasets were compared with the complete-case data using density plots.

Geometric mean ratios (GMR), corresponding two-sided 95% confidence intervals (CI), and p values were obtained from the models discussed above. Standard diagnostic plots were used to check the model assumptions. All the statistical analyses were performed in STATA 18 (StataCorp., 2023).

RESULTS

Descriptive Data

Among the 187 students who participated in the survey, 64 were excluded for the following reasons: not consent (n=4), immediate withdrawal after consent (n=24), no valid student visa (n=8), withdrawal after the visa question (n=13), and no response to the learning mode question (n=15). One participant self-identified as nonbinary; owing to the small sample size, gender was dichotomized as male/female, and this case was excluded. A total of 122 participants were included in the analysis. Descriptive summaries of their demographic characteristics, learning mode preferences, OLSE, and acculturative stress are shown in Table 1; mental health outcomes related to depression and anxiety are summarized in Table 2.

Demographics

Among the 122 participants, 73 (59.8%) were in the in-person learning group, and 49 (40.2%) were in the hybrid group. The mean age was 23.0 years (SD=2.1 years). Most participants were female (n=97, 79.5%), from Eastern China (n=71,

58.2%), were pursuing a master’s degree (n=95, 77.9%), were in their first or second year (n=109, 89.3%), were single (n=83, 68.0%), and were commuting less than 30 minutes to campus (n=94, 77.0%).

Learning Mode Preference and OLSE

Most students preferred in-person learning (n=71, 63.4%), followed by hybrid learning (n=30, 26.8%) and online learning (n=11, 9.8%). The overall median OLSE score was 99 (IQR 87–108). Students in the hybrid group reported lower OLSE scores (median=96, IQR 87–105.5) than those in the in-person group did (median=102.5, IQR 88–110).

Table 1: Demographic Information (N = 122)

Construct	Total (n=122)	In person (n=73)	Hybrid (n=49)
Age, mean (SD), yrs	23.0 (2.1)	23.2 (2.3)	22.7 (1.9)
Gender, n (%)			
Male	25 (20.5%)	19 (26.0%)	6 (12.2%)
Female	97 (79.5%)	54 (74.0%)	43 (87.8%)
Hometown, n (%)			
East China	71 (58.2%)	44 (60.3%)	27 (55.1%)
Central China	21(17.2%)	12 (16.4%)	9 (18.4%)
West China	18 (14.8%)	11 (15.1%)	7 (14.3%)
Northeast China	10 (8.2%)	4 (5.5%)	6 (12.2%)
SAR/Taiwan, China	2 (1.6%)	2 (2.7%)	0 (0.0%)
Faculty, n (%)			
Architecture, Building and Planning	4 (3.3%)	4 (5.5%)	0 (0.0%)
Arts	32 (26.2%)	24 (32.9%)	8 (16.3%)
Business and Economics	14 (11.5%)	10 (13.7%)	4 (8.2%)
Education	24 (19.7%)	13 (17.8%)	11 (22.4%)
Engineering and Information Technology	9 (7.4%)	6 (8.2%)	3 (6.1%)
Fine Arts and Music	2 (1.6%)	2 (2.7%)	0 (0.0%)
Law	3 (2.5%)	3 (4.1%)	0 (0.0%)
Medicine, Dentistry and Health Sciences	16 (13.1%)	4 (5.5%)	12 (24.5%)
Science	17 (13.8%)	7 (9.6%)	10 (20.4%)
Other	1 (0.8%)	0 (0.0%)	1 (2.0%)
Course level, n (%)			
Undergraduate	25 (20.5%)	14 (19.2%)	11 (22.4%)
Master	95 (77.9%)	58 (79.5%)	37 (75.5%)
Graduate Researcher (PhD)	2 (1.6%)	1 (1.4%)	1 (2.0%)
Year, n (%)			
First year	58 (47.5%)	31 (42.5%)	27 (55.1%)

