ORIGINAL RESEARCH

# Undergraduates' Negative Emotion and Academic Procrastination During COVID-19: Life Autonomy as a Mediator and Sense of School Belonging as a Moderator

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**Introduction:** This study aims to investigate the impact of COVID-19 on undergraduate students' academic procrastination and negative emotions. It seeks to examine the relationship between negative affect and academic procrastination among university students, considering the mediating role of life autonomy and the moderating effect of a sense of school belonging.

**Methods:** The study sample consisted of 776 university students from the Guangxi Zhuang Autonomous Region, China. Data collection involved the use of the Negative Affect Scale, Academic Procrastination Scale, Life Autonomy Scale, and Sense of School Belonging Scale. SPSS version 26.0 and PROCESS V3.5[80] to conduct relationship analysis, test the mediation model (model 4) and the moderated mediating model (model 7).

**Results:** The findings revealed significant relationships among the variables. Negative emotions were negatively related with life autonomy and sense of school belonging, and positively related with academic procrastination. Academic procrastination showed a negative correlation with both life autonomy and sense of school belonging. Sense of school belonging exhibited a positive relationship with life autonomy. The study also identified life autonomy as a mediator in the relationship between negative emotions and academic procrastination. Additionally, the sense of school belonging moderated the initial segment of the negative emotion-life autonomy-academic procrastination pathway.

**Discussion:** This study contributes to a better understanding of the association between negative affect and academic procrastination. It highlights that negative emotions have a direct and indirect influence on academic procrastination through the mediating role of life autonomy. Moreover, the moderating role of sense of school belonging suggests that the relationship between negative affect and life autonomy is stronger when the sense of school belonging is weaker.

**Keywords:** negative emotions, academic procrastination, undergraduates, life autonomy, school belonging

## Introduction

In 2020, the World Health Organization declared the outbreak of COVID-19 infection a global public health emergency.[1] The rapid spread of the disease, coupled with enforced lockdowns and quarantine measures, caused significant havoc to people's lives and property.[2] This resulted in enormous strain on the mental health of the general population. Especially during the pandemic, US students engaged in self-directed learning while schools were closed, resulting in challenges or difficulties in their studies and lives[3], which was also confirmed in university student surveys in the United Kingdom[4] and Canada.[5] Many university students experienced more mental health problems during the pandemic[6] as they were deeply affected by the restrictions put in place during the pandemic; at times, they were overwhelmed by negative emotions.[7] Their lack of maturity in mental development and inexperience in coping with challenges of the post-pandemic academic life probably made them more prone to internal trauma and stress reactions such as panic and anxiety.[8] A study of 3881 university students showed that negative emotion increased significantly in the period following the acceptance of the inevitable change of lifestyle during

COVID-19, with the prevalence of negative emotion before and during the epidemic being 21.16% and 26.6%, respectively.[9] Therefore, it is important to investigate the impact of the pandemic on the emotional state of university students.

The Covid-19 outbreak had been found to trigger negative psychological reactions, especially negative emotions, akin to being trapped in an unpleasant emotional activation situation.[10] A somewhat similar situation occurred in the aftermath of the New Guinea epidemic during which university students not only had to cope with their academic tasks, but they were also weighed down by concerns about the impact of the development of the epidemic on themselves and their families. Under prolonged stress, they were highly susceptible to academic procrastination.[11] In this regard, negative emotion has been found to be positively associated with academic procrastination.[12] According to existing research, academic procrastination is al so influenced by other factors. Among these, life autonomy is a positive predictor of academic procrastination. For example, in a survey of 1116 secondary school students, a sense of meaning in life was found to directly and negatively predict academic procrastination, reducing it through a fully mediated effect of increased self-control, followed by increased time management.[13] Given the significant mental stress caused by recent events, it is worthwhile to explore whether life autonomy can positively impact undergraduate students in the current post-pandemic period.[14] However, there are limited studies on the mediating pathway of life autonomy between negative emotion and academic procrastination.

In addition, the level of students' Sense of school belonging in the post-pandemic era may influence the strength of negative emotions. A study had found that regardless of whether Sense of school belonging was examined as a whole or divided into sub-dimensions, it was associated with negative emotions such as anxiety and depression in adolescents, and was thus a significant predictor of such emotions.[15] In particular, during the pandemic, adolescents with a greater sense of belonging to school were likely to experience more positive emotions such as relaxation and contentment; conversely, students with low levels of Sense of school belonging were more likely to have negative emotions such as loneliness and anxiety.[16] A study of Sense of school belonging found that it was a significant predictor of students' autonomy in life.[17] University students also improved their academic confidence and gained a sense of life autonomy through an increased Sense of school belonging.[18,19] Hence, a Sense of school belonging tends generally to be positively related to life autonomy.[20] Further, the sense of school belonging has also been confirmed to affect individual motivation, emotion and other related personal variables, thereby affecting procrastination behavior.[21] However, there are also fewer studies related to how Sense of school belonging is associated with negative emotions, life autonomy, and academic procrastination.

To sum up, there are limited studies on setting Sense of school belonging as a factor affecting academic procrastination caused by negative emotions. Further, the research on life autonomy as a mediator between negative emotions and academic procrastination is even lacking.

To enhance our understanding of academic procrastination following negative emotion experienced by university students during the pandemic period, we review relevant work in the literature in the next section. We then describe our moderating mediator model and present hypotheses regarding the mediating effect of life autonomy and the moderating effect of Sense of school belonging. Finally, we report on the testing of our hypotheses in post-epidemic studies and point to further directions for research in the conclusion section.

