Article

Depression, Acculturative Stress and Social Connectedness among International University Students in Japan: prevalence and correlation.

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Abstract:

(1) This study aimed to examine the prevalence of depression and its correlation with acculturative Stress and Social Connectedness among domestic and overseas students in Japan International University.

(2) Methods:

A Web-based survey was distributed among students of International University, which resulted in 263 responses. On the survey together with socio-demographic data, a nine-item tool from the Patient Health Questionnaire (PHQ-9), was used to measure the prevalence of Depression and its relationship with socio-demographic data, Social Connectedness Scale was used to measure Social Connectedness, and Acculturative Stress Scale for International Students (ASSIS) was used to measured acculturative stress.

(3) Results:

Depression was significantly high in international and domestic students (37.81% and 29.85% respectively). English language proficiency and students age (20 years old) showed a significant correlation with depression among domestic students (β=-1.63, p=0.038 and β=2.24, p=0.048). Stay length (third year) also displayed a significant correlation with depression among international students (β=1.08, p=0.032).

Among international and domestic students statistically significant positive correlation between depression and acculturative stress, negative associations of social connectedness with depression and acculturative stress were also found.

Suicidal or self-hurting ideation thoughts are found among around 20% of all students.

(4) Conclusions:

These findings indicate a relatively high prevalence of depression among students of International University, and overseas students are more affected. Depression, Acculturation stress and Social Connectedness show statistically strong intercorrelation, which highlights the need of host University to recognise the role of Acculturation and Social Connectedness in the development of Depression among students.

1. Introduction

Students' mental health is crucial to the quality of education. Regarding mental health, depression is a common disorder which affects 322 million people globally. In 2015, global depression prevalence was 4.4%, and in Japan, depression prevalence was 4.2%. If becoming too severe, depression can lead to suicide – the second leading death cause for people in age 15-29 [1]. Depression is more prevalent in university students compared to the general population [2]. Studies about correlating demographic factors with depression in university students vary in many countries with different main findings: e.g. gender, school year, age, marital status [3–9]. However, there were mixed results about the significance of each of the demographic factors. Depression, particularly in the population of international university students, was still a topic with limited research.

Acculturative stress is a predictor for depression [10–13]. Because international students start living in a new foreign environment, intercultural contacts can cause stress, and they need to adapt to negotiate potential conflicts. The results of cultural and psychological changes from this are known as acculturation [14]. Knowing more on how acculturative stress is linked to depression will help improve the support systems for student's mental health. In the US, findings of research about acculturation are mostly on acculturative stress, psychological adjustment, social belonging, depression, and anxiety [15]. While there are plenty of studies about acculturative stress in general immigrants, the amount of research on international students is still limited. University students suffering more stress have a worse quality of life [16]. The mental health conditions of these particular groups of the population need special attention, especially considering the value they contribute to the host nation as well as the world. Acculturative stress can lead to mental symptoms, but social support can help lessen such effect [17].

The social connectedness is a predictor for depression [18] and acculturative stress [19]. Social connectedness may be the key factor of social support towards understanding more about the problems of both depression and acculturative stress. Worse perceived social support in university students is linked to a higher risk of depression [20]. International students having bigger friendship network with host country people feel more satisfied and socially connected [21]. Perceived social support is one of the main factors act as protection against depression and anxiety [22] and increasing social support from a specific group of people (e.g. friends or family members) can strengthen the sense of coherence in university students (Japan) and help improve their mental health condition [23].

School and teachers also play an essential role in helping international students coping with acculturative stress [24] and can provide advice or suggestions for further professional care to students with depression. A large percentage of educators reported concerns about mental health issues in students and felt that more direct support and training opportunities are necessary [25]. It is essential to know more about the prevalence and mechanisms of depression, acculturative stress and social disconnectedness to improve existing help and support systems from the school or exploring new approaches.

In Japan, the mental health of university students is a serious issue, not only for domestic but also international students. Very high depression prevalence among first-year university students in Japan was reported [26]. Among suicide completers in Japanese universities, only 16.4% were diagnosed as having mental disorders, and only 16% received healthcare services by the university [27]. The number of international student**s** in Japan increased by 45% in 3 years: from 184,155 in 2014 to 267,042 in 2017) [28]. The prevalence of depression of international students in Japan was also very high (41%) [29].

This study examined the associations between (1) depression and acculturative stress, (2) depression and social disconnectedness, and (3) acculturative stress and social disconnectedness in

university students. Although these three essential factors (mental health - depression, acculturation - acculturative stress and social support - social disconnectedness) are related, empirical evidence had not been examined together in previous papers. This study hypothesised that there were existing interconnections among all these three factors. In later sections we explored a possible unified model for such interconnections. The environment of the study site not only provided a case study of a Japanese international university but also allowed examining the effects of the same situation on both domestic and international students. The university has a population of about half domestic and half international student. A mixed culture environment in a conservative country as Japan raised interest to analyse the effects of acculturation in this particular population. Contrary to expectation, domestic students also reported acculturative stress associating with depression and social connectedness. Simultaneously examining domestic students in an international university is a new approach which had not appeared in prior studies.

We discussed the prevalence of depression reported in the sample and several demographic factors. We gave possible explanations for the situation of depression, acculturative stress and social disconnectedness in the unique environment of the university campus, especially about the unexpected findings on domestic students. We also discussed the roles of the university in helping students with such problems, as well as the obstacles to those support services. Actual student's behaviours and school's programs were analysed, providing insights to potential hidden mechanisms which compliment empirical results. As we are aware of the big scope of the topics examined and discussed, recommendations for further research were presented at the end. This paper contributed to building a better and more sustainable environment of higher education primarily for international universities. The youth are the future of the world, and the sustainability of their educational environment is the key to not only their well-being but also to the sustainability of all humanity.

