



Mediating Effects of Academic Stress between Resilience and Academic Achievement: On the University Students majoring in Piano and Vocal Music

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This study finds out the structural relationship among resilience, academic stress, and academic achievement for university students majoring in piano and vocal music and verifies the mediating effect on academic stress between resilience and academic achievement. The subjects of this study are 608 students majoring in piano and vocal music at two universities in Sichuan, China. The SPSS 25 program is used to analyse the reliability and mean difference of resilience and academic stress, and the program is used to analyse the correlation and regression of resilience, academic stress, and academic achievement. In the results of this study, resilience has an explanatory power of about 28% for academic stress and has a negative (-) effect on academic stress. Resilience shows an explanatory power of about 22% for academic achievement and has a positive (+) effect on academic achievement. The explanatory power of resilience, an independent variable, and academic stress, parameter, on academic achievement at the same time is found to be about 22%. At this time, resilience has a positive effect on academic achievement, but academic stress has a negative effect on academic achievement. And academic stress partially mediates the effect of resilience on academic achievement. As can be seen from the partial mediating effect of academic stress between resilience and academic achievement, the higher the student's resilience, the lower the academic stress, which will improve the academic achievement of college students majoring in piano and vocal music. In addition, academic achievement can be improved when increasing the resilience of college students majoring in piano and vocal music. Therefore, in order to further improve the academic achievement of students majoring in piano and vocal music, a method of increasing the resilience of students is required. In future studies related to academic achievement of university students majoring

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in piano and vocal music, it is necessary to further study the structural relationship of academic achievement according to learning motivation and goal orientation.

Introduction

Academic achievement is one of the important indicators of evaluating each student's learning, and each student is evaluated as the result of the learning he/she has obtained (Ling & Wang, 2018). This academic achievement can be understood as an achievement in achieving a specific goal. When good academic achievement is achieved, it promotes students to enjoy learning behavior again, helping them create an atmosphere that makes it easier for them to immerse themselves in learning, and helps them reflect on the learning process (Lin, Liu, & Wang, 2022). Academic achievement includes the degree of student effort and intelligence in the learning process (Felsten & Wilcox, 1992). Academic achievement has elements of educational evaluation and academic evaluation, and its essence is to check whether all of them are suitable for evaluation, promote improvement of academic performance, and help students achieve progress at their original knowledge level (Li, 2018a). Academic achievement is expressed as a qualitative outcome of learning that is influenced by learners' internal motivation, creativity, and personality traits. This academic achievement is a total achievement that reflects not only numerical results such as grades, but also inner passion and creative disposition for learning (Wu & Li, 2010). Academic achievement predicts not only the cross-sectional results of academic performance, but also the processes such as learning attitude, learning method, ability to explore and practice, and ability to cooperate and exchange (Yang & Chang, 2012). In order to achieve good academic achievement, common cooperation between internal and external factors of students is necessary. Here, external factors that influence students' academic achievement include parental support, school environment, and interpersonal relationships, and internal factors include learning commitment, confidence, and achievement goals (Wang, 2017). Students with good academic achievement can have relatively many opportunities for social development, and most of the students who strive for excellent grades pursue continuous pursuit of social dimension, quality of life, and confidence in companionship, and move toward positive individual development (Yang, 2017). The high academic achievement of university students majoring in music had a relatively high level in their performance skills, human relationships, and subjective happiness. This increases human relationships by constantly participating in extracurricular work practice, art competitions, and concerts, and at the same time has a positive effect on individual subjective happiness (Wu, 2013). It was confirmed that high school students with relatively high academic performance also have high confidence (Nja et al., 2022). When students with high academic achievement face various types of studies, they were emotionally stable compared to low students and had relatively high academic execution ability and judgment (Zhou, 2001). The degree of academic achievement of high school students was also related to entering university, and the higher the academic performance, the more challenging they were for themselves, and the more knowledgeable they were in music learning (Wang, 2013).

According to the preceding studies above, students with higher academic achievement showed a positive effect on quality of life, individual development, performance skills, human relationships, subjective happiness, confidence, emotional stability, academic execution ability, challenge, and music learning. Therefore, it will be of great significance to explore the preceding variables that affect academic achievement in order to increase the academic achievement of university students majoring in piano and vocal music through this study.