## Literature Review
### Negative Emotions and Academic Procrastination

Negative emotions are unpleasant or unhappy feelings which often include depression, anxiety, loneliness, anger and stress.[22,23] Moreover, negative emotions arise as a result of the interaction of both traumatic events that occur in the external environment and related subjective experiences. Negative emotions such as anxiety, anger, helplessness and panic were commonly experienced by the public in response to the sudden outbreak of the Covid-19 infection.[24] It was found that the rate of anxiety among university students during the pre-pandemic period was only 12.94%[25] but during the pandemic, with strict preventive measures put in place, negative emotions, such as anxiety, sadness, nervousness, fear or panic, increased to 46.6%.[26] It has been confirmed that negative emotions are associated with the strength of the individual's subjective experience and vary according to gender. For example, after experiencing negative or adverse events, the emotional responses of men and women differed significantly in subjective stress intensity and physiological response patterns; subjective reports of negative emotions evoked by women were significantly higher than those of men.[27]

Although a wealth of research has contributed to a broader and deeper understanding of negative emotions, scholars have not developed a rigorous definition of negative emotions that is accepted by the academic community. In this study, therefore, we used Lovibond's[28] negative emotion scale and three-dimensional model, which suggests that stress, depression and anxiety are the most frequent negative emotions that individuals experience, and that they can be assessed both in relation to and independently of each other as negative emotions. Many studies focus on the relationship among the three dimensions of negative emotion and other influences. Specifically, negative emotions such as depression, anxiety and stress have been shown to affect undergraduates' engagement in interpersonal relationships, thus contributing to feelings of interpersonal alienation.[29] In this case, depression or stress can affect the motivation to learn; academic performance is thus impacted when students are overcome by such emotions.[30] Notably in post-epidemic, students were often overwhelmed by negative emotions such as anxiety, stress and depression during the school lockdown, and were inclined to develop behaviours such as perfunctory attitudes and delayed completion when faced with heavy learning tasks.[31]

Academic procrastination, a type of behaviour that involves an element of intentional delay in the learning process, has been defined differently in various studies.[32,33] For instance, academic procrastination can refer to a situation when an individual delays the commencement of a task that he or she has planned to carry out, or continues to delay or postpone the task while it is in the process of being completed. Alternatively, it has been suggested that academic procrastination is a behaviour whereby the student chooses to postpone the completion of an academic task despite being aware of the negative consequences of procrastination.[34,35] In short, academic procrastination is the purposeful and deliberate postponement of a task that must be completed. Clearly, academic procrastination among university students is a very important variable to examine, and during the COVID-19 pandemic, the pressure to improve achievement among university students has led to an increase in academic procrastination, while at the same time, tackling academic procrastination among university students is a major issue in student management and teaching in universities.[36] In the post-pandemic era, it is important to build up students' resilience to cope with emergencies and their own negative emotions.

Many studies have confirmed the relationship between negative emotions and academic procrastination. Firstly, anxiety has been found to negatively affect students' motivation to study[37] and this has contributed to academic procrastination behaviours.[38,39] Furthermore, negative emotions such as anxiety and depression are considered to be important causes of academic procrastination. When students feel that they cannot complete their academic tasks, they develop negative emotions such as tension and anxiety, and in order to alleviate these negative emotions, they usually choose to avoid them and engage in distractions such as entertainment and games, thus resulting in procrastination behaviours.[40] It should not be ignored to us that in the post-pandemic, when university students had to cope with difficult and stressful study tasks, they developed negative emotions, and subsequently, they were more likely to indulge in study procrastination behaviours.[41] In summary, negative emotions such as anxiety, stress, and depression are strongly associated with academic procrastination,[38] and stronger negative emotions are more likely to induce more severe incidences of academic procrastination.[11] Therefore, we propose the first hypothesis.

H1: Negative emotions are positively associated with academic procrastination.

Although there is much research suggesting a link between negative affect and academic procrastination, there is insufficient evidence to show a significant direct relationship between the two. This suggests that there is actually no consistent and systematic conclusion about the internal mechanisms of the relationship between negative affect and academic procrastination. Deeper exploration of the mediators and moderators of the relationship between negative affect and academic procrastination might help us to uncover and understand the relationship.

## The Mediating Role of Life Autonomy

Life autonomy is derived from the six dimensions of the Life Attitude Scale proposed by Man-Ying Hsieh: ideals, life autonomy, sense of being, love and care, life experience, and attitude towards death. Based on this theory, life autonomy is defined as the ability to take charge of the direction of one's life development and one's own choices, and to bear the consequences and responsibilities for one's choices.[42] From personal perspective, human life is open-ended and uncertain, and therefore one must be autonomous to improve oneself. In the face of this life's uncertainties, it is all

through independent and autonomous activities that self-development is prompted.[43] At the same time there are scholars who argue that autonomy in life is how one decides the direction of one's life, primarily the individual's capacity for self-determination.[44] Although these views may differ to some extent, what they have in common is that life autonomy includes the individual's ability to manage, choose, and take responsibility for his or her own life.

The exact relationship between life autonomy and negative emotions has not been conclusively proven but the relationships among the different dimensions of life autonomy, in particular the ability to self-manage, autonomy and choice and life responsibility, and negative emotions have been verified in previous studies. For example, it has been found that the stronger the negative emotions, the weaker the individual's self-control and self-management abilities. This implies that people who harbour negative emotions tend to experience a narrowing of consciousness, a narrowing of the scope of cognitive activity, and resistance to rational analysis, all of which resulting in reduced self-control and management abilities.[45,46] During the recent pandemic, many individuals experienced varying degrees of negative emotions such as anxiety, fear, anger, and depression. As a result, they developed avoidance and evasive responses, and even exhibited behaviours such as avoiding examination and treatment, preferring to remain in isolation, attacking epidemic prevention personnel, and were unable to seek treatment on their own initiative.[47] In a study on medical students, it was found that when they developed high levels of negative emotions, they were unable to develop positive attitudes and mindsets to address the problems faced, such as difficult academic tasks or stressful events; they were thus unable to fulfil and take responsibility for their lives.[48] In conclusion, individuals with stronger negative emotions have weaker life autonomy, including self-control, self-management and responsibility in life. To argue the above point, we propose a second hypothesis.

H2a: Negative emotions are negatively related to life autonomy.