2. Materials and Methods

2.1 Study site

In this study, we selected Ritsumeikan Asia Pacific University (APU), which is situated at Beppu City, Oita Province, as our study area because it was Japan's first truly international university and is currently the most diverse university in Japan in term of international faculty and student [30]. As of 2017, the number of international students and faculties on APU campus consisted of 50.1% of total 5,887 students and 49.4% of 166 faculty members respectively [31]. The diversity of APU is not only shown by the proportion of students and faculties but also their variety of origins. According to official statistics of the university in 2018, international students originate from 86 countries and regions, while the faculty member is from 22 different countries and regions [32]. The diversity of APU gave the study a more general look regardless of origins, whereas the ratio of domestic and international students provides a great chance to study domestic students who were neglected in other studies in the same field.

2.2 Participants

The study collected web-based questionnaires (Google Forms) of 268 students from a variety of countries who are currently studying at APU. 75% of number of participants were international students (N = 201), while domestic students accounted for 25% (N = 67). Participants consisted of 170 females (63.4%) and 98 males (36.6%) with half of them were freshmen or who had been staying in APU within one year. As for language proficiency, around 76% of international students could speak English with high proficiency, whereas most of the native students acquired medium English proficiency and only 20% of them could use English fluently. The rate of international students able to speak the Japanese language fluently was quite low with only 12.6%, and almost half of them informed their Japanese proficiency at a low level. More than half of participants, both domestic and international students, reported that they had no intimate partner at the time filling the questionnaire (Seven participants failed to report whether they had an intimate partner). A higher number of

	Domestic Students			International Students		
	Total (N = 67) Weighted %	Male (N = 25) Weighted %	Female (N = 42) Weighted %	Total (N = 201) Weighted %	Male (N = 73) Weighted %	Female (N = 128) Weighted %
Age						
17-19	28.36	20.00	33.33	35.82	31.51	38.28
20	25.37	40.00	16.67	16.92	10.96	20.31
>20	46.27	40.00	50.00	47.26	57.53	41.41
Length of stay						
Freshman	29.85	24.00	33.33	47.26	45.21	48.44
2 years	19.40	24.00	16.67	19.40	16.44	21.09
3 years	34.33	28.00	38.10	22.89	23.29	22.66
>3 years	16.42	24.00	11.90	10.45	15.07	7.81
English Proficiency						
Low	22.39	20.00	23.81	3.48	2.74	3.91
Average	58.21	60.00	57.14	20.40	15.07	23.44
High	16.42	16.00	16.67	58.71	67.12	53.91
Native	2.99	4.00	2.38	17.41	15.07	18.75
Japanese Proficiency						
Low	1.49	4.00	-	45.27	41.10	47.66
Average	5.97	8.00	4.76	42.29	42.47	42.19
High	1.49	4.00	-	11.94	16.44	9.38
Native	91.04	84.00	95.24	0.50	-	0.78
Intimate partner						
Yes	59.70	60.00	59.52	58.21	60.27	57.03
No	40.30	40.00	40.48	37.81	30.14	42.19
Religion						
Yes	23.88	24.00	23.81	37.31	45.21	32.81
No	76.12	76.00	76.19	62.69	54.79	67.19

international students reported they were religious than domestic students (37.31% compared to 23.88%).

Table 1: Prevalence of depression and ideation of suicide or self-hurting

2.3 Instruments

2.3.1 Measures of Depression

The PHQ-9, a nine-item tool from the Patient Health Questionnaire (PHQ), was used to measure Depression. The questionnaire consists of 9 questions based on the Diagnostic and Statistical Manual for Mental Disorders – 4th edition (DSM-IV) criteria for diagnosis depression. Only with nine questions, the PHQ-9 can be used for dual purposes that diagnosis depressive disorder and grade depressive symptom severity [33]. By asking the participants about the frequency of various symptoms over the past two weeks, people are categorised as a major depressive disorder or other depressive disorder. People are diagnosed positive to major depressive disorder or other depressive disorder if 5 or 2 depressive symptoms respectively present at least "more than half of the days" over the past two weeks, and one of the symptoms need to be depressed mood or anhedonia [34]. Notably,

the symptom "thoughts that you would be better off dead or of hurting yourself in some way" is counted regardless of duration. To estimate the severity of depression, the DSM-IV criteria are scored as "0" (not at all) to "3" (nearly every day) in the PHQ-9, and thus the depressive severity score ranges from 0 to 27. The severity of depression is also categorised into five levels (minimal depression, mild depression, moderate depression, moderately severe depression, and severe depression) based on the score 1-4, 5-9, 10-14, 15-19, and 20-27 accordingly.

The validity of PHQ-9 was tested for correlation with diagnosis by many mental health studies [35,36]. In the original study, Spitzer et al. acquired the validation of sensitivity and specificity at 73% and 98% respectively for significant depression among primary care patients [37]. PHQ-9 was used to measure depression of not only patients but also a wide range of population including international students [35,36,38,39]. The Cronbach alpha measured in our study was 0.81 and 0.80 for international and domestic students respectively, which were acceptable.

2.3.2 Measures of Social Connectedness

The measure of Social Connectedness in this research was the Social Connectedness Scale developed by Lee and Robbins to measure an individual's emotional distance or connectedness between itself and other people [40]. The Social Connectedness Scale consists of 8 items representing three aspects of belongingness: connectedness (4 items), affiliation (3 items), and companionship (1 item). Each item is rated on a 6-point Likert scale ranging from 1 (Strongly Disagree) to 6 (Strongly Agree). A sample is "I feel disconnected from the world around me". The total score is the sum of 8 items, with higher scores indicating higher social connectedness. The potential score of Social Connectedness ranges from 6 to 48.