Among the preceding studies on factors affecting academic achievement, there are studies on resilience and academic stress variables. First, we look at academic stress, and then we look at the effects that academic stress affects academic achievement. Then, we look at resilience, the relationship between resilience and academic stress (or academic achievement).

Academic stress refers to the psychological and physical tension students feel in their academic life (Schraml, 2013). Academic stress is an emotional pressure that students experience while performing tasks or goals required in an academic environment (Zhou & Wang, 2022). Academic stress was defined primarily as tension and anxiety resulting from test preparation and task closing (Li, Li, and Zhang, 2023). Academic stress occurs when students feel heavy academic burden and causes negative emotions such as anxiety and fear of failure. This academic stress can negatively affect students' mental health and academic performance (Gao, 2023). 43.2% of students at Shanxi University had academic stress, which served as a major factor in various psychological discomfort (Shang, 2014). Academic stress was mainly caused by students' frequent tests and academic tasks (Kim, 2015). Factors of academic stress were expressed as factors of studies, human relations, career, and environment. The factors of studies were grades, tests, and classes, and the factors of human relations were the relationship between students and teachers and the relationship between students and families at home. The factors of career path indicated the advancement to higher schools and future jobs. And Environmental factors indicated the surrounding environment of the students, the families, and schools (Kweon, 2007). The anxiety caused by tests, low acquisition grades, poor learning environment, and inefficient study methods were factors of academic stress (Kang & Lee, 2013). Learning motivation, inefficient time management, and economic management were suggested as factors of academic stress (Smith & Vale, 2006). As a result of examining the relationship between academic stress and academic achievement, middle school students with a high level of academic stress had a relatively low academic performance, and this academic stress showed a negative effect on academic achievement. This academic stress lowered students' academic performance by reducing learning immersion time because it causes high tension and mental and physical instability in their daily lives (Li, 2018b). For adolescents in China, the higher the level of academic stress, the more negative the academic achievement was (Hou, 2011). In a study of Chinese high school students, higher academic stress had negative effects on learning motivation and emotional stability (Liu, Li, & Zhao, 2018). Parents' high expectations of academic achievement increased students' academic stress, and this increased academic stress negatively affected academic achievement (Wang, Hu, & Wang, 2020). And piano and vocal university students continue to make efforts for a perfect performance on stage by constantly trying to reduce mistakes in performances and increase the evaluation value of the work in real performances. If they don't get the result of the perfect performance they think, even if the performance went relatively smoothly, stress arises from guilt and dissatisfaction in the final self-evaluation. In addition, most academic achievements in piano and vocal music majors are evaluated as achievements in each performance ability and singing ability (Choi, Kwon, Seog, & Jeong, 2008). In a study of 400 music students, 47% of piano major students and 36% of vocal music students were found to have high academic stress, and their academic achievement was relatively low compared to other students who were less stressed. Their stress was mainly due to the performance and singing ability of academic stress, future anxiety about their jobs, and interpersonal relationships. In addition, 7% of piano major students and 9% of vocal music students want to change their department in consideration of the current academic stress or intend to work in a job other than piano and vocal music after graduation (Hu, 2017). Music university students showed a clear negative correlation between academic stress and academic achievement. This academic stress led to difficulties in performing for piano, vocal music,

