

The benefits of personal strengths in mental health of stressed students: A longitudinal investigation

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Abstract

Objective This study used a two-wave longitudinal research design to explore the role of individual strengths, including interpersonal strength, intellectual strength, and temperance strength, in affecting the mental health of stressed college students.

Participants A total of 404 stressed Chinese college students were screened to participate in this 12-month longitudinal study.

Methods At the beginning of the study (Time 1), students who had not experienced stressful events within the last 12 months were invited to assess their strengths, psychological well-being, and psychological symptoms. After 12 months (Time 2), 404 students who reported stressful experiences completed the scales again and were retained for the final analyses.

Results Academics-related stressors were the most endorsed life events among college students, whose states of mental health showed downward trends from Time 1 to Time 2. Three strengths had weak to modest correlations to mental health at both Time 1 and Time 2. Although the additional variances of mental health explained by the three strengths were very modest, the mediational roles of the strengths were identified. The perceived stress completely mediated the relationship between the strengths and the psychological symptoms and partly mediated the relationship between the strengths and psychological well-being.

Conclusions Individual strengths may function as a defense against perceived stress and are protective factors of mental health. These strengths maintain mental health by enhancing the psychological well-being and reducing the psychological symptoms of individuals.

Keywords Strength · Depression · Anxiety · Flourishing · Perceived stress

Introduction

The causal relationship between stress and stress-related illnesses, such as depression, anxiety, and headaches, has been well established in previous longitudinal and neuroscience studies [1]. The levels of perceived stress among undergraduates are higher than anticipated. The National College Health Assessment conducted by the American College Health Association investigated the health-related information of 66,887 undergraduates from 140 colleges in 2014 [2]. The results revealed that approximately 91.50 % of the respondents reported average and above-average perceived stress in their daily campus life [2]. Within the past 12 months, 63.20 % of the student respondents have felt very sad and 54.70 % have experienced overwhelming anxiety [3]. However, only 37.50 % of the respondents received the necessary psychological or mental health services from counselors, therapists, or psychologists [2]. Therefore, cultivating the ability of students to maintain mental health when faced with stress and frustrations is extremely important in a positive educational environment [4].

During the past decade, numerous studies have demonstrated the positive functions of individual strengths on promoting psychological well-being (e.g., satisfaction

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with life and happiness) and reducing psychological symptoms (e.g., depression, anxiety, and stress) [5–7]. Strengths can be defined as cognitive self-schemas related to oneself, others, and the world [8] that are worthy of praise; they are substantially stable but can change in response to major life events, deliberate interventions, or continuous lifestyle actions [9]. Three cross-cultural and universal strengths have been identified in previous publications, namely, interpersonal strength, intellectual strength, and temperance strength [10–15]. Interpersonal strength refers to the strength that reflects “love, concern, and gratitude of a person toward others”; intellectual strength refers to the strength that reflects the “curiosity and zest for creativity of an individual”; and temperance strength refers to the strength that “describes people who persist in achieving goals and exhibit self-control” [15]. These strengths were proven to have solid associations with mental health outcomes, such as satisfaction with life [16], psychological well-being [17], pathological internet use [18], and psychopathological symptoms [12]. Using one’s strengths in daily life is a positive psychology intervention (PPI) [19] that effectively increases well-being and decreases psychopathological problems among diverse populations in both Western and Eastern countries [20–22]. Waters [23] systematically reviewed 12 school-based PPI programs and concluded that the programs are significantly related to the well-being and academic performance of the students. Nevertheless, little is known about the accurate role of strengths in stressful contexts. A preliminary longitudinal study found that the use of strengths reduces stress [24]; however, a search of PubMed, SCOPUS, and PsycINFO using keywords such as “strength” and “perceived stress” revealed that no further study has investigated the functions and internal mechanisms of strengths in affecting perceived stress and stress-related outcomes.

According to the classical transactional model of stress and coping [25], stressed individuals recognize stressful experiences as the cognitive appraisal of their current psychological resources and objective stressors/environment. In other words, individuals with high levels of strengths occupying more psychological and social resources are hypothesized to perceive less stress from the same objective stressors compared to individuals with low levels of strength, a reaction that, in turn, causes less psychological symptoms. To the best of our knowledge, only one cross-sectional study has validated, albeit only partly, the above hypothesis. In their study, the researchers revealed that individuals with high levels of vitality-related strengths perceived less stress from minor life events and, consequently, experienced few psychological symptoms [26]. However, the temporal relationship between strengths, perceived stress, and mental health cannot be drawn without a rigorous longitudinal design. Both the

initial levels of stress and mental health should be controlled in the research design and data analysis. Importantly, accurate results can only be obtained by following the individuals who personally experienced stressful events during a certain period [27]. Thus, a longitudinal study is warranted.