In the original study of Social Connectedness scale, the internal reliability or coefficient of Cronbach's alpha estimated was 0.91 [40], whereas alpha coefficient in other studies was from 0.83 to 0.93 [19,21,41–43]. The Alpha Coefficient in this study of international and domestic students were similar with 0.95. The construct validity was also supported by the negative association with anxiety and positive association with self-esteem [44] and a negative correlation with acculturative stress [19].

2.3.3 Measures of Acculturative stress

We measured acculturative stress using the Acculturative Stress Scale for International Students (ASSIS) developed by [45]. The ASSIS, a 36-item questionnaire about acculturative stress of international students, covers 7 major factors: Perceived Discrimination (8 items), Homesickness (4 items), Perceived Hatred (5 items), Fear (4 items), Culture Shock (3 items), Guilt (2 items), and Miscellaneous (10 items). Each item is scored on a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). The sum of all 7 major factors represents the total score of acculturative stress. The higher the total score, the higher the degree of acculturative stress international students undergo. However, since our study was conducted on a speaking English campus in a country whose English is not a native language, the survey was modified suitably with the study area. Specifically, based on the item "I feel nervous to communicate in English", we added one more item related to student's Japanese proficiency that "I feel nervous to communicate in Japanese". On the other hand, as the factor related to social connectedness was covered in the SCC, we omitted "I feel intimidated to participate in social activities" to keep the total score from 36 to 180.

In other researches, the alpha coefficient for acculturative stress total score was from 0.92 to 0.95 for international students [19,41,46,47]. In this study, the alpha coefficient was 0.95 for both international students and domestic students, indicating a very high average inter-item correlation. The construct validity of ASSIS was supported by the positive correlation with depression [46,47] and mental health [48], the negative correlation with condom-use intentions [48].

2.4 Procedure

Google Forms was selected as the platform to conduct the questionnaire for this study because of its common and easy management. Then, the questionnaire was distributed in several classes and the Vietnamese community in APU on second and 5th November 2018. We chose the Vietnamese

community as two authors are original from Vietnam. As for in-class questionnaire, 1% bonus grade was given an incentive for students. Participants were noted that doing questionnaire was voluntary and encouraged to do it faithfully. The purpose, content, and confidentiality of the questionnaire were explained carefully in the presentation before we published the survey link on the University's internal network system. Besides, several cases of late participation in the questionnaire were also recorded. The response rates of in-class distribution and in-Vietnamese community distribution were 80.61% (212/263) and 13.79% (56/406).

2.5 Statistical analysis

The statistical analysis of the research consists of two main parts. The first part is for estimating the potential risk factors that can cause depression and ideation of suicide or self-hurting, whereas the second part is to test the association of two predictors (social connectedness and acculturative stress) with the level of depression and frequency of suicidal or self-hurting thought respectively.

The correlations between depression and demographic factors, ideation of suicide or self-hurting and demographic factors were examined to find out potential risk factors. People who tolerated major or other depressive disorder were considered as depressed, while people were tolerating the thought better off dead or hurting themselves were considered as having ideation of suicide or self-hurting. The independent variables are demographic factors such as gender, age, length of stay, language proficiency (both Japanese and English), intimate partner, and religion.

Dichotomous logistic regression was used as a statistical analysis tool for testing the potential risk factors, because of three main points: (1) predetermined number of variables was comprised in the model making it show each variable's significance more clearly; (2) the model can indicate all odd ratios simultaneously between dependent variable and other categories [49]; and (3) Binary logistic regression was widely used in other studies with the same topic [20,36,50,51]. Thus, the examined model with depression and ideation of suicide or self-hurting as dependent variables were presented as follows respectively:

$$\ln(\tfrac{p}{1-p})_{depression} = \ln(Odd\ Ratios)_{depression} = \alpha + \beta_{1j}gender_{1j} + +\beta_{2j}age_{2j} + \beta_{3j}stay_{3j} + \beta_{4j}Eng_{4j} + \beta_{5j}Jap_{5j} + \beta_{6j}partner_{6j} + \beta_{7j}religion_{7j} + e, \qquad (1)$$

$$\ln(\tfrac{p}{1-p})_{ideation} = \ln(Odd\ Ratios)_{ideation} = \alpha + \beta_{1j}gender_{1j} + +\beta_{2j}age_{2j} + \beta_{3j}stay_{3j} + \beta_{4j}Eng_{4j} + \beta_{5j}Jap_{5j} + \beta_{6j}partner_{6j} + \beta_{7j}religion_{7j} + e, \qquad (2)$$

with p: the probability of being depressed / thinking of suicide or self-hurting.

α: intercept

β: coefficient which is the logarithm of Odd Ratios

j: categorical factor of independent variables

gender, academic, etc.: independent variables

e: error term

Models (1) and (2) were applied for both domestic and international students for comparative purpose. However, as no domestic students reported low Japanese proficiency and very few reported average Japanese proficiency, Japanese proficiency variable was omitted when models (1) and (2) were employed on data set of domestic students.

To test our hypotheses, Pearson Correlation Coefficient (PCC) analysis was employed for two reasons: (1) PCC indicates the strength of linear relationship of two variables [52]; and (2) PCC was widely used in studies in the same field [53–56]. According to the Cauchy-Schwartz inequality, PCC (r) has a value between -1 and +1, where +1 indicates total positive linear correlation, 0 indicates no linear correlation, and -1 shows total negative linear correlation [57].