and instrumental music majors (Kee & Sung, 2012). In previous studies of resilience, there are studies examining the relationship ‘between resilience and academic stress (or academic achievement)’. Resilience is the ability of a student to effectively avoid emotional problems that appear in adversity and is a measure to maintain coolness in hardship and respond to various threats. It shows an appropriate flexible response, reduces sensitivity to negative emotions, treats life positively, and has a vital element of an optimistic life. Resilience is an individual's protection factor, and it plays a role in transforming itself into an adaptive mechanism by converting negative factors into a driving force for challenge (Liu, 2016a). This resilience had a positive effect on middle school students' academic achievement (Liu, 2016b). In addition, this resilience had a positive effect on college students' life and academic performance (Han, 2016). Resilience is an advantageous protective factor of self-growth, but there is a phenomenon that gradually declines or increases over time depending on the characteristics of students. If they are not exposed to a crisis for a long time, each student cannot trigger resilience, and the level of resilience gradually decreases (Li, 2014). In a study of elementary school students with low resilience, psychological resilience was increased by the self-resilience promotion program. After that, the students to be treated showed a clear decrease in stress of study, friends, and teachers (Jo, 2014). It was revealed that resilience had a negative relationship with stress. Students with low levels of resilience showed a higher level of stress than students with high levels of resilience, even if they had the same experience in the same situation (Solomon, 2014). The control and activity of resilience showed a negative correlation with academic stress, where each degree of control and activity helped students actively cope with problems even in difficulties and improved other negative problems (Lee & Lee, 2018). For music major students, it was shown that the increase in resilience effectively controls the increase in stress. Although competition among students in each field in the music department is severe, students with high resilience have been optimistic about the situation to overcome fierce competition (Zhu, 2020). As a result of conducting an eight-week collage music therapy program for university students of music department, resilience improved from four weeks after the experiment, and from eight weeks later, academic achievement in the music subject improved significantly. This was because academic achievement in the subject was improved due to the progress of resilience (Wen, 2014). The resilience of art major students had a positive effect on academic achievement, cognitive factors, and optimistic emotional factors. It was confirmed that resilience promotes each student's academic achievement by stimulating the student's learning motivation (He, 2019).

Based on the preceding studies mentioned above, it is necessary to study the causes of stress and academic achievement of university students majoring in piano and vocal music in relation to resilience. If the academic achievement of piano and vocal music students is not good, future job difficulties are expected in the future. Therefore, in order to improve academic achievement, it is first necessary to understand the degree of resilience and stress of piano and vocal music major students. Nevertheless, research on resilience and stress for academic achievement of piano and vocal music major students in China (relational studies of three variables) have not yet been found. Therefore, this study explores the relationship of resilience and stress that affects academic achievement in university students majoring in piano and vocal music at two universities in Sichuan Province. And we would like to verify whether academic stress acts as a partial or complete parameter between resilience and academic achievement.

In order to achieve the above research purpose, the following research problems are raised.



- (1) The resilience of university students majoring in piano and vocal music will affect academic stress.
- (2) The resilience of the students majoring in piano and vocal music will affect academic achievement.
- (3) Academic stress of the students majoring in piano and vocal music will affect academic achievement.
- (4) Academic stress will serve as a parameter between resilience and academic achievement of the students majoring in piano and vocal music.

Method

Research Design

This study establishes a mediation model of academic stress on resilience and academic achievement based on the preceding studies in the introduction to explore the structural relationship of resilience, academic stress, and academic achievement for university students majoring in piano and vocal music. In order to verify the mediating effect of academic stress in the relationship between resilience and academic achievement, regression analysis is conducted according to the order of the methods proposed by Baron & Kenny (1986).

Research Subjects

In this study, a questionnaire and academic achievement were surveyed on 700 students majoring piano, and vocal music at S and SM, two representative universities of in Sichuan Province, China, from September 10 to September 19, 2022. This survey was conducted by Wenjuanxing, a Chinese professional survey company. As a result of examining 639 copies of the collected data, 608 questionnaires were effectively used for the final analysis, excluding 31 copies of the questionnaire that were unfaithfully written and the questionnaire that was omitted. The participants used in the final analysis were 214 male students (35.2%) and 394 female(64.8%), and according to grade, 140 first-year students(23.0%), 165 second(27.1%), 198 third(32.6%), and 105 fourth(17.3%). The population of this study is university students majoring in piano and vocal music in the music department of Sichuan Province.

Research Tools and Procedures

Resilience

The resilience used in this study is based on the measurement tools of Shin, Kim, & Kim (2009), and the resilience consists of a total of 27 questions, 9 questions for each controllability, proactivity, and sociality. In this study, as a result of the first confirmative factor analysis to confirm the validity of the resilience variable and the suitability of the factor structure, the controllability, proactivity, and sociality, which are the sub-variables of resilience are composed of 9, 9, and 9 questions.

