DETECTING FEMALE INTERNATIONAL STUDENTS' PARTICIPATION AND SATISFACTION IN HIGHER EDUCATION

Angel Chang[1,*], Cheng-Yi Kang[2] and Dian-Fu Chang[3]

[1]Institutional Research and Strategic Analytics
San José State University
One Washington Square, San Jose, CA 95192, USA
*Corresponding author: hcachang@ucdavis.edu

[2]Doctoral Program in Foresight for Educational Leadership and Technology Management
[3]Department of Education and Futures Design
Tamkang University
No. 151, Yingzhuan Road, Tamsui District, New Taipei City 251301, Taiwan
{ 155984; 140626 }@mail.tku.edu.tw

Abstract. *Studying abroad has become a transformative experience for young adults enrolled in higher education. Many countries view international academic mobility and educational exchanges as critical components for sharing knowledge, building intellectual capital, and remaining competitive in global settings. The issues of recruiting and retaining international students have been addressed in higher education consistently; however, there are few studies exploring female international students. Based on the total quality management (TQM) theory, the study considered student satisfaction a key component for retaining female international students in higher education. This study samples 215 cases in Taiwanese higher education. ANOVA and regression analysis were used to analyze the data. The findings of this study suggest that female international students in undergraduate programs are less satisfied than those in graduate programs. The results reveal that overall satisfaction is the most important factor in student learning for female international students in Taiwan. The design of this study suggests that student satisfaction could be a useful indicator to detect the overall quality of programs.*
Keywords: Female international students, Global mobility, Higher education, Internationalization, Satisfaction, Total quality management (TQM)

1. **Introduction.** Global student mobility for academic, economic, or political purposes has promoted the ease of intellectual exchange in today's world. Many countries view international academic mobility and educational exchanges as critical components of sharing knowledge, building intellectual capital, and remaining competitive in global settings. Studying abroad is a way to foster mutual understanding and cooperation, especially in a climate of increased political uncertainty and unrest [1]. According to a 2021 OECD report, international students preferred disciplines in science, technology, engineering, and mathematics (STEM): one-third of them enrolled in these disciplines in 2019.

There is gender disparity in disciplines such as engineering, manufacturing and construction, arts and humanities, and health and welfare. For example, in engineering, manufacturing, and construction disciplines, 71% of students were male while the remaining 29% were female. As for humanities and arts, 38% of students were male while 62% were female. Also, in health and welfare, 37% of students were male while 63% were female. Moreover, students in Asia are more internationally mobile at undergraduate and master's levels, while European students tend to be more mobile at undergraduate and doctoral

levels [2]. Studying abroad has become a transformative experience for young adults enrolled in higher education. Studying abroad is also seen as a way to improve employability in increasingly globalized labor markets. International student mobility has received increasing policy attention in recent years as it impacts the economic development and educational system in general [2].

Taiwan also attempts to improve the quality and global competitiveness of its higher education programs via global mobility. Global mobility in this study refers to attracting and retaining international students. Many studies have addressed how to attract and retain inbound students in higher education settings while there are few studies superficially about female international students. In view of the limited research in the field, our study intends to focus on female international students in Taiwan's higher education system. The data from the Ministry of Education in Taiwan revealed that the gender ratio among international students has changed in the higher education system; in 2020, there were 52,714 inbound students pursuing degrees. Among these students, 27,948 of them were females, and 24,766 of them were males [3]. The number of female inbound students in higher education will continue to increase in the future [4].

Regarding the changing gender ratio, it is worthwhile to explore the increasing enrollment of female students. After reviewing the previous literature, we found that female international students might be a group worth more studying in higher education settings. Taking Taiwan's higher education as an example, the findings of this study may contribute to the knowledge of the field. Student participation in higher education includes pursuing degrees or enrolling in non-degree programs. In this study, we focus on female international students who pursued degrees in the Taiwanese higher education system.

Student satisfaction could be used to assess international students' campus life [5,6]. Previous studies suggest that satisfaction is a significant indicator to suggest how well international students have adjusted to their new studying environment [6,7]. Fečiková argued that customer satisfaction is the foundation of total quality management (TQM) [8]. TQM theory has been applied to different educational settings in addition to companies in various industries. TQM could be related to policies within companies and educational settings. Policy implementation mechanisms also contribute to customer satisfaction [9]. Customer satisfaction is the most crucial component of TQM quality assurance. TQM practices are significantly and positively related to customer satisfaction and the quality of service customers received [10].