Raw data was edited in MS Excel and saved as CSV files. The data then was transferred into the database of STATA statistical software (version 15.1) to run statistical analysis. STATA statistical software was used to run both dichotomous logistic regression and Pearson Correlation Coefficient.

Additionally, Robust statistics was also comprised in the model for omitting the outliner [58]. The p-value indicated the significance of independent variables in the models. It is conventional to choose p-value <0.05 as a required statistical significance [59].

3. Results

3.1 Descriptive results

According to the PHQ-9, 37.81% of international students and 29.85% of domestic students were found to be positive with depression (see Table 2). The proportion of depressed international students was higher than domestic students by almost 8%. However, while the percentage of international students screened as major depression (14.93%) was lower than who was screened as positive to other depression (22.89%), the proportion of domestic students perceiving major depression (17.91%) was more significant than other depression (11.94%). Among depressed domestic students, there was no difference between males and females. On the other hand, female international students had more rate of depression than male international students.

Of the 67 domestic students and 201 international students, more than half of them received minimal depression or mild depression. More domestic students reported suffering moderate depression or higher, compared to international students. Different from domestic students whose males (44%) underwent moderate depression or more surpassed females (38.09%), depression level of female international students (37.5%) was more severe than that of males (28.77%).

The average rate of students who thought better off dead or hurting themselves was 20.9% and 23.38% for domestic students and international students respectively. Notably, unlike the relatively equal ratio of male and female international students in reporting suicidal or self-hurting thought, there was a considerable disparity between domestic males and females. The number of male students (36%) thought off suicide and self-harming was three times greater than female students (11.09%), even though the frequency of thought was mostly several days. Another significant point was that there were students thought of suicide and hurting themselves nearly every day among both domestic (1.49%) and international students (1.49%).

Table 2: Prevalence of depression and ideation of suicide or self-hurting

	Domestic Students			International Students		
	Total (N = 67) Weighted %	Male (N = 25) Weighted %	Female (N = 42) Weighted %	Total (N = 201) Weighted %	Male (N = 73) Weighted %	Female (N = 128) Weighted %
Type of depression	**29.85**	**28.00**	**30.95**	37.81	34.25	39.84
Other depression	11.94	8.00	14.29	22.89	19.18	25.00
Major depression	17.91	20.00	16.67	14.93	15.07	14.84
Level of depression	**100.00**	**100.00**	**100.00**	100	100	100
Minimal depression	20.90	24.00	19.05	25.37	34.25	20.31
Mild depression	38.81	32.00	42.86	40.30	36.99	42.19
Moderate depression	29.85	32.00	28.57	26.37	20.55	29.69
Moderately severe depression	5.97	8.00	4.76	5.47	4.11	6.25
Severe depression	4.48	4.00	4.76	2.49	4.11	1.56
Suicidal or self-hurting thought	**20.90**	**36.00**	**11.90**	**23.38**	**21.92**	**24.22**
Several days	16.42	32.00	7.14	15.42	15.07	15.63
More than half the days	2.99	-	4.76	6.47	5.48	7.03
Nearly everyday	1.49	4.00	-	1.49	1.37	1.56

Based on the PHQ-9, ASSIS, and SCS, the average total scores of each concept was presented in Figure 1. As can be seen, domestic students (8.61) had higher average stress level compared to that of international students (8.04), but the difference was negligible. The scale of social connectedness of international students and domestic students were almost similar, whereas the result indicated that acculturative stress was perceived more among international students than domestic students.

Figure 1: Depression, social connectedness, and acculturative stress total scores
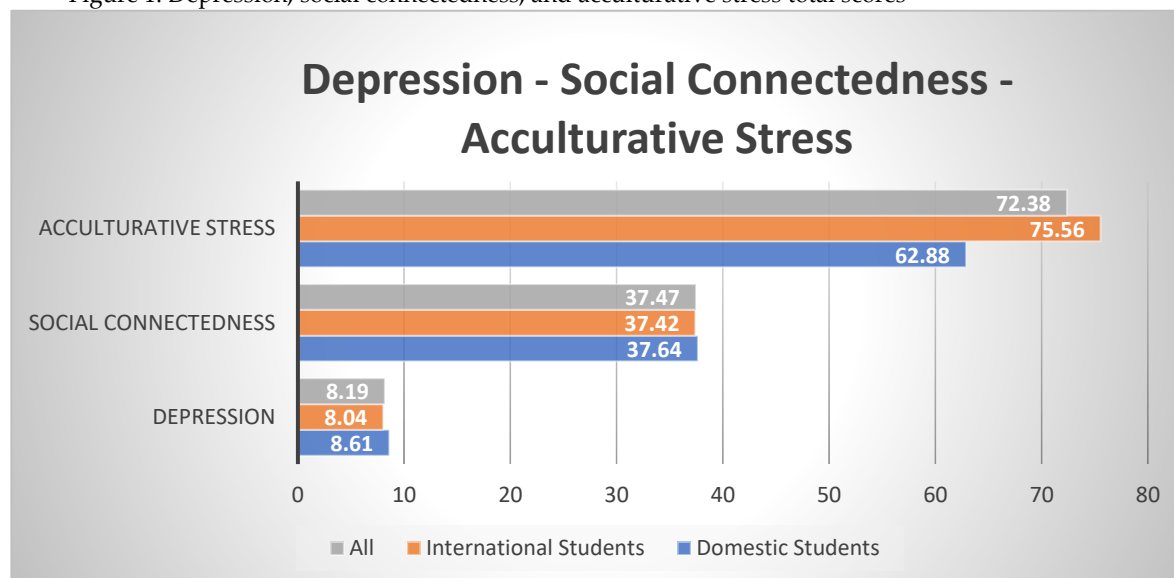
3.2 Main analysis

Utilising dichotomous logistic regression with two dependent variables "depression" and "thought of suicide or self-hurting" against all independent demographic variables, the results were displayed in Table 3. The table indicated the estimated coefficients and the p-value of each variable for both domestic students and international students (with coefficient is the logarithm of Odd Ratio).