Academic Stress

The scales of Academic stress are based on the measurement tools of Bak & Park (2012), and academic stress consists of a total of 30 questions, 10 questions for each study,

class, and score stress. In this study, as a result of the first confirmative factor analysis to confirm the validity of the academic stress variable and the suitability of the factor structure, the stress of study, class, and score, which is sub-variables of academic stress, is composed of 10, 10, and 10 questions.

Academic Achievement

The weights ratio of the scores for each item to evaluate academic performance are as shown in Table 1. Academic achievement is represented by the grades obtained in a first-quarter test of the semester right after the previous questionnaire survey for piano and vocal major, from total 14 classes consisting of 50 students each. These grades are classified into five levels ranging from 1st (low group) to 5th (high group) based on Stanines classification, with 4% of the 1st grade being classified as low, 19% of the 2nd and 3rd grades as mid-low, 54% of the 4th, 5th, and 6th grades as mid, 19% of the 7th and 8th grades as mid-high, and 4% of the 9th grade as high. Meanwhile, as shown in Table 2, the reliability values for each sub-variable of resilience and academic stress were above .827, indicating good reliability. All measurement tools used a 5-point Likert scale consisting of ‘not at all’, ‘rarely’, ‘sometimes’, ‘often’, and ‘very often’. Based on the skewness values in Table 2, it can be determined that the data from this study has normality as they are less than 1.6 and greater than -1.5. Furthermore, all kurtosis values are less than 2.7, indicating that the data from this study also has normality. (Jiang & Ko, 2022).

Table 1. The weight ratio of scores for each item to evaluate academic performance

Key Concept	Evaluation Area	Achievement Standards	Evaluation Content	Score Weights for Each Item(%)
Basic Performance or Basic Vocalization	Piano	Performance of a Piece according to Musical Signs	Basic Performance Skills	60
	Vocal Music	Vocalization of a Song according to Musical Signs		
Understanding and Expression of a Work	Piano	Expressiveness of a Work by Performance	Expression of a Work by Performance	35
	Vocal Music	Expressiveness of a Work by Vocal Music	Expression of a Work by Vocal Music	
Stage	Piano	Performance on the Stage	Stage Costume Manners and Control of the Stage	5
	Vocal Music	Performance on the Stage	Stage Costume Manners and Control of the Stage	
Total				100

Table 2. Number of items, descriptive statistics, and reliability of resilience and academic stress

Variable	Sub-variable	Number of Questions	Min. Value	Max. Value	Ave.	SD	Skewness	Kurtosis	Cronbach's Alpha Value
Resilience	Controllability	9	1.10	4.90	3.17	.48	.92	1.82	.919
	Proactivity	9	1.15	4.87	3.28	.48	.91	1.92	.953
	Sociality	9	1.13	4.94	3.08	.49	.92	1.72	.948
Academic Stress	Study	10	1.16	4.55	3.06	.49	-.61	1.83	.925
	Class	10	1.21	4.63	2.96	.49	-.64	1.63	.827
	Score	10	1.24	4.72	2.76	.48	-.64	1.93	.959



Data Analysis

The data from this study Measurement data are analysed using the SPSS 25.0 program. The main analysis process is as follows. Reliability of each Resilience and academic stress is confirmed through the Cronbach's alpha value. Descriptive statistics for each variable of resilience and academic stress are obtained. And correlation analysis is performed between each of these variables and academic achievement. And to find out how much resilience and academic stress affect the academic achievement of university students majoring in piano and vocal music, simple regression analysis of academic achievement (dependent variable) according to resilience (independent variable) is conducted, and multiple regression analysis of academic achievement (dependent variable) according to each sub-variable of resilience, controllability, proactivity, and sociality (independent variable) is performed. And simple regression analysis on academic achievement according to academic stress is conducted, and multiple regression analysis on academic achievement according to each sub-variable of academic stress, such as study stress, class stress, and score stress is performed. To explore the mediating effect of academic stress between resilience and academic achievement, a simple regression analysis of academic stress (dependent variable) according to the average value of controllability, proactivity, and sociality, which (independent variables) are each sub-variables of resilience is conducted. A simple regression analysis of academic achievement according to resilience is conducted, and multiple regression analysis of academic achievement according to resilience and academic stress is performed.