Various evidences suggest that life autonomy reduces the incidence of academic procrastination.[49] For instance, owing to the lockdown imposed during the Covid-19 pandemic, university students had more discretionary time at their disposal, but their mental development was not yet adequately mature to develop autonomous habits.[50] They would manifest lower self-management skills in such an environment,[51] generating inertia in learning, which in turn leads to academic procrastination.[52] This finding is also confirmed in a study by Wang Shurui[53] which showed that university students' self-control negatively predicted academic procrastination. Likewise, the higher the level of self-directed learning, the better the academic performance of university students, and the less likely they are to suffer from burnout and procrastination.[54] Finally, in an intervention study on the meaning of life, it was found that university students were less likely to engage in academic procrastination when they were deeply aware of their academic responsibilities as undergraduates.[55] In summary, all three dimensions of life autonomy, namely self-management, autonomy, and responsibility negatively predict academic procrastination. Therefore, the following hypotheses are proposed:

H2b: Life autonomy and academic procrastination are negatively related.

In summary, the stronger the negative emotions, the weaker the life autonomy, which in turn promotes academic procrastination. Conversely, the weaker the negative emotion and the stronger the life autonomy, the less likelihood there is of the student to engage in academic procrastination. Therefore, we propose the following hypothesis:

H2: Life autonomy mediates the relationship between negative emotions and academic procrastination.

## The Moderating Role of Sense of School Belonging

Belonging first appeared in the hierarchy of needs theory proposed by the American psychologist Maslow,[56] who divided human needs into five levels from low to high: physiological needs, security needs, the need to belong and love, the need for respect, and the need for self-actualization. The need to belong refers to the individual's desire to join a group and to be cared for as well as care for others. Sense of school belonging is considered to be a combination of two feelings: when students experience respect, inclusion, support, etc. from teachers and friends, and the other, when they feel they are part of the school.[57] Some researchers have also argued that Sense of school belonging focuses more on the positive emotions

of students ie, feeling respected and comfortable in school, feeling accepted in school, having a sense of worth, and becoming one with the class or school.[18,58,59]

Previous research has also confirmed that students' Sense of school belonging has a powerful impact on many factors. For example, Sense of school belonging affects the student's self-efficacy,[45] influences interpersonal interactions among university students,[60] and especially during the COVID-19 lockdown, the strength of a student's Sense of school belonging could significantly affect academic mood.[61] According to Li et al,[62] students' negative emotions during the pandemic were impacted by their Sense of school belonging. It has been demonstrated that low levels of Sense of school belonging are significantly associated with negative emotions such as loneliness and anxiety.[63] On the other hand, students with higher levels of Sense of school belonging are better able to adapt to school life, are more motivated to learn, are more academically engaged, and have better academic performance[64,65]; they subsequently experience less negative emotions.[66] Therefore, we propose the following hypothesis.

H3a: Sense of school belonging is negatively related to negative affect.

Research investigating the effect of Sense of school belonging on academic procrastination suggests that the strength of Sense of school belonging has different effects on academic procrastination. For example, it has been suggested that students who do not have a strong sense of belonging to their school experience tend to exhibit dropout tendencies, leading to learning interruptions and academic procrastination.[67] However, a stronger sense of belonging to school is associated with higher school adjustment and life satisfaction,[68] thus facilitating learning persistence;[69,70] such students are also negatively associated with academic burnout and academic procrastination which are significant negative predictors of academic delay.[71] In particular, during the pandemic, the isolation policy put in place by the authorities created much displeasure, reduced both the students' dependence on their school and their sense of belonging to school, thus leading to boredom and academic procrastination.[72] In summary, it is worth exploring further how students' Sense of school belonging affects academic procrastination. Therefore, we propose the following hypothesis.

H3b: Sense of school belonging is negatively related to academic procrastination.

While the exact relationship between Sense of school belonging and life autonomy is not well established, the relationship between Sense of school belonging and the other dimensions of life autonomy, namely responsibility and self-sufficiency, has been validated in previous studies. A sense of belonging at school not only enhances students' subjectivity and sense of ownership in school development, but also motivates them to be autonomous.[73] Studies on undergraduates with a low Sense of school belonging revealed that they were concerned about not fitting in with the group or class and thus they adopted an avoidant attitude towards learning; this subsequently led to a lower level of autonomous learning.[17,74] On the other hand, university students who had a higher Sense of school belonging had a higher degree of recognition of their role and were more willing to take on responsibilities.[75] This sense of collective responsibility not only affected them positively during their university years, but also had an important impact on their integration into a new community after graduation.[76] In summary, university students' Sense of school belonging has a positive impact on life autonomy, especially the dimensions of autonomy and responsibility. Therefore, we propose the following hypothesis.

H3c: Sense of school belonging is positively related with life autonomy.

It follows that Sense of school belonging generally acts as a mediator or moderator in studies of stressful events or in relation to negative emotions such as depression.[63,77] Further, it is possible that this affects individual perceptions of emotions and aspects such as autonomy and responsibility, thus influencing the pathway of transition from negative emotions to life autonomy. In summary, we propose the following hypothesis:

H3: Sense of school belonging moderates an initial segment of the "negative emotions → life autonomy → academic procrastination" pathway.

# Materials and Methods

## Participants and Procedures

This study utilized a stratified random sampling method to ensure representative data collection. Initially, we conducted stratified sampling among 67 colleges and universities in Guangxi Zhuang Autonomous Region, China. From this pool, three colleges were selected based on their regional representativeness. The selection criteria for these colleges included the following: (1) experience in campus lockdown management during the COVID-19 pandemic, (2) willingness to participate in the study for ethical reasons, and (3) exclusion of students from other schools. However, due to school closures resulting from the ongoing COVID-19 pandemic, only one of the three selected schools granted authorization for our investigation. This particular school has a student population exceeding 15,000. It is worth noting that the freshman year had not yet commenced at the time of data collection, while the third year consisted of students engaged in off-campus internships as part of their graduation requirements. Consequently, we focused our sampling efforts on sophomore students. Using a random sampling method, we selected 800 sophomore students from the authorized school to participate in our study. After data collection, we meticulously examined the completed questionnaires for validity. As a result, we obtained a total of 776 valid questionnaires. Among these respondents, 219 were male (28.22%), and 557 were female (71.78%). The age range of participants fell between 19 and 25 years old (M4.5, SD=2.564). Prior to the questionnaire survey, the researcher conducted exploratory focus group interviews with students in the school to have a better understanding of their emotional profile and psychological state. Most of the respondents indicated that they had been emotionally depressed during the COVID-19 pandemic; they said that they were not interested in their studies or life, and appeared to be perfunctory or even self-absorbed. They also felt depressed by the impact of the pandemic on their social lives and studies, and these negative emotions continued to affect their mood to study, causing them to become increasingly resistant to engaging in academic pursuits.