The results showed multiple demographic characteristics predicted the depression in domestic students at p-value <0.05, whereas only one potential predictor can be found in international students. Domestic students in the age of 20 were more likely to have depression compared to who aged from 17 to 19 (β = 2.24, ϱ = 0.048). Another predictor of depression for domestic students was English proficiency. People speaking average English had a lower rate of depression than whom acquired low English proficiency (β = -1.63, ϱ = 0.038). On the other hand, the only predictor for international students was the stay length. Living in Japan for three years international students suffered from a higher risk of depression than freshman (β = 1.08, ϱ = 0.032).

Table 3: Coefficient (β) and ϱ-value for predictors of depression and suicidal or self-hurting ideation

	Domestic students				International students			
	Depression		Suicidal or self-hurting thought		Depression		Suicidal or self-hurting thought	
	β	ϱ – value	β	ϱ – value	β	ϱ – value	β	ϱ – value
Gender: Male								
Female	0.24	0.721	-1.57	0.042*	0.05	0.879	-0.01	0.980
Age: 17-19								
20	2.24	0.048*	-0.38	0.744	-0.87	0.129	-1.16	0.097
>20	2.24	0.104	-0.23	0.835	-0.59	0.216	-0.85	0.132
Length of stay:								
Freshman								
2 years	-1.46	0.190	0.99	0.288	0.80	0.103	1.00	0.079
3 years	-2.63	0.063	1.29	0.219	1.08	0.032*	0.53	0.388
>3 years	-2.87	0.096	0.74	0.538	1.04	0.106	1.32	0.073
English Proficiency: Low								
Average	-1.63	0.038*	-0.77	0.349	-0.03	0.968	1.05	0.331
High	-1.33	0.112	-1.50	0.194	-0.27	0.720	0.48	0.654
Native	-	-	1.15	0.461	0.40	0.621	0.84	0.461
Japanese Proficiency: Low								
Average	-	-	-	-	-0.04	0.910	0.07	0.847
High	-	-	-	-	-0.25	0.638	-1.38	0.089
Native	-	-	-	-	-	-	-	-
Intimate partner:								
No								
Yes	0.42	0.549	-0.08	0.949	0.20	0.55	0.15	0.702
Religion: No								
Yes	-0.91	0.255	-0.33	0.759	-0.45	0.180	0.007	0.986

Note: *, and *** are statistically significant at 0.05, and 0.001 respectively

As for predictor of suicidal or self-hurting thought, only one predictor was estimated, and it was gender variable. Compared to female domestic students, males were more likely to think better off suicide or hurting themselves (ϱ = 0.033).

In pairwise correlation analysis (see Table 4 and Table 5), almost every hypothesised relationship was found to be statistically significant at p-value < 0.001 for both international and domestic students, except for the correlation between acculturative stress and suicidal or self-hurting thought. According to the finding, our hypotheses were confirmed that three factors (Depression,

Acculturative Stress, and Social Connectedness) were all correlated in both domestic students and international students. In domestic students, social connectedness had a moderately negative relationship with depression, thought of suicide or self-hurting, and acculturative stress with a coefficient at -0.6, -0.5, and -0.55 respectively. The positive correlation between depression and acculturative stress was confirmed, but it was an only weak relationship (r = 0.42) Besides social connectedness, depression was another factor that positively associated with suicidal or self-hurting thought.

Table 4: Correlational relationship among Depression, Acculturative Stress, and Social Connectedness (Domestic students)

Pearson correlation (domestic student)	1	2	3	4
1. Depression	1.00			
2. Suicidal or self-hurting thought	0.46***	1.00		
3. Acculturative stress	0.45***	0.15	1.00	
4. Social Connectedness	-0.60***	-0.50***	-0.55***	1.00

Note: *, and *** are statistically significant at 0.05, and 0.001 respectively

Table 5: Correlational relationship among Depression, Acculturative Stress, and Social Connectedness (International students)

Pearson correlation (international student)	1	2	3	4
1. Depression	1.00			
2. Suicidal or self-hurting thought	0.58***	1.00		
3. Acculturative stress	0.41***	0.19**	1.00	
4. Social Connectedness	-0.54***	-0.33***	-0.58***	1.00

Note: *, and *** are statistically significant at 0.05, and 0.001 respectively

Surprisingly, the association between acculturative stress and depression in international students was weaker than in domestic students ($r_{international}$ = 0.41 < $r_{domestic}$ = 0.45), although the gap was relatively small. Compared to the dominant impact of social connectedness in domestic students, the level of depression in international students had the strongest positive correlation with the thought of suicide or self-hurting (r = 0.58). Social connectedness in international students only had a weak connection with suicidal or self-hurting thought (r = 0.33). While acculturative stress was statistically significantly associated with suicidal or self-hurting thought, but the Pearson's r coefficient was quite small (r = 0.19, ϱ = 0.008).