Results

Correlations of the Variables

To verify the relationship among resilience, academic stress, and academic achievement, correlation analysis is conducted (Table 3). Each controllability, proactivity, and sociality, which are sub-variables of resilience, has a negative correlation with study stress ($r=-.454, -.429, -.526$, class stress ($r=-.428, -.527, -.538$), and score stress ($r=-.545, -.540, -.628$), which are a sub-variable of academic stress. But each controllability, proactivity, and sociality, which are sub-variables of resilience, has a positive correlation with piano score ($r=.498, .491, .488$) and vocal music ($r=.491, .482, .482$). In addition, resilience (total) had a negative correlation with academic stress (total) ($r=-.530$), but a positive correlation with academic achievement (total) ($r=.474$). Each study stress, class stress, and score stress, which are sub-variables of academic stress, has a negative correlation with piano score ($r=-.418, -.418, -.430$) and vocal music ($r=-.409, -.413, -.422$), which are a sub-variable of academic achievement. Academic stress(total) has a negative correlation with academic achievement (total score of piano and vocal music) ($r=-.432$).

Table 3. Correlation matrix of resilience, academic stress, academic achievement, and each sub-variable.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	
RE	RE(1)	1										
	CO(2)	.449**	1									
	PRO(3)	.425**	.585**	1								
	SO(4)	.548**	.566**	.557**	1							
AS	AS(5)	-.530**	-.476**	-.543**	-.443**	1						
	SS(6)	-.608**	-.454**	-.429**	-.526**	.580**	1					
	CS(7)	-.404**	-.428**	-.527**	-.538**	.551**	.446**	1				
	SCS(8)	-.504**	-.545**	-.540**	-.628**	.664**	.458**	.558**	1			
AA	AA(9)	.474**	.496**	.488**	.487**	-.432**	-.415**	-.416**	-.427**	1		
	PT(10)	.476**	.498**	.491**	.488**	-.435**	-.418**	-.418**	-.430**	.497**	1	
	VT(11)	.470**	.491**	.482**	.482**	-.426**	-.409**	-.413**	-.422**	.497**	.487**	1

※ Resilience: RE, Controllability: CO, Proactivity: PRO, Sociality: SO, Academic Stress: AS, Study Stress: SS, Class Stress: CS, Score Stress: SCS, Academic Achievement of Average Values on Piano and Vocal Music Test Result: AA), Piano Test Result: PT, Vocal Music Test Result: VT. **p≤.01 level(two tailed).

Resilience, Academic Stress, and Academic Achievement by Gender and Grade

As a result of independent sample t-verification (or a one-way distribution analysis F-verification) for resilience, stress, and academic achievement by each gender and grade at the level of p≤.05, there is a significant difference in study stress, class stress, and score stress by only grade, and it is confirmed that stress increases as the grade increases.

Table 4. Analysis of the average difference of resilience, stress, and academic achievement by demographic variables of resilience, academic stress, academic achievement, and each sub-variable.

Demographic Variable	Category	Resilience (M±SD)			Academic Stress (M±SD)			Academic Achievement(M±SD)	
	T(or F)	CO	PRO	SO	Study	Class	Score	PT	VT
	p value								
Gender	Male	3.18 ±.40	3.28 ±.47	3.10 ±.43	3.07 ±.47	2.96 ±.41	2.75 ±.45	3.29 ±.47	3.19 ±.43
	Female	3.17 ±.46	3.28 ±.43	3.08 ±.42	3.05 ±.41	2.96 ±.40	2.76 ±.47	3.29 ±.40	3.20 ±.42
	t	.164	-.033	.520	.321	-.015	-.352	.184	.179
	p	.870	.973	.604	.748	.988	.725	.854	.858
Grade	Freshman	3.15 ±.44	3.24 ±.47	3.03 ±.48	2.84 ±.36	2.88 ±.40	2.62 ±.43	3.30 ±.38	3.20 ±.46
	Sophomore	3.22 ±.48	3.28 ±.46	3.15 ±.40	2.97 ±.47	2.92 ±.41	2.73 ±.42	3.29 ±.46	3.19 ±.42
	Junior	3.11 ±.48	3.22 ±.44	3.01 ±.45	3.08 ±.44	2.94 ±.43	2.77 ±.40	3.26 ±.46	3.19 ±.44
	Senior	3.18 ±.42	3.27 ±.46	3.08 ±.44	3.18 ±.43	3.09 ±.45	3.00 ±.43	3.29 ±.40	3.17 ±.41
	F	.772	.933	.966	2.36*	2.98*	3.31*	.095	.091
	p	.210	.424	.409	≤.05	≤.05	≤.05	.866	.963