To maintain customer satisfaction, TQM provides benefits in improving the quality of received products. If students feel their needs are met, their level of satisfaction might increase [11]. In this study, we hypothesize that student satisfaction was a key component for retaining female international students in Taiwanese higher education. This study addresses the following research questions.

a) Were female international students satisfied with the quality of degree programs?

b) What are the levels of satisfaction among female international students pursuing undergraduate, master's, and doctoral degrees in Taiwan?

c) Which dimensions of satisfaction could be enhanced based on the results of this current study?

We continue this paper with the method section, which includes the samples, ANOVA, and regression analysis. The results section displays the level of satisfaction among female international students and whether they would recommend their programs to other new students. We conclude this study and provide policy recommendations for the higher education system in Taiwan as well as suggestions and implications for further studies.

2. **Method.** In this section, we introduce the measurement construct of this study, samples, methods, and length of the data collection. We also discuss the rationale of ANOVA and the underlying theory of the regression model in this study.

2.1. **The measurement construct.** According to TQM theory, program quality is based on the high satisfaction of customers. In this study, TQM was assessed by learning, environment, academic inclusiveness, migration policy, and overall satisfaction. Since the population of this study is female international students in Taiwan, we assume that the higher satisfaction of these students in Taiwan, the higher the program quality. Then, if these students are highly satisfied with the program quality, they would recommend their enrolled programs to other new students. The instrument was designed using the 5-point Likert scale. On the scale, 1 represented strongly disagree, 3 represented neutral, and finally, 5 represented strongly agree.

2.2. **Samples.** This study aims to explore the quality of academic programs based on the experience of female international students in Taiwan. To collect such data, the survey was sent to female international students in Taiwan and these students responded to the survey on a voluntary basis. The survey was sent to students enrolled in the program randomly. It belongs to a random sampling survey. The survey collection period is during the COVID-19 pandemic in 2021 and the method was employing an online questionnaire platform. If students felt uncomfortable continuing the survey, they were able to stop responding to the survey immediately. After excluding incomplete questionnaires and students who participated in non-degree programs, the valid sampling population is 215 respondents. Among these 215 students, 30% of them identified as undergraduates, 40.5% of them were master's students, 26.5% of them were doctoral students, and the remaining 3% did not specify. The valid samples showed that most female international students enrolled in health and medical science (40%) and engineering-related programs (30%). The academic majors of the survey participants are shown in Table 1.

TABLE 1. The academic majors of the participants

Academic majors	Frequency	Percent (%)	Cumulative percent (%)
Life science	19	8.8	8.8
Physical & math	10	4.7	13.5
Computer science	9	4.2	17.7
Engineering & technology	65	30.2	47.9
Agricultural & forestry	21	9.8	57.7
Health & medical	86	40.0	97.7
Personal, transport & security services	5	2.3	100.0
Total	**215**	**100**	

2.3. **Analysis of variance.** The software SPSS (statistical package for the social sciences) was used to conduct the data analysis in this study. ANOVA (analysis of variance) was used to analyze the data, particularly the "overall satisfaction" and "recommendation" among students who pursue degrees. We examined whether the sampling population has equal variance before applying ANOVA. Levene's test examined the null hypothesis with samples drawn from populations with equal variance [12]. If the Levene statistic 'based on the mean' has a significance value of $p > 0.05$, then we fail to reject the null hypothesis. Then, we might confirm both assumptions underlying the one-way ANOVA are met.

When conducting multiple analyses on the same dependent variable, the chance of Type 1 error increases, thus increasing the likelihood of obtaining significant results by chance.

To avoid the Type 1 error, a Bonferroni correction is applied. Typically, the researcher can assign a new alpha for the set of dependent variables (or analysis) that does not exceed some critical value: $\alpha_{critical} = 1 - (1 - \alpha_{altered}) k$, where $k =$ the number of comparisons on the same dependent variable [13]. The different means among groups are checked by bootstrapping with 1000 samples to identify their BCa 95% confidence interval (CI).

2.4. **Regression analysis.** The regression analysis is applied to examining whether the underlying theory – TQM – can explain the satisfaction of female international students in Taiwan. In this study, we examine how well the predictors can explain the outcome variable: overall satisfaction. The predictors in the model are learning, environment, academic inclusiveness, and migration policy. In this regression model, satisfaction can be explained by student learning, environment, academic inclusiveness, and migration policy. We assumed that these predictors can explain the level of overall satisfaction among female international students in Taiwan.