4. Conclusion and discussion

4.1 Prevalence of depression

In term of university students, depression rate was reported quite high in Japan. One-third of the total 105 students endorsed possessing mild depression and higher using The Center for Epidemiologic Studies Depression Scale (CES-D) [60]. A study in 2011 based on The Zung Self-Rating Depression Scale (SDS) showed 30% of 2,197 of Japanese dental college students having symptoms of moderate or severe depression [61]. The depression prevalence of domestic students in APU was also around 30%. From these cases, it can be seen that the depression rate of Japanese college students is close to 30.6% of the prevalence of depression among university students indicated in the systematic review [62]

Compared to the depression rate of university students in other countries, the prevalence of depression of APU and Japan, in general, might be lower. A study in India employing the University Student Depression Inventory (USDI) found 53.2% of students being positive to depression [3]. Using Depression Anxiety Stress Scale-21 (DASS-21), 60.8% of Egypt students, 37.2% of Malaysian students, and 33% American students reported having depression [5,9,63]. 41.3% student. Recent research of a

web-based questionnaire of 4330 students at Onsekiz Mart University, using BAPI depression scale showed that 28.25% exhibited symptoms of depression [7]. The differences of depression prevalence in university students among countries might be because different types of questionnaire were used to measure depression (PHQ-9, The Center for Epidemiologic Studies Depression Scale (CES-D) [60], The Zung Self-Rating Depression Scale (SDS) [61], the University Student Depression Inventory (USDI) [3], Depression Anxiety Stress Scale-21 (DASS-21) [5,9,63], and BAPI depression scale [7]). Moreover, the difference might also derive from the other macro-scale, micro-scale and personal-scale factors. Depression can be influenced by a socio-economic background in which the university is located, such as income inequality and cultures [64]. While the micro-scale factors which are living arrangement on campus and academic environment might play an essential role in driving depression [3]. Apart from that, personal activities, beliefs, and issues might also be crucial contributors to depression [3,64].

As for international students, based on the record of students who visited mental health service in Tsukuba University health care, 34% of international students were found to be depressed using [65]. In another study of international students employing The Center for Epidemiologic Studies Depression Scales reported 41% of 480 respondents to be depressed [29]. The depression prevalence of international students in our study was 37.81%. The difference among results might be because of different depression measures. Moreover, the availability of mental health treatment prevention facilities in study sites should also be included. A study of depression prevalence of Chinese International students in the United States showed that 45% of participants were screened positive to depression. This result was higher than other studies in Japan, where most of the international students are Asians [29,65], which suggests later researchers should take the cultural gap between the origin of international students and host country into consideration.

In our study, the gender difference was also found in term of depression. In both international and domestic students, females were more likely to have depression than males. This result is consistent with other studies in various countries [3–5,29]. The gender difference was explained as female students had higher emotional, physiological, and behavioural reactions to stressors [66].

In general, this study provides a depression prevalence based on questionnaires collected from both domestic and international students at APU - a unique environment comprising faculty members and students with the same proportion of half international and half domestic and high variety of origins. These characteristics which contribute to the importance of this study in multiculturally educational environment research.

4.2 Demographic factors associated with depression

Demographic factors as predictors for depression vary based on groups of people. In our study, demographic data such as age, gender, length of stay in a new environment, language and so on, were selected to examine the association with depression for both international and domestic students by using dichotomous logistic regression. Compared to another finding of the depression of international student in Japan [67], we confirmed that age and Japanese language proficiency were not potential predictors of depression for international students in Japan. On the other hand, studies of international students in the United States [68] revealed English proficiency as predictors for depression. Moreover, our study also confirmed English proficiency as the depression predictor for domestic students (β = -1.63, ϱ = 0.038). Besides reasons, such as a high percentage of foreign faculty members and students and mandatory English-based subjects for domestic students, there might be different underlying mechanisms between Japanese and English that Linguistic researchers should be clarified.

However, our findings provided one statistically significant predictor of depression different from [67] in international students. International students in a 3rd year had a higher chance of being depressed compared to freshmen (β = 1.08, ϱ = 0.032). The reasons might come from several sources: (1) 3rd year students in APU need to take major courses which are more difficult than introduction and basic courses in first and second years; (2) the end of 3rd year is the period that students have to think about their career paths; and (3) the process of the acculturation in international students did

not reach outcome of harmony with the host culture, resulting in conflict and stress [69]. Even though not included in the article, our collected data indicated a slight increase in acculturative stress according to the rise of the length of stay. Perhaps, there is not enough time for the acculturation process to complete as it may take a long time (even decades or generations) as in the cases of migrating individuals [69].

On the other hand, there were three demographic factors found statistically significant with depressive disorders in domestic students. First, age was found to be a significant predictor for depression. People aged 20 was found to have more chance to be depressed than people in age 17-19 (β = 2.24, ϱ = 0.048). This finding opposed the finding of international students in Australia, which mentioned the negative relationship between age and depression [70]. The reason might derive from that Japanese teenagers were afraid of becoming adult [71], and when Japanese teenagers become 20, they will be considered an adult after the Coming of Age Day (Seijin no Hi).