A correlational design and an online questionnaire were used to collect data for this study. At the end of the school day, the class teachers showed their students the QR code associated with the questionnaire. Students who agreed to participate in the study scanned the QR code, entered the form, answered the questions and then clicked submit "QR" stands for "quick response". The class teacher had earlier given a detailed briefing to students on the purpose of the study, and assured them that participation in the questionnaire survey was on a voluntary basis. Any participant could withdraw from completing the questionnaire at any point in time.

## Materials

The questionnaire used in this study consisted of five parts and included 80 items that comprised: (a) demographic information, (b) Negative Affect Scale, (c) Academic Procrastination Scale, (d) Life Autonomy Scale and (e) Sense of school belonging Scale. Demographic information included gender, home address, and parent's occupation. The Negative Affect Scale, Academic Procrastination Scale and Sense of school belonging Scale mentioned above were originally developed in English, but were translated into Chinese for this study. In order to improve the quality of the translations, a back-translation method[78] was used, whereby the first researcher translated the English into Chinese, the second researcher back-translated the translated Chinese into English, and the third researcher then compared the original, translated and back-translated versions of the scales to assess the accuracy of the translations. The translations were corrected and optimized before the questionnaire was finalized to ensure the equivalence of the scales.

## Negative Affect Scale

Adopted by Clark and Watson[79] for a three-factor model of depression, anxiety and stress. Lovibond[28] developed the depression-Anxiety-Stress Scale (DASS-42) based on this three-factor model to assess adults' depression, anxiety and stress. The latter scale used in this study contained twenty-one items assessing various negative emotional states such as depression, anxiety and stress (eg, "I do not seem to feel any pleasure or relief at all"; "I feel breathless", etc.). Participants rated themselves on a 5-point Likert scale ranging from 1-very much in line to 5-very much not in line. The questionnaire was reverse-assigned, with higher scores indicating higher indices of depression, anxiety and stress. In this study, the Cronbach's alpha coefficient for the scale was 0.965.

## Academic Procrastination Scale

Tuckman's Academic Procrastination Scale, developed by Tuckman,[80] consisted of 16 questions measuring a person's level of academic procrastination behaviour (eg, "I will put off finishing things I do not like to do" "I will put in the necessary time even if it is boring work, such as studying", etc.). Possible scores ranged from 16 to 80. Each question was scored from 1 - Strongly Agree to 5 - Strongly Disagree, where four of the sixteen questions were reverse scored. In this study, the Cronbach's alpha coefficient for the scale was 0.920.

## Life Autonomy Scale

The Life Autonomy Scale was developed by scholar Man-Ying Hsieh of Tzu Chi University in Taiwan. It consisted of 70 items and six subscales: ideal, life autonomy, sense of being, love and care, life experience, and attitude towards death. In this study, the Life Autonomy subscale was selected (eg, "I always play the role expected of me by others instead of doing what I really want to do"; "I can choose the life I want to live", etc.). All items were scored on a 5-point Likert scale, from "totally disagree" to "totally agree" on a scale of 1 to 5, with questions 1–6 being scored negatively and questions 7–12 being scored positively. The higher the total score, the more positive the attitude towards life, while the opposite is true for a negative attitude towards life. The internal consistency coefficient of the scale was 0.946, which was a good confidence level. In this study, the Cronbach's alpha coefficient for the scale was 0.825.

## School Attribution Scale

This scale, used in this study to assess "Sense of school belonging", was developed by Goodenow[57] and revised by Chinese scholars Pan Dafang, Wang Qin, Song Lili, Ding Jinhong and Dai Jiajun[81] as the Chinese version of the PSSM. It has 18 items and assesses a student's commitment to school in terms of attachment, behavioural attitudes and identification with the school (eg, "I feel as if I am part of this school; I feel like a part of this school"; "This school has a harder time accepting students like me", etc.). The scale is based on a 5-point scale. The scores are "1" for never, "2" for slightly not, "3" for average, "4" for slightly like this; "5" for always. Five of the sixteen questions are reverse scored. In this study, the Cronbach's alpha coefficient for the scale was 0.838.

## Statistical Analyses

The analytical tool used in this study was IBM SPSS 26.0. First, we conducted Harman's one-way test for common method bias[82]. The results of the non-rotated principal component analysis showed that nine factors had eigenvalues greater than one, of which the contribution to the total variance was 66.124%. The first factor accounted for 32.025%, which was below the critical criterion of 40%,[83] indicating no significant common method bias. In other words, the differences between the independent and dependent variables were due more to differences in the nature of the variables than to the data collection and measurement methods.

The descriptive statistical analysis, correlation analysis and model testing of the data were carried out to verify the research hypotheses. First, the mean and standard deviation of each variable were calculated to observe trends in concentration and dispersion. Next, Pearson product moment correlation coefficients were calculated to test the correlation of all the variables (see Table 1 and Table 2). Finally, the research hypotheses were further examined on the basis of correlations, using PROCESS V3.5[84] to test the mediation model (model 4) and the moderated mediating model l (model 7). For both models, gender, age and academic achievement were used as control

**Table 1** The Descriptive Statistics Among Variables

|  | N | M | SD |
|---|---|---|---|
| **Negative Emotion** | | | |
| Male | 219 | 2.242 | 0.916 |
| Female | 557 | 2.074 | 0.673 |

(*Continued*)