Second year	51 (41.8%)	33 (45.2%)	18 (36.7%)
Third year	11 (9.0%)	7 (9.6%)	4 (8.2%)
Fourth year	1 (0.8%)	1 (1.4%)	0 (0.0%)
Fifth year and above	1 (0.8%)	1 (1.4%)	0 (0.0%)
Length of stay, n (%)			
less than 3 months	15 (12.3%)	8 (11.0%)	7 (14.3%)
3-6 months	18 (14.8%)	8 (11.0%)	10 (20.4%)
6-12 months	14 (11.5%)	10 (13.7%)	4 (8.2%)
1-3 years	46 (37.7%)	28 (38.4%)	18 (36.7%)
more than 3 years	29 (23.8%)	19 (26.0%)	10 (20.4%)
Relationship, n (%)			
Single	83 (68.0%)	47 (64.4%)	36 (73.5%)
Dating	34 (27.9%)	24 (32.9%)	10 (20.4%)
Married/De facto	3 (2.5%)	1 (1.4%)	2 (4.1%)
Other	2 (1.6%)	1 (1.4%)	1 (2.0%)
Sleep, mean (SD), hours	7.1 (1.1)	7.2 (1.0)	7.1 (1.2)
Commute time, n (%)			
less than 30 mins	94 (77.0%)	57 (78.1%)	37 (75.5%)
more than 30 mins	28 (23.0%)	16 (21.9%)	12 (24.5%)
Ran Out of Food, n (%)			
Yes	14 (11.5%)	10 (13.7%)	4 (8.2%)
No	108 (88.5%)	63 (86.3%)	45 (91.8%)
Couldn't Afford Medicine, n (%)			
Yes	10 (8.2%)	7 (9.6%)	3 (6.1%)
No	112 (91.8%)	66 (90.4%)	46 (93.9%)
Favorite mode, n (%)*			
In-person	71 (63.4%)	49 (72.1%)	22 (50.0%)
Online	11 (9.8%)	4 (5.9%)	7 (15.9%)
Hybrid	30 (26.8%)	15 (22.1%)	15 (34.1%)
OLSE score, median (IQR)*	99 (87-108)	102.5 (88-110)	96 (87-105.5)
Acculturative stress score, median (IQR)*	88 (67-112)	83 (63-107)	101 (68-121)

Note. IQR = interquartile range (25th–75th percentile), SD = standard deviation.

*Missing data: Favorite mode: In person 5 (7%), Hybrid 5 (10%); OLSE: In person 19 (26%), Hybrid 9 (18%); Acculturative stress: In person 15 (21%), Hybrid 6 (12%).

Acculturative Stress

The overall median acculturative stress was 88 (IQR 67–112). Scores were higher and more variable among hybrid learners (median=101, IQR 68–121) than among in-person learners (median=83, IQR 63–107).

Depression and Anxiety Symptoms

On average, the students reported mild depressive symptoms (mean=8.1, SD=5.7). With a PHQ-9 cutoff of 10, thirty-four (32.4%) students met the criteria for moderate to severe depression. Compared with in-person learners, hybrid learners reported more symptoms (mean=9.2, SD=5.3 vs mean=7.3, SD=5.8).

Anxiety scores followed a similar pattern. The mean GAD-7 score was 7.5 (SD=5.3), reflecting mild anxiety, with 31 (29.8%) students classified as moderate to severe. Compared with in-person learners, hybrid learners reported slightly higher levels of anxiety (mean=8.6, SD=5.2 vs mean=6.7, SD=5.3).

Table 2: Descriptive Statistics of Outcome Measures (N = 122)

Construct	Total (n=122)	In person (n=73)	Hybrid (n=49)
Depression score, median (IQR)	7 (4-11)	6 (4-9)	8 (5-12)
Depression score, mean (SD)	8.1 (5.7)	7.3 (5.8)	9.2 (5.3)
Depressive symptoms, n (%)			
Minimal (0-4)	27 (25.7%)	19 (30.6%)	8 (18.6%)
Mild (5-9)	44 (41.9%)	28 (45.2%)	16 (37.2%)
Moderate (10-14)	20 (19.0%)	7 (11.3%)	13 (30.2%)
Moderately severe (15-19)	9 (8.6%)	5 (8.1%)	4 (9.3%)
Severe (20-27)	5 (4.8%)	3 (4.8%)	2 (4.7%)
Anxiety score, median (IQR)	7 (3-11)	6 (2-10)	7 (5-12)
Anxiety score, mean (SD)	7.5 (5.3)	6.7 (5.3)	8.6 (5.2)
Anxiety symptoms, n (%)			
Minimal (0-4)	29 (27.9%)	22 (36.1%)	7 (16.3%)
Mild (5-9)	44 (42.3%)	23 (37.7%)	21 (48.8%)
Moderate (10-14)	21(20.2%)	12 (19.7%)	9 (20.9%)
Severe (15-21)	10 (9.6%)	4 (6.6%)	6 (14.0%)