The stepwise method was used to select the best-fit model. It also uses the following criteria to enter and remove variables in the model: probability-of-F-to-enter <= .050 as well as probability-of-F-to-remove >= .100. In this study, we calculated the variance inflation factor (VIF) to verify the regressive equation fitted the related assumptions. The formula of tolerance and VIF are listed as follows [14]:

$$\text{Tolerance} = 1 - R_i^2$$
$$\text{VIF} = 1/\text{Tolerance} = 1/\left(1 - R_i^2\right)$$

R_i^2 refers to the square of the regression.

In addition, the estimated standardized residual of the model is examined to see whether the error is independent. Multicollinearity affects the accuracy of the model as the predictors in the regression model are highly correlated to each other. If the model has multicollinearity, it is hard to select the most significant predictor. It will also affect the coefficient estimate of predictors and affect the interpretation of the model. As a result, it might affect the overfitting of the regression model. If the predictors in this study are highly correlated, then we exclude those predictors.

3. **Results.**

3.1. **Analysis of satisfaction.** We calculated the mean and bootstrap of learning, environment, academic inclusiveness, migration policy, and overall satisfaction with the samples. The results show that female international students in Taiwan responded that migration policy ($M = 2.01$) and academic inclusiveness ($M = 3.06$) are the areas that can be improved as the mean scores are lower. The environment is 3.77 which is the highest among all the variables and then overall satisfaction and finally learning. The high mean scores of the later three variables suggest higher satisfaction among female international students in Taiwan.

The bootstrap of overall satisfaction indicated the mean is 3.72, BCa (bias-corrected accelerated) 95% confidence interval shows from 3.60 to 3.81. The mean and standardized deviation of overall satisfaction is robust among samples with bootstrapping. The mean, standardized deviation, and their BCa 95% CI with bootstrapping are shown in Table 2.

3.2. **Test of homogeneity of variance.** Levene's test examines the null hypothesis and whether variables have equal variance. Overall satisfaction refers to the overall satisfaction of female international students in Taiwan while recommendation refers to whether these students recommend their enrolled programs to other new students. The results of Levene's test are shown in Table 3. Thus, we fail to reject the null hypothesis. In this case, both assumptions underlying the one-way ANOVA are met.

TABLE 2. The mean and bootstrap with samples

| | | | Statistic | Bootstrap[a] | | | |
| | | | | Bias | Std. error | BCa 95% CI | |
						Lower	Upper
Learning		N	215	0	0		
		Mean	3.71	.00	.05	3.62	3.80
		Std. deviation	.775	−.002	.038	.709	.840
Environment		N	215	0	0		
		Mean	3.77	.00	.05	3.67	3.86
		Std. deviation	.803	.000	.040	.723	.882
Academic inclusiveness		N	215	0	0		
		Mean	3.06	.00	.08	2.90	3.21
		Std. deviation	1.105	−.003	.039	1.034	1.169
Migration policy		N	215	0	0		
		Mean	2.01	.00	.06	1.90	2.13
		Std. deviation	.800	−.002	.038	.732	.866
Overall satisfaction		N	215	0	0		
		Mean	3.72	.00	.05	3.60	3.81
		Std. deviation	.814	.000	.046	.724	.904

Note. a. Unless otherwise noted, bootstrap results are based on samples.

TABLE 3. Test of homogeneity of variance with satisfaction and recommendation

Test of homogeneity of variance					
Variables	Statistics	Levene's test	df1	df2	Sig.
Overall satisfaction	Based on mean	.903	2	212	.407
	Based on median	.575	2	212	.564
	Based on median and with adjusted df	.575	2	211.778	.564
	Based on trimmed mean	1.268	2	212	.284
Recommendation	Based on mean	2.248	2	212	.108
	Based on median	2.332	2	212	.100
	Based on median and with adjusted df	2.332	2	207.999	.100
	Based on trimmed mean	2.764	2	212	.065

3.3. **ANOVA and group differences.** This section reports whether the mean of overall satisfaction among students enrolled in programs is different and whether they would recommend their programs to other new students. Comparing the mean differences between undergraduates and graduates can show how the level of satisfaction varied. The results reveal overall satisfaction of ANOVA is significant ($p = .000$), while the recommendation is not significant ($p = .561$), as shown in Table 4. It implies that undergraduates and graduate students in master's and doctoral programs may have different levels of overall satisfaction in their study journey. The result reflects the question "Will you recommend others to study your program?", the mean is 3.80 on the 5-point Likert scale. Most female international students are satisfied with the quality of programs and they will recommend new students to join their programs.