**Table 1** (Continued).

|  | **N** | **M** | **SD** |
|---|---|---|---|
| Age | | | |
| 19 | 289 | 2.125 | 0.732 |
| 20 | 201 | 2.181 | 0.697 |
| 21 | 245 | 2.052 | 0.759 |
| 22 | 28 | 2.252 | 1.015 |
| 23 | 5 | 1.533 | 0.507 |
| 24 | 2 | 2.333 | 0.471 |
| 25 | 6 | 2.619 | 1.548 |
| Achievement | | | |
| 1 | 84 | 2.121 | 0.945 |
| 2 | 141 | 2.038 | 0.715 |
| 3 | 253 | 2.064 | 0.698 |
| 4 | 233 | 2.200 | 0.757 |
| 5 | 65 | 2.246 | 0.722 |
| **Academic Procrastination** | | | |
| Male | 219 | 2.665 | 0.714 |
| Female | 557 | 2.565 | 0.600 |
| Age | | | |
| 19 | 289 | 2.590 | 0.637 |
| 20 | 201 | 2.628 | 0.638 |
| 21 | 245 | 2.549 | 0.624 |
| 22 | 28 | 2.748 | 0.607 |
| 23 | 5 | 2.425 | 1.025 |
| 24 | 2 | 2.781 | 0.398 |
| 25 | 6 | 2.698 | 0.835 |
| Achievement | | | |
| 1 | 84 | 2.538 | 0.719 |
| 2 | 141 | 2.500 | 0.595 |
| 3 | 253 | 2.531 | 0.614 |
| 4 | 233 | 2.677 | 0.617 |
| 5 | 65 | 2.807 | 0.685 |
| **Life Autonomy** | | | |
| Male | 219 | 3.467 | 0.642 |
| Female | 557 | 3.572 | 0.582 |

(*Continued*)

**Table 1** (Continued).

|  | N | M | SD |
|---|---|---|---|
| Age | | | |
| 19 | 289 | 3.532 | 0.593 |
| 20 | 201 | 3.506 | 0.596 |
| 21 | 245 | 3.576 | 0.604 |
| 22 | 28 | 3.598 | 0.627 |
| 23 | 5 | 4.067 | 0.927 |
| 24 | 2 | 3.958 | 0.648 |
| 25 | 6 | 3.125 | 0.349 |
| Achievement | | | |
| 1 | 84 | 3.609 | 0.657 |
| 2 | 141 | 3.561 | 0.614 |
| 3 | 253 | 3.595 | 0.600 |
| 4 | 233 | 3.504 | 0.571 |
| 5 | 65 | 3.353 | 0.573 |
| **Sense of School Belonging** | | | |
| Male | 219 | 3.224 | 0.633 |
| Female | 557 | 3.270 | 0.541 |
| Age | | | |
| 19 | 289 | 3.273 | 0.577 |
| 20 | 201 | 3.271 | 0.527 |
| 21 | 245 | 3.224 | 0.570 |
| 22 | 28 | 3.222 | 0.730 |
| 23 | 5 | 3.556 | 0.845 |
| 24 | 2 | 3.833 | 0.079 |
| 25 | 6 | 3.102 | 0.468 |
| Achievement | | | |
| 1 | 84 | 3.308 | 0.659 |
| 2 | 141 | 3.361 | 0.565 |
| 3 | 253 | 3.276 | 0.537 |
| 4 | 233 | 3.224 | 0.543 |
| 5 | 65 | 3.008 | 0.594 |

**Notes**: Achievement is dummy coded (1= top 10% of grade; 2= top 10–20% of grade; 3= Top 20–40% of grade; 4= Top 40–70% of grade; 5= Not in the top 70%).
**Abbreviations**: M, Mean; SD, Standard deviation.

**Table 2** Correlations Among Variables

|  | M | SD | I | 2 | 3 | 4 |
|---|---|---|---|---|---|---|
| Negative emotion | 2.122 | 0.753 | I |  |  |  |
| Academic procrastination | 2.593 | 0.635 | 0.613*** | I |  |  |
| Life autonomy | 3.543 | 0.601 | −0.477*** | −0.572*** | I |  |
| Sense of school belonging | 3.257 | 0.569 | −0.437*** | −0.511*** | 0.546*** | I |

**Note**: ***p < 0.001.
**Abbreviations**: M, Mean; SD, Standard deviation.

variables. Indirect effect indicators were tested using bias-corrected bootstraps (n = 5000) and 95% confidence intervals. When the 95% confidence interval does not include zero, the parameter is statistically significant.[85]

# Results

## Descriptive Statistics and Correlation Analysis

A descriptive analysis of negative emotions, academic procrastination, life autonomy and Sense of school belonging among university students and the correlations are shown in Table 1 and Table 2.

Descriptive analyses and correlations between variables, as shown in Table 2, indicated, as expected, that negative affect was significantly and positively related with academic procrastination (r=0.613, p<0.001); negative affect was significantly and negatively related with life autonomy (r= −0.477, p<0.001) and Sense of school belonging (r=0.-437, p<0.001); academic procrastination was significantly and negatively related with life autonomy (r=0.-572, p<0.001) and Sense of school belonging (r=−0.511, p<0.001), while life autonomy was significantly positively related with Sense of school belonging (r=0.546, p<0.001). Therefore, the relationships of the study variables were consistent with the hypotheses.

## Mediating Effect of Life Autonomy

In this study, a multiple regression analysis was conducted using Model 4 of the SPSS Process component, with negative affect as the independent variable, academic procrastination as the dependent variable, and life autonomy as the mediator.

In addition, as gender, age, and academic achievement might affect the variables, they were, therefore, used as control variables. Gender, age, and academic achievement were transformed into dummy variables before entering the mediation model. When gender, age and academic achievement were used as control variables, the relationship coefficients between independent variables and dependent variables changed very little, so gender, age and academic achievement had no significant influence on the entire mediation model.