Note. IQR = interquartile range (25th–75th percentile), SD = standard deviation. Missing data: Depression: In person 11 (15%), Hybrid 6 (12%); Anxiety: In person 12 (16%), Hybrid 6 (12%).

Learning Mode and Depression

As shown in Table 3, the unadjusted regression model indicated a 1.32-fold (95% CI: [1.05, 1.65]; p=0.018) change in geometric mean depression scores for the hybrid group compared to the in-person group. Hardly any changes were observed in the association after adjusting for age, gender, financial difficulties, and OLSE (GMR=1.33; 95% CI: [1.04, 1.71]; p=0.021). After further adjusting for acculturative stress, the association attenuated (GMR=1.17; 95% CI: [0.93, 1.48]; p=0.175). A 1-unit increase in acculturative stress was associated with a 1.01-fold (95% CI: [1.01, 1.01]; p<0.001) relative change in the geometric mean depression score.

Adjusted exploratory mediation analysis (Table 4) suggested that the total effect of learning mode on depression (GMR=1.35; 95% CI: [1.06, 1.72]; $p=0.014$) comprised a direct effect (GMR=1.17; 95% CI: [0.95, 1.45]; $p=0.141$) and an indirect effect via acculturative stress (GMR=1.15; 95% CI: [1.01, 1.32]; $p=0.037$).

Learning Mode and Anxiety

The unadjusted regression model indicated a 1.31-fold (95% CI: [1.03, 1.67]; $p=0.028$) change in geometric mean anxiety scores for the hybrid group compared with the in-person group (see Table 3). Hardly any changes were observed in the association after adjusting for age, gender, financial difficulties, and OLSE (GMR=1.32; 95% CI: [1.02, 1.71]; $p=0.033$). Further adjusting for acculturative stress attenuated the effect (GMR=1.10; 95% CI: [0.88, 1.36]; $p=0.397$). Every 1-unit increase in acculturative stress was associated with a 1.01-fold (95% CI: [1.01, 1.01]; $p<0.001$) relative change in the geometric mean anxiety score.

Table 3: Regression Results for Learning Modes on Depression and Anxiety

Construct	Geometric mean ratio	95% CI	p value
Depression			
Univariable			
In-person	Reference		
Hybrid	1.32	(1.05 to 1.65)	0.018
Multivariable – Model 1*			
In-person	Reference		
Hybrid	1.33	(1.04 to 1.71)	0.021
Multivariable – Model 2**			
In-person	Reference		
Hybrid	1.17	(0.93 to 1.48)	0.175
Anxiety			
Univariable			
In-person	Reference		
Hybrid	1.31	(1.03 to 1.67)	0.028
Multivariable – Model 1*			
In-person	Reference		
Hybrid	1.32	(1.02 to 1.71)	0.033
Multivariable – Model 2**			
In-person	Reference		
Hybrid	1.10	(0.88 to 1.36)	0.397

Note. *Adjusted for age, gender, OLSE, and financial difficulties. **Further adjusted for acculturative stress based on Model 1*.

In the adjusted exploratory mediation analysis, the total effect of the learning mode on anxiety (GMR=1.31; 95% CI: [1.03, 1.67]; $p=0.026$) included a direct

effect (GMR=1.10; 95% CI: [0.92, 1.31]; p=0.307) and an indirect effect via acculturative stress (GMR=1.20; 95% CI: [1.03, 1.39]; p=0.016). Negligible differences were observed between the adjusted and unadjusted models (see Table 4).