* p≤.05 level

Regression Analysis of Resilience and Academic Stress on Academic Achievement

A regression analysis is conducted to find out the degree of explanatory power of each resilience and academic stress that affects academic achievement (piano, vocal music), and to see explanatory power of resilience that affects academic stress, as shown in Table 5. In the case of the regression model (Model 1), which includes only resilience as a predictor, the effect of each sub-variable of resilience on academic achievement is analyzed, and each sub-



variable of resilience explains 25% of the total variable of academic achievement. At this time, the value of the beta coefficient (β) is found to be .52, .47, and .47 respectively in controllability, proactivity, and sociality. In the case of the regression model (Model 2) using only academic stress as a predictor, as a result of analyzing the effect of academic stress on academic achievement, academic stress explains about 19% of the total variance of academic achievement, and the value of β is -.43. In the case of the regression model (Model 3), which includes 'sub-variables of resilience' and academic stress as predictors, their predictors explain 22% of the total variance of academic achievement. At this time, the values of β are .52, .49, .48 and -.43, respectively, in controllability, proactivity, and sociality, and academic stress. In the case of the regression model (Model 4), which includes only resilience as a predictor, the effect of each sub-variable of resilience on academic stress is analyzed, and each sub-variable of resilience explains 29% of the total variable of academic stress. At this time, the values of β are .52, -.54, and -.47, respectively, in controllability, proactivity, and sociality.

Table 5. Regression analysis of dependent and predictive variables.

Dep. Var.	Pred. Var.	B	SE	β	p	R ²	F	p	
Academic Achievement	Controllability	.51	.03	.52	$\leq .05$.25	166.2	$\leq .05$	
	Proactivity (Model 1)	.46	.04	.47	$\leq .05$				
	Sociality	.48	.03	.47	$\leq .05$				
	Academic Stress (Model 2)	-.41	.01	-.43	$\leq .05$.19	258.9	$\leq .05$	
	Academic Stress	Controllability	.49	.03	.52	$\leq .05$.22	176.5	$\leq .05$
		Proactivity (Model 3)	.47	.03	.49	$\leq .05$			
		Sociality	.46	.03	.48	$\leq .05$			
Academic Stress		-.42	.01	-.43	$\leq .05$				
Academic Stress	Controllability	-.50	.02	-.52	$\leq .05$.29	195.9	$\leq .05$	
	Proactivity (Model 4)	-.55	.02	-.54	$\leq .05$				
	Sociality	-.45	.02	-.47	$\leq .05$				

※ Dependent Variable: Dep. Var., Predictive Variable: Pred. Var.

Mediating Effect of Academic Stress between Resilience and Academic Achievement

In order to verify the mediating effect of academic stress in the relationship between resilience and academic achievement (piano, vocal music), a hierarchical regression analysis is conducted as shown in Table 6 in the order of the method proposed by Baron & Kenny (1986).

Table 6. Mediating effect of academic stress between resilience and academic achievement

	Dep. Var.	Pred. Var.	B	SD	β	p	R ²	F	p
Step 1	Academic Stress	Resilience	-.58	.03	-.53	$\leq .05$.28	285.5	$\leq .05$
Step 2	Academic Achievement	Resilience	.42	.01	.47	$\leq .05$.22	275.8	$\leq .05$
Step 3	Academic Achievement	Resilience	.38	.02	.40	$\leq .05$.22	188.1	$\leq .05$
		Academic Stress	-.34	.01	-.35	$\leq .05$			