As shown in Table 3, the total effect of negative affect on academic procrastination was statistically significant (β=0.371, SE=0.025, p<0.001), indicating a positive predictive influence of negative affect on academic procrastination. This predictive influence remained significant when life autonomy was added, as shown in Table 4 (β=0.142, SE=0.018, 95% CI=[0.108, 0.179]). Negative emotion had a significant negative effect on life autonomy (β = −0.375, SE = 0.025, p < 0.001) and life autonomy had a significant negative effect on academic procrastination (β = −0.377, SE = −0.031, p < 0.001). Life autonomy mediated academic procrastination through a negative correlation with negative emotion. Furthermore, the bias-corrected percentile bootstrap method further revealed a moderating mediating effect, with boot-strap confidence intervals (95%) between the upper and lower bounds not containing zero values for both the direct effect of negative affect on academic procrastination and the mediating effect of life autonomy between negative affect and academic procrastination (Table 4). This suggests that negative emotion could have a direct effect on academic procrastination but also an indirect effect on academic procrastination through life autonomy; the direct and mediating effects accounted for 72.39% and 27.61% of the total effect, respectively.

**Table 3** Testing the Mediating Effect of Negative Emotion on Academic Procrastination

| Predictors | Life Autonomy (M) | | | | | Academic Procrastination (Y) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | β | SE | t | 95% CI | | β | SE | t | 95% CI | |
| | | | | LLCI | ULCI | | | | LLCI | ULCI |
| Gender | 0.031 | 0.043 | 0.717 | −0.053 | 0.115 | 0.015 | 0.037 | 0.392 | −0.059 | 0.088 |
| Age | −0.002 | 0.008 | −0.191 | −0.017 | 0.014 | −0.003 | 0.007 | −0.401 | −0.016 | 0.011 |
| Achievement | −0.029 | 0.017 | −1.672 | −0.062 | 0.005 | 0.037* | 0.015 | 2.448* | 0.007 | 0.066 |
| Negative Emotion | −0.375 | 0.025 | −14.783*** | −0.425 | −0.325 | 0.371 | 0.025 | 14.826*** | 0.322 | 0.421 |
| Life Autonomy | | | | | | −0.377 | 0.031 | −12.025*** | −0.439 | −0.316 |
| R-square | 0.235 | 0.481 | | | | | | | | |
| F | 47.3117*** | | | | | 118.889*** | | | | |

**Notes**: *p < 0.05, ***p < 0.001. Analyses conducted by PROCESS Model 4, N = 776. Gender is dummy coded (1, female, 2, male).

**Table 4** Effect of Negative Effect on Academic Procrastination After Inclusion of Life Autonomy: Total Effect, Direct Effect and Indirect Effect Among the Variables

| Predictors | Effect Size | Boot SE | 95% CI | | Relative Effect Size |
|---|---|---|---|---|---|
| | | | LLCI | ULCI | |
| Total Effect | 0.5129 | 0.024 | 0.4657 | 0.5602 | |
| Direct Effect | 0.371 | 0.025 | 0.3222 | 0.4205 | 72.39% |
| Indirect Effect | 0.142 | 0.018 | 0.1081 | 0.1785 | 27.61% |

**Note**: Analyses conducted by PROCESS Model 4, N = 776.

## Moderated Mediation Effects

To examine the moderating role of Sense of school belonging on the pathway "negative emotions → life autonomy", the first segment of the mediation model was analysed by adding the moderating variable Sense of school belonging. The moderated mediation model was then analysed using SPSS PROCESS 3.5. The results showed that the interaction term between Sense of school belonging and negative affect reached a significant level (β= −0.136, p<0.001) with a 95% CI of [−0.208, −0.064]); the model is shown in Table 5.

To better test the mediated model with moderation, Sense of school belonging was divided into high, medium, and low groups according to plus or minus one standard deviation (Table 6), and a simple slope test was also conducted (Figure 1). The results showed that high values of Sense of school belonging (β=0.130, SE=0.020, p<0.001, 95% CI=[0.091, 0.170]) was associated with higher life autonomy than low values of Sense of school belonging (β=0.072, SE=0.012, p<0.001, 95% CI= [0.051, 0.097]), the relationship between negative emotions and life autonomy negative correlation was strengthened.

This study further analysed the moderating effect of Sense of school belonging through a simple slope test. The moderating variables were grouped according to the mean score of Sense of school belonging plus or minus one standard deviation into a low Sense of school belonging group (M - 1SD) and a high Sense of school belonging group (M + 1SD). Analysing the results, the following findings emerged.

1. When levels of Sense of school belonging were low, university students' levels of life autonomy showed a decreasing trend as levels of negative emotions increased (Effect= −0.190, t=−6.926, p<0.001).
2. When the sense of belonging to the school was high, the level of life autonomy of university students showed a significant downward trend with an increase in the level of negative emotions (Effect= −0.345, t=−8.595, p<0.001). Essentially, the correlation between negative affect and life autonomy was stronger when the prevalence of school affiliation was lower.

**Table 5** Testing the Moderated Mediating Effect of Sense of School Belonging on Academic Procrastination

| Predictors | Life Autonomy (M) | | | | | Academic Procrastination (Y) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | β | SE | t | 95% CI | | β | SE | t | 95% CI | |
| | | | | LLCI | ULCI | | | | LLCI | ULCI |
| Gender | 0.061 | 0.039 | 1.580 | −0.015 | 0.137 | 0.015 | 0.037 | 0.392 | −0.059 | 0.088 |
| Age | −0.008 | 0.007 | −1.073 | −0.021 | 0.006 | −0.003 | 0.007 | −0.401 | −0.016 | 0.011 |
| Achievement | −0.006 | 0.016 | −0.352 | −0.036 | 0.025 | 0.037* | 0.015 | 2.448 | 0.007 | 0.066 |
| Negative Emotion | −0.268 | 0.027 | −9.79*** | −0.321 | −0.214 | 0.371 | 0.025 | 14.826*** | 0.322 | 0.421 |
| Life Autonomy | | | | | | −0.377 | 0.031 | −12.025*** | −0.439 | −0.316 |
| Sense of School Belonging | 0.407 | 0.035 | 11.679*** | 0.339 | 0.476 | | | | | |
| Negative emotion Sense of School Belonging* | −0.136 | 0.037 | −3.698*** | −0.208 | −0.064 | | | | | |
| R-square | 0.385 | | | | | 0.481 | | | | |
| F | 68.257*** | | | | | 118.889*** | | | | |

**Notes**: *p < 0.05, ***p < 0.001. Analyses conducted using PROCESS model 7 with N = 776. Gender is dummy coded (1, female, 2, male).