4.3 Interconnections among depression, social connectedness, and acculturation

Our results supported the hypothesis of associations among all three factors: depression, acculturative stress and social disconnectedness, making a triangle interconnection (see Figure 2). The characteristics, significances and explanations of the triangle are presented accordingly, from each element to the whole model:

Figure 2: Model of Depression, Social Connectedness, and Acculturative Stress
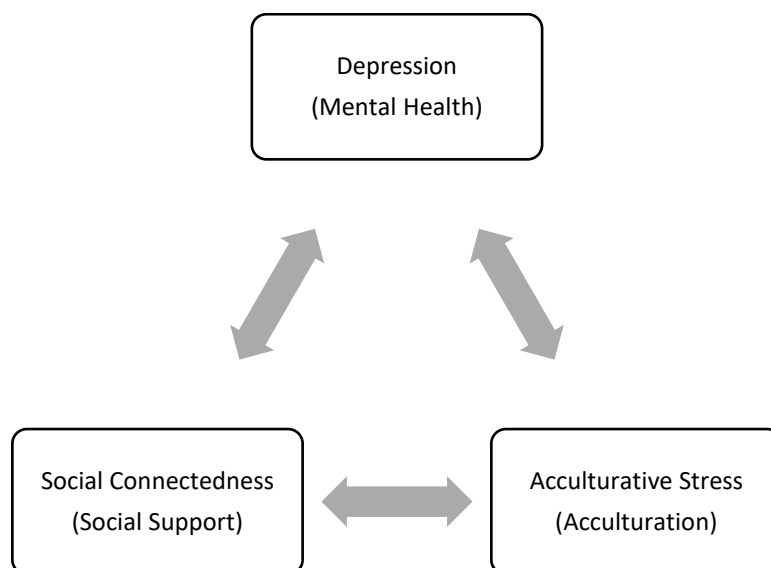
4.3.1 Depression and acculturation

Our results confirmed the positive correlation between depression and acculturative stress in international students (r = 0.41). These results were supported by similar findings from other studies [10–13,46,47]. Acculturative stress happens during the acculturation process as a result of facing various unfamiliar aspects in daily life while individuals try to adapt to the new environment. International students are prone to acculturative stress, especially those coming to a country with more differences (e.g. climate, food, language, race, landscape, culture) [72]. When such stress becomes severe enough to contribute to the chance of depression, it is a severe risk that needs to be prevented. In the other direction, depression might be a barrier to the acculturation process. People who have depressive symptoms, such as depressed mood or anhedonia [34], might face more burdens during the acculturation process, which leads to higher acculturative stress.

Acculturation does not necessarily be the movement towards increasing similarity with host culture but can result in rejection and turn back to own standards. The outcome of acculturation

process can be harmony or conflict [69]. This implies that acculturation does not always make students comfortably accept the new aspects of their lives in the host country. They can adapt by different strategies including rejecting instead of embracing new values, which can result in long-term conflicts. Such continuous conflicts will induce stressful responses over a long period instead of ceasing towards harmony with the new environment. This is a risk to students' mental health since stress, especially when sustained, is very likely a cause of depression [73]. Therefore, to prevent potential risk of mental health and particularly depression, it is important not only to help lessen students' acculturative stress but also to avoid prolonged acculturative stress by ensuring a right direction of adaptation.

4.3.2 Social connectedness as a connection key to the other two factors

The negative associations of social connectedness with depression and acculturative stress were found (r = -0.54 and r = -0.58 respectively). Results of our study support the findings from other papers on the positive influence of social connectedness on depression and acculturative stress. The more students feel connected to the new environment, the less stressful the acculturation is [19]. Social connectedness also lessens the negative impacts of depression directly or indirectly [18], such as through the effects of social support as discussed below. In the other direction, feeling less socially connected also can be the result of depression or acculturative stress.

Regarding psychological constructs in social connectedness, while perceived social support reflects the interactions with the social environment, sense of belongingness deals with issues from within the self [40]. The properties of these concepts imply the impacts on students' social connectedness both from outside environment – changes of social network during acculturation and from properties and status of the self – which is directly related to one's mental health condition. Individuals with low social connectedness do not tend to engage in behaviours that increase their sense of connectedness or even avoid social activities, distancing themselves from other people; thus, they experience even more isolation and psychological distress. On the other hand, individuals with high social connectedness tend to participate in social activities and feel more comfortable to so [74]. Such tendencies may drive people at either end of social connectedness level to reinforce their current condition, meaning those already have low social connectedness will find it even more challenging to receive social support. High social connectedness, on the contrary, may reflect a more satisfied social network and in turn, may help them receive better social support in time of need. Social support offers buffering effects against the association between acculturative stress and mental disorder [17].

The quality of students' social network and how they perceive it are crucial for their mental health, especially when adolescents are more vulnerable to the influence of social connections due to the characteristics of their brain development [75]. International students have three types of friendship: co-national, host-national, and multi-national. All types have their roles in helping students to adapt to the new environment while lessening stress in the process [21]. Through social network - friends, family members, romantic partners and communities or organisations the individual belongs to, students can rely on the mental and physical support during the acculturation process or when feeling depressed.

4.3.3 Unified model of interconnections

According to the results of our analysis, which are aligned with results and theories from other studies, together with the discussions above, we conclude that the three factors of depression, acculturative stress and social connectedness associated with each other. In a broader view, perhaps these interconnected factors partially show the relationships among particular covering aspects of mental health, acculturation and social support.

As the world nowadays is becoming more and more globalised, the number of international students has been increasing rapidly for the last decade [76] By coming to other regions or countries, international students will face acculturative stress when trying to adapt to the new environment. This might lead to mental health problems such as depression. A social network is an essential aspect of a human's life and living apart from home requires students to create a new social network. The

feeling of being connected to the new society is crucial for students to live comfortably in the new environment as well as to ensure their mental well-being. Therefore, the model of interconnections among depression, acculturative stress, and social connectedness can contribute to the study field of sustainable education and society.

4.3.4 Unexpected results in domestic students

Surprisingly, the presence and impacts of acculturative stress were expected to only occur in international students, but it was also found in the case of domestic students. Notably, there were statistically significant associations between acculturative stress and depression (r = 0.45), and between acculturative stress and social connectedness (r = -0.55). The finding, thus, confirmed the model we presented in national samples.