In this study, in order to understand the mediating effect of academic stress, a regression

analysis of the effect of resilience, an independent variable, on academic stress, which is a parameter, in step 1 explained about 28% of the total variance of academic stress. At this time, the value of the beta coefficient (β) is $-.53$. In step 2, the independent variable, resilience, is predicted to have about 22% of explanatory power about academic achievement, which is a dependent variable (value of β : $.47$). In step 3, academic stress significantly predicts academic achievement (value of β : $-.35$) in a regression analysis on the effect of 'resilience as an independent variable and academic stress as a parameter at the same time' on academic achievement. And the effect of resilience, an independent variable, on academic achievement is significantly reduced (value of β : $.47 \rightarrow .40$). Meanwhile, the smaller the effect of resilience, the remaining independent variable, on academic achievement, after controlling the effect of academic stress in Table 6, the greater the mediating effect, and when the effect reaches zero, it can be said that it has a complete mediating effect. (Kenny, 2001). And when calculated by the method proposed by Sobel (1982) by using the data in Table 6, the Z value is -13.56 ($p \leq .05$).

Therefore, based on the above findings, we can confirm that the mediating effect of academic stress influences the effect of resilience on academic achievement, thereby reducing the direct effect of resilience on academic achievement (in Table 6). And as a result of the Sobel test, it is confirmed that academic stress partially mediated between resilience and academic achievement.

Conclusions and Implications

In this study, the correlation and regression analysis of the study subjects were conducted to verify the mediating effect of academic stress between resilience and academic achievement of university students majoring in piano and vocal music in the department of music. In the correlation analysis, each sub-variable of resilience showed a negative (-) correlation in the relationship with each sub-variable of academic stress, but a positive (+) correlation in the relationship with each sub-variable of academic achievement. This explains the relationship that students with high resilience may have lower academic stress and higher academic achievement. As a result of regression analysis, controllability ($\beta = .52$) in the effect of controllability, proactivity, and sociality, which are each sub-variables of resilience, on academic achievement had the most positive effect on academic achievement. Among the factors related to controllability, proactivity, and sociality of resilience, controllability was the factor that had the greatest effect on academic achievement on university students majoring in piano and vocal music. Therefore, it is judged that controllability should come first for university students majoring in piano and vocal music to improve their academic achievement. The results of this can be said to be in the same context as the results of 'the higher the resilience, the higher the academic achievement' (Li & Zhang, 2020) in 400 Chinese middle school students under difficult family environments and social stress. In a study of 350 Chinese university students, students with high resilience tended to have higher academic achievement than those with low resilience even in high-stress situations (Yang & Liu, 2023). In the study of Li & Zhang (2020) and Yang & Liu (2023), it was not revealed how the sub-variables of resilience identified in this study affect academic achievement. A survey of 250 Chinese adolescents with high academic achievement on the factors affecting academic achievement confirmed that resilience is an important cause (Chen & Wu, 2022). Chen & Wu's study is the result of a study that estimated independent variables with dependent variables, unlike this study. In any case, Chen & Wu's study conclusion is that resilience acts as a predictor of academic achievement. Therefore, their prior research also confirmed that resilience had a positive effect on academic achievement. In the effect of