**Table 6** Conditional Indirect Effect of Negative Emotion on Academic Procrastination via Life Autonomy Across Levels of Sense of School Belonging

| Conditional Effect of Sense of School Belonging | Effect | Boot SE | 95% CI | |
|---|---|---|---|---|
| | | | LLCI | ULCI |
| Low (M-1SD) | 0.072 | 0.012 | 0.051 | 0.097 |
| Medium (M) | 0.101 | 0.014 | 0.075 | 0.130 |
| High (M+1SD) | 0.130 | 0.020 | 0.091 | 0.170 |

**Note**: Bootstrap sample size = 5000.
**Abbreviations**: M, Mean; SD, Standard deviation; Low, 1 SD below the mean; High, 1 SD above the mean.

Figure 2 shows a mediated regulation model in which Sense of school belonging moderated the mediated model of life autonomy by buffering the effect of negative emotions on life autonomy, and life autonomy moderated the first stage of the mediated process, establishing the first stage of mediated regulation.
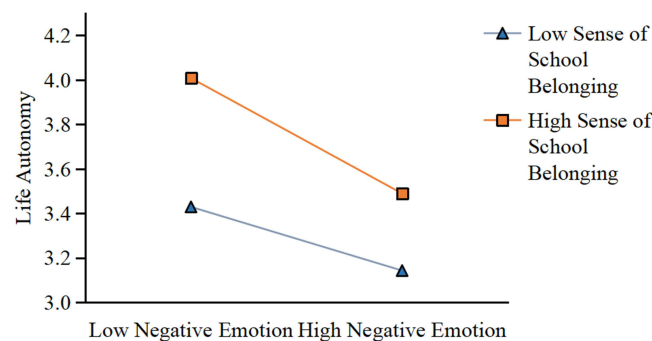


**Figure 1** A model of the mediating role of Life Autonomy and the moderating role of Sense of school belonging (β values are shown).
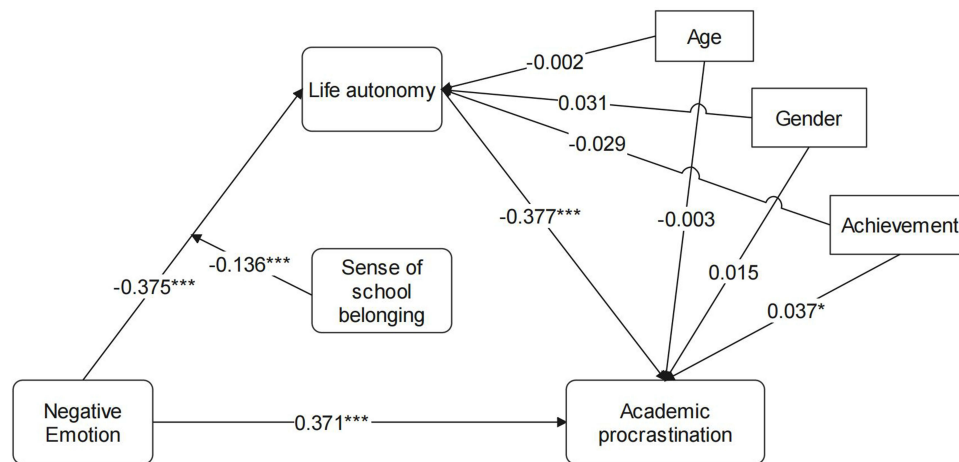
**Figure 2** Sense of school belonging between Life Autonomy and Negative Emotion for high and low levels.
**Note**: *P<0.05; ***p<0.001.

# Discussion
## Discussion of the Results

This study developed a moderated mediation model of negative emotion and academic procrastination among university students. It was found that (1) negative affect and academic procrastination were positively related; (2) life autonomy mediated the relationship between negative affect and academic procrastination; and (3) Sense of school belonging moderated the first segment of the pathway in the mediated model. These results were consistent with the hypotheses presented above.

Firstly, the results of this study found a positive relationship between negative emotion and academic procrastination, confirming H1 and consistent with previous research findings that stronger negative emotion leads to academic procrastination behaviours. This finding reveals that the strong negative emotions among university students during the period of the Covid-19 lockdown led to the occurrence of academic procrastination tendencies. As suggested by Ruoyi Qu,[11] during COVID-19 pandemic, the nature of the learning task could cause students to be disinterested in learning when they were weighed down by negative emotion, which in turn led to resistance and avoidance attitudes or academic procrastination. After delving into the reasons behind academic procrastination, research findings emphasized the influence of task characteristics, such as the difficulty, importance, and attractiveness of academic tasks, on academic procrastination.[86,87] These studies indicate that when students face tasks that are unimportant, excessively complex, or lacking in interest, they may experience stress, anxiety, and worry. These negative emotions can diminish their learning motivation and potentially lead to academic procrastination. Neuroimaging meta-analysis results further support this view, revealing that during the occurrence of negative emotions, two brain regions, namely the anterior insula and amygdala, form a neural salience network that may underlie procrastination behavior.[88,89] In fact, stronger negative emotions may result in more severe procrastination behavior.[90] Furthermore, some in-depth studies have proposed the mechanisms through which negative emotions such as anxiety[39], stress,[41] and depression[40] influence academic procrastination. They have found a positive correlation between these negative emotions and academic procrastination.[11] In conclusion, there is a close relationship between academic procrastination, students' negative emotions, and the neural basis of these emotions. Understanding these factors contributes to a better comprehension and resolution of academic procrastination issues.