This result might derive from:

1. A high percentage of foreign faculty members and students: Half of the faculty members and half of the students of APU are from foreign countries. The campus is a multicultural environment, and domestic students have a high degree of contact with different races, cultures and languages. Since the environment is different from a regular Japanese campus, domestic students need to adapt to the unfamiliarity and thus have acculturative stress.

2. Many Japanese students came from different provinces around Japan: APU campus is located on a mountain in Beppu city – a relatively small city surrounded by natural landscapes. Students came from other regions of Japan may not feel familiar and comfortable with the local characteristics.

3. Communication difficulty due to language barrier: APU is an international university providing both English courses and Japanese courses. Most international students are taking English-based program, and they are not required to take major subjects taught in the Japanese language. Unlike in international universities of English-speaking countries (e.g. the US), international students in APU do not need high proficiency level of the host country's language (Japanese) to complete the programs. Likewise, domestic students can choose courses taught in Japanese for a majority of the total required credits. There is no highly required mutually used language as in many other cases of international universities. The number of both international students fluent in Japanese and domestic students fluent in English are not high.

4. Mandatory English-based subjects for domestic students: domestic students are required to complete 20 credits of major subjects taught in English for graduation. Students with low English proficiency who struggle with basic communication will face even more pressure with academic English. Adapting to this unfamiliar study environment causes stress similarly to that of acculturation. Even though the total acculturative stress of domestic students was lower than international students (see Figure 1), English proficiency was found to be a predictor of depression only in Domestic students.

5. Co-national social network as inhibitor to acculturation: Similar to international students being too dependent on co-national groups find it harder to adapt to the host country's environment [77] and make friend with host country's students [78], likewise perhaps Japanese students overly depend on Japanese groups also find it harder to adapt to the international university's environment and to make friend with international students.

5. School's support and recommendation

This section will look at examples of support services and policies from APU and provide further recommendations for international universities in a similar situation, especially for countries in which native language is not English. The following part presents counter-measures for general mental health issues and acculturative stress respectively.

Regarding mental health support, APU has a free counselling service for helping students who face difficulties of acculturation and other personal matters. Students can be referred to a professional or specialised institution if needed. The counselling service has clinical psychologists in both genders and languages (English and Japanese). The school's clinic (free healthcare services) also provides

information and support for mental health and especially cares for first-year students' acculturative pressures. However, those services are not active in seeking students in trouble, so students need to initiate and actively seek help to receive support, which can be a problem for those who are already depressed.

There are also mandatory annual health check-ups for students, but they do not cover mental health issues. Hence, mental health issues should also be included in the mandatory annual health check-up for better monitoring. Moreover, we recommend the school's health services to create a close relationship with students' communities. It will be easier to receive information about students in need of professional support.

Regarding acculturation support, APU implements many methods to help first-year students adapt to a new, unfamiliar environment. As acculturation is an important aspect of an international university, there were important research projects and programs from the school on this topic. Such research projects are often collaborations of faculty members, school administrators and students. Examples of some help programs are mandatory Japanese language courses for international students, pre-admission guidebooks, guidance sessions, group-work arrangements, accommodation support, global goods supply, and hosting various student-based support organisations and club activities. Furthermore, acculturation support for domestic students studying in an environment with a high percentage of students from different cultures also needs to be taken into consideration.

There are also other several minor recommendations to increase the effectiveness of the support services mentioned above:

- Creating a warm, close and friendly education environment may encourage students to express their inner feelings more.
- Increasing information exchange that is particularly important for monitoring students' mental conditions.
- Paying more attention to the expectations of international students before coming to a country where English is not a native language, and social structures are unique.
- Empowering community-based activities is a potential bottom-up approach for reducing mental health risks as well as difficulties from acculturation.

6. Limitation and recommendation for further support

This paper has some limitations. In the data collection process, we used convenient sampling and needed to modify the model questionnaire slightly. Findings were based on self-reported measures. Regarding the result on depression, the questionnaire was collected around the beginning of November, when signs of the coming winter were apparent, so depression might also be affected by seasonality, primarily when a large number of students originated from tropical areas. The impacts of seasonality on depression were confirmed in other studies [79,80].

The presented model is still in early development stage. This is only a preliminary idea for studies of international students and mental health. Therefore, the validity of the interconnection model needs to be tested and reviewed by further studies with cases in different regions and countries using larger, diverse and longitudinal samples. Apart from this, there is a need to find out cause-effect relationships among the factors, as well as for qualitative studies to provide more in-depth information. We also recommend a meta-analysis for the mental health of international students in Japan.

Appendix A

From our findings, more than 20% of total students endorsed thinking better off dead or hurting themselves at least several days in the last two weeks before the questionnaire was conducted. While domestic and international students had the same rate of students thinking of suicide or self-hurting

almost every day (1.49%), similar to other findings of [36,81], the number of domestic male students tolerated from ideation of suicide or self-hurting more than female students, the disparity was much more significant as ideation of suicide or self-hurting in domestic males was three-fold higher than in females. The result of logistic regression analysis also indicated gender as the only predictor for ideation of suicide or self-harm (β = -1.52, ϱ = 0.033). The result was interpreted as domestic male students had more potential to think of suicide or self-harm. Causes of this gender difference might be because of: (1) high access rate of Japanese males to suicide sites [82], (2) having been physically assaulted [83].

Additionally, even though the coefficient r was small (r = 0.19), there was a statistical significance of the positive correlation between acculturational stress and frequency of ideation of suicide or self-hurting in international students, which supported findings of similar studies [55,56]

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