controllability, proactivity, and sociality, which are each sub-variables of resilience, each negatively affected academic stress ($\beta = |-.54|$, $|-.52|$, $|-.47|$) in the order of proactivity, controllability, and sociality. This shows that the more social students majoring in piano and vocal music, the less academic stress, and the more active students, the higher the academic stress. Therefore, in order to relieve the stress of university students majoring in piano and vocal music, it is thought that the school needs to change its perception and actively help create an atmosphere where students can collaborate rather than compete in studies. This result comes together in context with the results of 1,200 Chinese healthcare workers, which showed that the higher the sub-variables of resilience, endurance, toughness, and optimism, the lower the psychological stress (Tang & Zhang, 2022). In a study of 500 Chinese adolescents, the higher the resilience, the lower the level of stress and anxiety (Wang, Li, & Zhao, 2019). A study by Tang & Zhang (2022), Wang, Li, & Zhao (2019) did not reveal how sub-variables of resilience affect academic stress, as stated in this study. Therefore, their prior research also confirmed that resilience had a negative effect on academic stress. Each sub-variable of resilience, 'controllability, proactivity, and sociality' and academic stress simultaneously affected academic achievement in the order of controllability, proactivity, sociality, and academic stress. ($\beta = |.52|$, $|.49|$, $|.48|$, $|-.43|$). It is found that each controllability, proactivity, and sociality, which are sub-factors of resilience, have a greater effect than academic stress in the academic achievement of university students majoring in piano and vocal music. In order to achieve good academic achievement of university students majoring in piano and vocal music, it is confirmed that more attention and direction should be paid to cultivating factors of resilience rather than factors of relieving academic stress. On the other hand, as stated in this study, previous studies in China did not conduct multiple regression analysis on the effects of resilience and academic stress (independent variable) on academic achievement (dependent variable). In a longitudinal study of 500 Chinese university students, 'Analysis of the Effects of Academic Stress and Resilience on Academic Achievement of University Students,' academic stress negatively affected academic achievement, and resilience alleviated the negative impact of academic achievement (Liu & Zhang, 2021). In 'the effect of resilience and academic stress on students' academic achievement' on 300 Chinese high school students (Zhou & Lee, 2020), it was concluded that the higher the resilience, the more academic stress was alleviated, and that this relaxation improved academic achievement. Therefore, their prior research also confirmed that resilience has a positive effect on academic achievement, and academic stress has a negative effect on academic achievement. Finally, it is confirmed that the academic stress of university students majoring in piano and vocal music in the department of music partially mediates the effect of resilience on academic achievement ($Z = -13.56$; $p \leq .05$). Therefore, it is judged that in order to improve the academic achievement of university students majoring in piano and vocal music, university members need to find factors to improve resilience, which is the fundamental cause of 'academic stress and academic achievement' rather than trying to reduce factors to remove academic stress. Therefore, through previous studies, we would like to find ways to improve each individual's resilience for university students majoring in piano and vocal music. In a study of strategies to increase individual resilience of 1,743 university students in Shandong Province of China, Zhang (2020) examined the relationship between resilience and positive coping styles and said that psychological education programs that strengthen the positive minds of university students are required to increase resilience. In the Li (2019) study of 28 health-related college students, life experience, social and economic factors, personal attributes, resource support, and role modeling played an important role in resilience. So, the university suggested that it is necessary to strengthen resilience through training, mentoring, and extracurricular activities of each university student. Chen (2018) found that there are

various ways to improve resilience from a psychological and biological perspective through literature research on strategies for improving resilience. So, he suggested that the development of psychological and cognitive treatments is necessary to strengthen resilience. And in a case study of improved resilience among workers in the public health system, Liu (2022) confirmed that the use of digital tools, strengthening multi-sector partnerships, and community engagement have a positive effect on resilience. Therefore, to increase the resilience of college students majoring in piano and vocal music, which are the subjects of this study, as stated in the preceding studies above, it will be possible through psychological education programs that strengthen positive minds, accumulation of life experiences, development of social and economic factors, personal attributes development, resource support promotion and role modeling selection, psychological and cognitive therapy development, multi-sector partnership reinforcement, and community participation.

Limitations and Future Direction for Research

Although the results of this study provided practical knowledge and theories on the relationship among resilience, stress, and academic achievement, they still have the following limitations.

This study had limited conditions to generalize this study to the population of universities in the entire region of China, with only the subjects of the study consisting of students from two universities in Sichuan Province, China. There was an imbalance in the gender distribution of participants, and it can be a problem for sampling methods when trying to generalize the results of this paper to other populations. And it is possible that academic achievement will not reflect the participants' actual performance as it is displayed only as grades obtained from the first quarter of the semester immediately after the survey.

The values of learners' resilience and academic stress variables will also be greatly influenced by the social and cultural environment of each ethnic group in China. Therefore, in future studies, it will be necessary to study the relationship between resilience, academic stress, and academic achievement according to each ethnic group in China. This study did not consider academic achievement according to the learning motivations and goal orientation of university students majoring in piano and vocal music. So, in future studies of academic achievement, it will be necessary to further study the structural relationship of academic achievement according to the learning motivations and goal orientation of university students majoring in piano and vocal music. Furthermore, as in this study, it will be necessary to study the relationship among resilience, academic stress, and academic performance for university students majoring in instrumental music, not university students majoring in piano and vocal music.

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