Table 4: Exploratory Mediation Analysis of Acculturative Stress in the Relationships between Learning Modes and Depression and Anxiety

Construct	Geometric mean ratio	95% CI	p value
Depression			
Unadjusted			
Indirect effect	1.15	(1.01 to 1.29)	0.029
Direct effect	1.16	(0.96 to 1.40)	0.134
Total effect	1.32	(1.07 to 1.64)	0.010
Adjusted*			
Indirect effect	1.15	(1.01 to 1.32)	0.037
Direct effect	1.17	(0.95 to 1.45)	0.141
Total effect	1.35	(1.06 to 1.72)	0.014
Anxiety			
Unadjusted			
Indirect effect	1.17	(1.03 to 1.34)	0.016
Direct effect	1.09	(0.90 to 1.31)	0.386
Total effect	1.27	(1.01 to 1.60)	0.037
Adjusted*			
Indirect effect	1.20	(1.03 to 1.39)	0.016
Direct effect	1.10	(0.92 to 1.31)	0.307
Total effect	1.31	(1.03 to 1.67)	0.026

Note. *Adjusted for age, gender, OLSE, and financial difficulties.

The findings were consistent in sensitivity analyses using multiple imputed data (see Appendix C. The results from Imputed Data).

DISCUSSION

Main Findings

We observed lower levels of depression and anxiety among participants in the in-person learning group than among those in the hybrid learning group. Regression analyses indicated that adjustment for acculturative stress attenuated the associations between learning mode and mental health. Furthermore, mediation analyses demonstrated that acculturative stress mediated the relationship between learning mode and mental health outcomes among CIS.

The reason why participants in the hybrid learning group self-reported higher depression and anxiety scores than those in the in-person learning group may be that the CIS faced more challenges in online settings than in face-to-face settings.

In the few studies available, the CIS complained about the silence during Zoom-based group discussions (Qu & Forsey, 2024). The online environment also undermines their confidence in class (Sun et al., 2025) and further discourages their participation (Qu & Forsey, 2024). Students may perceive themselves as marginalized when they are unable to participate fully in the group. The online setting also complicates communication with lecturers. According to the CIS, their instructors tend to respond slowly to emails, and it is considerably easier for them to approach instructors in person after class (Sun et al., 2025). Such difficulties in participation and communication may not only contribute to negative perceptions of online learning experience but also lead to mental health concerns. Research has indicated that decreased satisfaction with online learning is related to increased symptoms of depression and anxiety among CIS (Bi et al., 2023).

The results of the mediation analyses suggest that the association between the learning mode and mental health outcomes may operate through acculturative stress. To our knowledge, no prior studies have directly examined the relationship between learning mode and acculturative stress. Future studies should explore this relationship further, particularly through longitudinal or comparative designs. Understanding the relationship between the learning mode and acculturative stress may require a closer examination of the multidimensional nature of acculturation, including linguistic, social, academic, discrimination, and family-related factors (Berry, 2006; Safdar & Berno, 2016). Consistent with existing research, acculturative stress was positively associated with psychological distress among international students and immigrant populations worldwide (Amlashi et al., 2024; Lee et al., 2004; Sirin et al., 2013; Zuo et al., 2025).

International students face the challenge of adapting to a new sociocultural environment while studying at a university overseas. However, literature explicitly focusing on international students' online or hybrid learning experiences remains scarce. While a systematic review suggested that hybrid learning promotes greater student engagement and better academic performance than in-person settings do (De Bruijn-Smolders & Prinsen, 2024), the conclusion does not seem to align with the perceptions of CIS. Such discrepancies may be due to differences in the study populations. Furthermore, evidence from a systematic review revealed that international students exhibit higher levels of depression and anxiety than domestic students (Maharaj et al., 2025). They also demonstrate lower levels of mental health literacy and are less likely to use mental health services than their local counterparts (Han et al., 2025). These findings underscore the importance of recognizing international students as a heterogeneous subgroup when the relationship between learning mode and students' mental health is examined. Aggregating them with the general university population may overlook the acculturative challenges they encounter and impede the provision of appropriate mental health support.