The stressors for undergraduate students are also different from those for young adults in a community. The interactions of students with one another and the university environment are closely associated with the psychological well-being of the students [4]. Researchers have identified academic performance, pressure to succeed, and post-graduation plans as the top three undergraduate concerns [28], which should be considered as major life events rather than minor life events for student populations. Accordingly, the specific stressors should be clarified because previous studies implied that strengths may have different roles when different levels of stress are being faced [29]. For instance, Duan and Guo [30] explored the contributions of strengths to posttraumatic growth in the indirect trauma group (low-stress group), direct trauma without posttraumatic stress disorder (PTSD) group (medium-stress group), and direct trauma with PTSD group (high-stress group). The results of their study indicated that intellectual strength was the only significant contributor in the indirect trauma group; interpersonal and temperance strengths were significant contributors in the direct trauma without PTSD group; and only temperance strength could significantly predict growth in the direct trauma with PTSD group [30]. A previous study showed the positive role of temperance strength only under less stressful situations (i.e., perceived stress from minor life events) [26]. Thus, the roles of strengths under the more stressful situations of students should be further explored.

Present study

This study attempts to clarify the temporal relationship among the individual strengths, perceived stress, and mental health of stressed undergraduate students. The participants were followed for 12 months, but only those who reported stressful events during this period were included in the final sample. As indicated by the World Health Organization [31], mental health as a complete profile comprises both positive and negative components. In this study, psychological well-being and psychological symptoms were adopted to reflect the complete mental health profile of the students. Guided by the transactional model of stress and coping [25] as basis, we hypothesized that students who possess strong individual strengths perceive low stress in the following period and thus experience better psychological well-being and less

psychological symptoms. To the best of current knowledge, this work is the first longitudinal study to examine the role of the three strengths in stressful campus contexts. The results could provide further foundation for a strength-based prevention program in the context of education.

Methods

Participants and procedures

The announcement for participant recruitment was published in the bulletin boards and websites of four comprehensive universities at the beginning of the semester (i.e., in September 2014; Time 1). The universities are located in Shanghai, Nanjing, Chongqing, and Nanning, and represented the different levels of economic and social development in different regions of China. The announcement indicated the following: (1) 300 students from each university were needed to take part in a 12-month longitudinal study, (2) all students without active mental and physical illnesses were welcome to participate in the longitudinal study, and (3) the participants would be required to complete several self-reported online questionnaires at the beginning of the study and after 12 months. Convenience sampling method was used to approach these universities, a total of 1528 participants were recruited from the four universities, and their e-mail addresses were collected for communication.

A two-wave longitudinal research design was adopted. At the end of September 2014, the 1528 participants were invited to complete the Adolescent Self-Rating Life Events Checklist (ASLEC) sent via e-mail. A written informed consent was obtained before the participants completed the questionnaires. Among the 1528 participants, 855 students who reported experiencing stressful events within the last 12 months were removed (refer to the measurements section for scoring information). The remaining 673 students did not report experiencing any stressful life events within the last 12 months. The second batch of e-mails was sent to the 673 participants, who were asked to complete strengths and mental health scales, including Brief Strengths Scale (BSS), Flourishing Scale (FS), and Depression Anxiety and Stress Scale (DASS). Twelve months later (i.e., August 2015; Time 2), the third batch of e-mails was sent to the participants to assess their perceived stress from September 2014 to August 2015 and their current mental health outcomes. Among the 673 participants, 195 students did not respond to the e-mails and were thus removed from the data pool. An additional 74 participants were removed as they indicated none of 27 life events happened to them. These procedures guaranteed that all the involved participants had normal psychological states at the beginning of the study and would have experienced several stressful

events in the following 12 months. The Human Subjects Committee of the four universities approved the aforementioned procedures and granted ethics approval.

Measurements

Perceived stress was measured through the ASLEC. The checklist was developed to assess whether a life event had happened to the participants within the last 12 months and to rate the influence level of such a life event among college students [32]. Participants were asked to rate 27 items (i.e., 27 life events) using a five-point Likert scale from 0 (did not happen to me) to 4 (extremely serious) according to their personal experiences within the past 12 months. The mean score of the whole scale was adopted, with a high score reflecting a high negative influence. Xin and Yao [33] evaluated the psychometric characteristics of the scale using 10,566 students and indicated high Cronbach's alpha (0.92), good test-retest reliability (0.73), good criteria validity, and construct validity.

The 12-item BSS was developed to measure the three strengths (i.e., interpersonal strength, intellectual strength, and temperance strength; each strength has four items) among individuals who have or do not have mental health issues [13]. On the basis of their own actual situation, participants were required to rate how much they disagree (1 = extremely disagree) or agree (7 = extremely agree) with each item using a seven-point Likert scale. Subscale scores were obtained by summing up the corresponding item scores and dividing the sum by the number of items. High scores indicated that an individual has a high level of a particular strength. According to the developers, the BSS showed Cronbach's alpha above 0.72, as well as good construct validities and criteria validities in clinical and nonclinical samples [13].