Table 5 displays the result of post hoc tests on overall satisfaction among students who pursued undergraduate, master's, or doctoral degrees. The post hoc tests show that female international students in undergraduate programs are less satisfied compared to

TABLE 4. ANOVA results of overall satisfaction and recommendation

Overall satisfaction	Sum of squares	df	Mean square	F	Sig.
Between groups	11.116	2	5.558	9.024	.000
Within groups	130.577	212	.616		
Total	141.693	214			
Recommendation	**Sum of squares**	**df**	**Mean square**	**F**	**Sig.**
Between groups	1.057	2	.529	.580	.561
Within groups	193.343	212	.912		
Total	194.400	214			

TABLE 5. Post hoc results to examine the overall satisfaction among students

Multiple comparisons (Bonferroni)							
Dependent variable	(I) Degree	(J) Degree	Mean (I-J)	Std. error	Sig.	BCa 95% CI Lower	Upper
Overall satisfaction	Undergraduate	Master	−.456*	.126	.001	−.714	−.226
		Doctor	−.518*	.140	.001	−.783	−.271
	Master	Undergraduate	.456*	.126	.001	.213	.733
		Doctor	−.062	.134	1.000	−.298	.199
	Doctor	Undergraduate	.518*	.140	.001	.230	.812
		Master	.062	.134	1.00	−.227	.323

Note. CI = confidence interval; * The mean difference is significant at the 0.05 level.

students who pursued graduate degrees. The satisfaction at the graduate level reveals that there is no significant difference between master's and doctoral programs.

3.4. **Results of regression analysis.** The results reveal that the predictors can explain 68.10% of overall satisfaction in the regression model ($R = .827$, adjusted $R^2 = .681$). According to the results of the stepwise method, the predictors of the regression model are learning and environment satisfaction. The VIF is less than 10, which indicates there is no collinearity issue in this current regression model. Since the standardized error of the estimation was .459, it implied no significance of the error correlated with the testing of Durbin-Watson (DW = 2.132). The normal plot of regression standardized residuals (with observed cumulated probability and expected cumulated probability) is displayed in Figure 1.

The results of the regression model are shown in Table 6. As previously mentioned, predictors that are highly correlated are excluded from the final model. As academic inclusiveness and migration policy are highly correlated, these two predictors are excluded from the final regression model. The results suggest that female international students in Taiwan perceive migration policy might influence their academic inclusiveness during their academic journey.

Learning and environment explained most of the overall satisfaction. These results suggested that most female international students in Taiwan were satisfied with their learning and the environment during their academic journey.

4. **Conclusions.** This study explores the academic journey of female international students in Taiwanese higher education. We found that the overall satisfaction of these students reflected the overall quality of academic programs. The findings suggest that academic inclusiveness and migration policies could be areas to improve overall student satisfaction among female international students in Taiwan. The suggestions may provide strategies for policymakers to improve educational planning to recruit and retain these students.
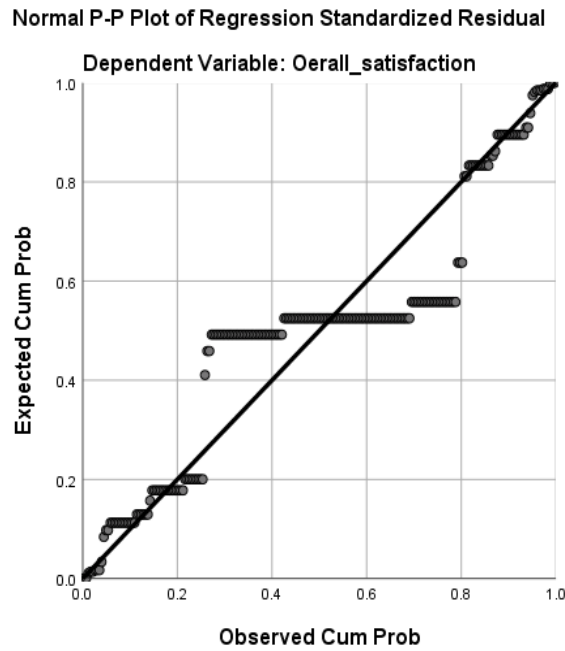
FIGURE 1. The normal plot of regression standardized residuals

TABLE 6. The excluded predictors of the regression model

Excluded variables							
Excluded predictors	B	t	Sig.	Partial r	Collinearity statistics		
					Tolerance	VIF	Minimum tolerance
Academic inclusiveness	$-.023^a$	$-.589$	.556	$-.041$	.985	1.016	.660
Migration policy	$-.078^a$	-1.967	.050	$-.134$	.928	1.078	.649

Note. a. The excluded predictors in this regression model are academic inclusiveness and migration policy.