Subsequently, the results of this study also confirmed the validity of H2, H2a and H2b, indicating that negative emotions were negatively related to life autonomy, and that life autonomy mediated the relationship between negative emotions and academic procrastination. Firstly, the findings showed that negative emotions had a negative predictive effect on life autonomy, which is consistent with previous research findings that reveal that life autonomy may be diminished if individuals have strong negative emotions.[91,92] This has also been confirmed in neuroscience studies. The

nervous system is affected by self-awareness control, which enhances the excitation and autonomous coordination ability of cerebral cortex neurons. However, when individuals are stimulated by negative emotions, the amplitude of N2 in the prefrontal area of the brain will decrease, which will interfere with the control of self-awareness and autonomous coordination ability.[93]

In other words, when students are immersed in negative emotions, the adaptive and regulatory functions of life autonomy are weakened by the various problems brought about by negative emotions,[94] making such individuals less able to protect themselves and withstand stressful events or negative life experiences.[95] Secondly, occurrence of academic procrastination.[34,96] Conversely, academic procrastination is a consequence of reduced or absent capacity for self-discipline, autonomy and self-management, and therefore, all dimensions of life autonomy are associated with academic procrastination.[97–99] Therefore, it is suggested that schools can provide online training for students in emotional regulation. Relevant research findings have shown that this type of training can enhance students' general emotional regulation skills and significantly reduce procrastination behavior.[100]

Furthermore, this study found that life autonomy can act as a mediator between negative emotions and academic procrastination, serving as a mediating pathway for negative emotions to act on academic procrastination, which supports the hypothesis of H2. It is worth noting that life autonomy is one of the fundamental principles of contemporary bioethics, and it has been argued that the principle of life autonomy respects human autonomy, and that individuals with greater life autonomy are more able to respect the wishes of others, control their own will and make decisions about their own affairs.[101] As a result, they are less likely to be affected by sudden stressful events and they do not develop negative emotions easily.[14] Similarly, the more autonomous a person is, the more he or she knows what to do, and can demand, enjoy, or fulfil tasks or rights.[98,102] Accordingly, autonomous students are more likely to be motivated to complete learning tasks and avoid academic procrastination.[97,98] Of course, teachers or schools can increase opportunities for students to participate and more choices through curriculum design or school activity planning, allowing students to practice and improve their autonomous decision-making and proactive problem-solving skills in a safe environment, thereby improving A sense of belonging to the school.

Finally, our findings confirmed H3, revealing a correlation between Sense of school belonging and negative emotions, life autonomy, and academic procrastination. This presents the argument that when a person is in a negative mood, Sense of school belonging may interact with negative emotions to influence the individual's life autonomy, and that Sense of school belonging plays a moderator in the mediating model. It is worth emphasizing that our study identified a first-segment moderating model of Sense of school belonging, which enriches the relevant literature. In other words, Sense of school belonging buffers the effect of life autonomy on the relationship between negative affect and academic procrastination. This means that when individuals are overwhelmed by negative emotions, those who have a strong Sense of school belonging are better able to deal with and face problems caused by negative emotions and develop strong psychological resilience and self-reflective thoughts.[103,104] This underlines the value of negative emotion constructs in helping individuals to enhance their sense of responsibility, self-control and self-management, and ultimately reducing the occurrence of academic procrastination.[11,105] In addition, students' sense of belonging to school can be strengthened by establishing a good teacher-student relationship, creating an open and inclusive campus environment, providing opportunities for meaningful participation, and paying attention to and meeting the individual needs of students, thereby weakening the influence of negative emotions on academic procrastination behavior.

## Discussion of Implications

In a theoretical sense, this study deepens the understanding of the impact of negative emotion on academic procrastination by linking negative emotion to academic procrastination. Specifically, we conducted an analysis of the mediating and moderating effects. First, the results of the study, which included students' life autonomy as a mediating variable, indicated that students' negative emotions affected their life autonomy and ultimately had a positive correlation with their academic procrastination, while students' Sense of school belonging had a negative moderating effect on the relationship between negative emotions and life autonomy. This finding implies that the negative emotions experienced by university students may be mitigated by increasing their sense of belonging to the school, thus increasing their ability to actively exercise autonomy, self-management and self-control, and reducing their academic procrastination behaviour.

In a practical sense, the relationship among the four variables presented in this study may contribute to a greater understanding of the mechanisms by which negative emotions induce procrastination behaviour among undergraduates and even the general population, When students have sufficient autonomy, self-control and self-management in response to a public health crisis, there will be fewer occurrences of academic procrastination behaviours It is also important to strengthen Sense of school belonging interventions for the university population. Measures should be taken to inhibit the development of negative emotions, while promoting the growth of life autonomy and strengthening the Sense of school belonging.

## Limitations and Future Direction

Here, we shall discuss two limitations to this study. Firstly, in this the cross-sectional study, the data and results from the questionnaire reflected only the psychological conditions and characteristics of university students in the short term. Although the study revealed correlations between variables, it cannot introduce causal relationships between the variables, and it is difficult to reflect the relationship between negative affect and academic procrastination in a dynamic and comprehensive manner. We encourage subsequent researchers to conduct longitudinal studies or follow-up studies that can better explore the ongoing, long-term interactions between the elements.

Secondly, the study population was limited to students at one university in China, and there was no detailed investigation of the specific majors of the participants. The limited representativeness of the sample population due to restrictions during the COVID-19 outbreaks in different regions might have affected the validity of the results. Hence, the results may not be globalized and generalized, and the validity may be affected by factors such as bias. Therefore, follow-up studies should try to have a study sample from different regions and include university students with different majors.

## Conclusion

This study tested a moderated mediating model to examine the relationship between negative affect and academic procrastination among university students during the COVID-19 pandemic, the mediating role of life autonomy in the link between negative affect and academic procrastination, and the moderating role of Sense of school belonging in the first segment of the "negative affect → life autonomy → academic procrastination" pathway. The results showed that negative affect positively predicted academic procrastination and that life autonomy mediated the relationship between negative affect and academic procrastination. In addition, Sense of school belonging moderated the relationship between negative affect and life autonomy, with the moderating effect being higher when the Sense of school belonging was stronger. These findings provide a more comprehensive understanding of the relationship between negative affect and academic procrastination.

## Ethics Approval and Informed Consent

This study was conducted in strict accordance with the Declaration of Helsinki. Informed consent has been obtained from all participants and has been reviewed and approved by the Academic Ethics Committee of Jiangnan University.

## Disclosure

The authors report no conflicts of interest in this work.

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