By preliminarily identifying acculturative stress as a possible mediating factor, the present study extends the literature and offers an initial step toward understanding how variations in learning mode may interact with international students' experiences of acculturation as well as their mental health. Note that the

findings from this study should not be interpreted as evidence that hybrid learning is directly associated with poorer mental health outcomes. Rather, the findings highlight the potential role of acculturation in shaping the relationship between the learning mode and international students' mental health.

Implications

Observations from the present study underscore the importance of addressing acculturative stress among CIS, highlighting both theoretical and practical considerations. Theoretically, the findings extend our understanding of the relationships among the learning mode, acculturative stress, and mental health outcomes among CIS. In practice, universities should implement mental health programs that specifically target acculturative challenges, particularly in the context of online or hybrid learning. In addition to providing academic support and increasing opportunities for social interaction on campuses, institutions could design culturally tailored interventions and involve student representatives in co-design processes to enhance relevance and effectiveness. From a policy perspective, these results shed light on the development of institutional guidelines and resource allocation aimed at mitigating acculturative stress and promoting mental health among international students.

Strengths and Limitations

This study has several strengths. First, it focused specifically on the CIS, the largest international student cohort in Australia, rather than treating international students from multiple countries as a homogeneous group. This allowed us to capture culturally specific experiences. Second, data were collected in 2024, when pandemic restrictions had ended and students had more autonomy in choosing to study in face-to-face, online or hybrid modes. Our study provides insights into learning modes and mental health in a context different from what occurred during the pandemic, when most existing studies were carried out. Third, we applied robust statistical methods, including multiple imputation, to address missing data. Finally, we used validated instruments to measure variables such as acculturative stress and OLSE.

Several limitations of the present study must be acknowledged. First, participants were recruited on a voluntary basis, and no formal sampling frame was available, preventing calculation of representativeness. This recruitment strategy may have introduced selection bias, with students experiencing mental health difficulties possibly being more likely to participate. Second, the sample size recruited ($n=122$) fell short of the number required ($n=614$), limiting statistical power and precision. Our findings should therefore be considered exploratory. Third, the cross-sectional design precludes causal inference; therefore, the mediation results must be interpreted with caution. Finally, as the study was conducted at a single metropolitan, research-intensive university, the findings may not be generalizable to other settings or student populations.

Directions for Future Research

Future research may benefit from being conducted at the institutional level to enable access to a larger sample, thereby increasing statistical power and enhancing the reliability of the findings. Studies with longitudinal designs could help examine potential causal relationships, both between online learning and acculturative stress, and between acculturative stress and mental health. Moreover, qualitative approaches, such as interviews and focus groups, could generate richer and more nuanced insights into the interplay between online learning, acculturation, and mental health on the basis of the lived experiences of CIS.

CONCLUSION

The present study used a cross-sectional study design to examine the relationships among learning mode, acculturative stress, and mental health outcomes among CIS in Australia. The results indicated that participants in the hybrid learning group self-reported higher depression and anxiety scores than participants in the in-person learning group did. Based on mediation analysis, acculturative stress significantly mediated the association between learning mode and mental health outcomes among CIS. As an exploratory investigation, this study does not permit causal inferences. Nevertheless, the findings provide preliminary evidence that the observed differences in mental health outcomes across groups may essentially reflect differences in acculturative stress between the two learning groups. It also highlights the necessity for researchers to pay attention to how the learning mode may be related to acculturative processes among international students. These findings could be used by professionals in education, cross-cultural, and mental health settings to develop targeted programs supporting international students' psychological wellbeing. Future research could adopt longitudinal designs and qualitative approaches to provide a more nuanced understanding of this topic.

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In the preparation of this manuscript, we utilized artificial intelligence (AI) tools for content creation with the following capacity:

- None
- Some sections, with minimal or no editing
- Some sections, with extensive editing
- Entire work, with minimal or no editing
- Entire work, with extensive editing

No artificial intelligence (AI) tools were used in the preparation of this article. All content is the original work of the authors and complies with the academic integrity standards.

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Appendix

We will include appendices (such as figures and tables) online as supplemental materials, but not in the print copy or PDF galley online.

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