TABLE 7. The final regression model

Variables in model	Unstandardized coefficients		Standardized coefficients	t	Sig.	Collinearity statistics	
	B	Std. error	Beta			Tolerance	VIF
(Constant)	.123	.171		.723	.470		
Learning	.547	.050	.521	11.046	.000	.668	1.496
Environment	.415	.048	.409	8.667	.000	.668	1.496

Note. Outcome variable: Overall satisfaction; Predictors: Learning and environment

Previous studies suggest that satisfaction could be an indicator to assess the quality of academic programs as well as international students' campus life. According to the TQM theory, the quality of academic programs can be reflected in the level of student satisfaction. Understanding what might contribute to student satisfaction might potentially improve the quality of academic programs. This study found that learning and environment contribute most to student satisfaction. In addition, we also found that the level of satisfaction is different between undergraduates and graduates. Finally, the migration policy and academic inclusiveness are related. The findings of this study could be used

for policy recommendations for improving the experience of female international students in Taiwan.

Since the topic has been little explored in the previous literature, the findings of this study can add to the existing research in the field. This study focuses on student satisfaction; however, we recognize that it might not be the sole factor in student recruitment and retention. For future studies, we encourage including student engagement and academic performance-related factors in the questionnaire.

REFERENCES

[1] R. Bhandari and P. Blumenthal, Global student mobility and the twenty-first-century silk road: National trends and new directions, in *International Students and Global Mobility in Higher Education*, R. Bhandari and P. Blumenthal (eds.), Palgrave Macmillan, New York, NY, USA, 2011.

[2] OECD, *Education at a Glance 2021: OECD Indicators*, OECD Publishing, Paris, France, https://doi.org/10.1787/b35a14e5-en, 2021.

[3] MOE, *Educational Statistics 2021 (International Students Section)*, https://depart.moe.edu.tw/ED4500/cp.aspx?n=1B58E0B736635285&s=D04C74553DB60CAD, 2021.

[4] D.-F. Chang and W.-C. Chou, Mining the diversity of inbound students based on time series analysis, *ICIC Express Letters, Part B: Applications*, vol.13, no.3, pp.287-296, 2022.

[5] D.-F. Chang and W.-C. Chou, Detecting the institutional mediation of push-pull factors on international students' satisfaction during the COVID-19 pandemic, *Sustainability*, vol.2021, no.13, 11405, https://doi.org/10.3390/su132011405, 2021.

[6] A. Salimi, Social-emotional loneliness and life satisfaction, *Procedia – Social and Behavioral Sciences*, vol.29, pp.292-295, 2011.

[7] I. Yalçun, Social support and optimism as predictors of life satisfaction of college students, *Int. J. Adv. Counseling*, vol.33, pp.79-87, https://doi.org/10.1007/s10447-011-9113-9, 2011.

[8] I. Fečiková, An index method for measurement of customer satisfaction, *The TQM Magazine*, vol.16, no.1, pp.57-66, 2004.

[9] J. L. García-Alcaraz, F. J. F. Montalvo, C. Sánchez-Ramírez et al., Importance of organizational structure for TQM success and customer satisfaction, *Wireless Networks*, vol.27, pp.1601-1614, 2021.

[10] K.-B. Ooi, B. Lin, B.-I. Tan and A. Y.-L. Chong, Are TQM practices supporting customer satisfaction and service quality?, *Journal of Services Marketing*, vol.25, no.6, pp.410-419, 2011.

[11] J. Brata and D. Soediantono, Total quality manufacturing (TQM) and recommendations for its application in the defense industry: A literature review, *International Journal of Social and Management Studies*, vol.3, no.3, pp.50-62, 2022.

[12] A. Aljandali, *Multivariate Methods and Forecasting with IBM SPSS Statistics*, Springer, Cham, Switzerland, 2017.

[13] Statistics Solution, *Bonferroni Correction*, https://www.statisticssolutions.com/bonferroni-correction/, Accessed on Jun. 12, 2022.

[14] D. C. Howell, *Statistical Methods for Psychology*, 5th Edition, Duxbury Press, Pacific Grove, CA, USA, 2002.