Psychological well-being of humans was assessed through the FS using eight items, such as engagement, relationship, competence, and life purpose [34]. Participants were required to provide their individual answers according to a seven-point scale, from strongly disagree (1) to strongly agree (7). Mean scoring was adopted; a high score denoted the high function and success levels of the respondent. Positive psychometric properties (e.g., univariate structure and high Cronbach's alpha) characterized the scale in community and adolescent populations [17, 34, 35].

Depression and anxiety symptoms over the past week were measured the DASS, a 21-item self-reporting scale that contains three subscales (7 items per subscale) [36]. The participants were asked to indicate their individual answers using a four-point scale based on their experiences in the previous week, from "did not apply to me at all" (0) to "applied to me very much or most of the time" (3). Mean scoring was adopted, and high scores in the three subscales separately reflected the high level or severity of

psychological symptoms. Previous studies revealed the good internal consistency and factor structure of the DASS [37].

Data analysis plan

Data were analyzed by SPSS 23.0. First, the profile of the participants and the stressful events in the final sample was obtained. The most endorsed events were listed with descriptive statistics. Second, the descriptive statistics and Pearson's correlations between the researched variables, including the three strengths, perceived stress, psychological well-being (i.e., flourishing), and psychological symptoms (i.e., depression and anxiety), were calculated. Third, the first group of linear regressions using the variables at Time 1 was conducted. All the students reported their initial states of mental health to be under very mild stress according to the procedures of the study. Three independent regressions were constructed. Flourishing, depression, and anxiety at Time 1 were, respectively, set as dependent variables in each regression. The demographic variables were entered in the first step, and the three strengths were entered in the second step. Fourth, another three linear regressions were conducted using the researched variables at Time 1 and Time 2. In each regression equation, the demographic variables were entered in the first step; flourishing, depression, and anxiety at Time 1 were separately set as corresponding controlled variables and entered in the second step of each regression; and the three strengths were entered in the third step. The three strengths were expected to still significantly explain the variances of mental health outcomes even after controlling for baselines. For these regressions, the Enter method was used with the entry of the probability of F less than 0.05 and a removal higher than 0.10. Finally, the mediation effect was examined using Model 4 in the PROCESS macro with bootstrap resampling of 10,000 iterations and 95 % bias-corrected confidence intervals [38]. The obtained statistics were considered statistically significant if the 95 % confidence interval did not contain a zero. Each strength was set as a predictor (X), and each mental health outcome (i.e., flourishing, depression, and anxiety) was set as an outcome (Y). The perceived stress at Time 2 was set as a mediator (M). The corresponding mental health outcome at Time 1 was set as the controlled variable. A significant indirect effect was expected to be achieved.

Results

Profile of participants and stressful events

As described in the “Methods” section, 269 students were removed due to the loss of contact and their non-experience

of stressful events. A final total of 404 students (195 females and 209 males) with a mean age of 20.43 (SD = 0.74, 18–24 years) were thus qualified for the study. Among the qualified students, 102 were in a relationship, whereas 302 were single. An independent sample t test examination indicated no significant differences in the interpersonal strength (mean \pm SD_{included} = 5.99 \pm 0.71, mean \pm SD_{excluded} = 5.95 \pm 0.90; $t = 0.72$, $p = 0.47$), temperance strength (mean \pm SD_{included} = 5.00 \pm 0.97, mean \pm SD_{excluded} = 4.86 \pm 1.14; $t = 1.70$, $p = 0.09$), intellectual strength (mean \pm SD_{included} = 5.77 \pm 0.83, mean \pm SD_{excluded} = 5.67 \pm 1.01; $t = 1.36$, $p = 0.17$), psychological well-being (mean \pm SD_{included} = 5.51 \pm 0.92, mean \pm SD_{excluded} = 5.45 \pm 1.03; $t = 0.85$, $p = 0.39$), depression (mean \pm SD_{included} = 0.62 \pm 0.55, mean \pm SD_{excluded} = 0.81 \pm 0.58; $t = -1.27$, $p = 0.20$), anxiety (mean \pm SD_{included} = 0.83 \pm 0.58, mean \pm SD_{excluded} = 0.86 \pm 0.59; $t = -0.65$, $p = 0.52$) at Time 1 between the included and excluded participants. In addition, their age ($F = 0.75$, $p = 0.39$), gender (Chi-square = 1.32, $p = 0.27$), and marital status (Chi-square = 1.94, $p = 0.72$) likewise showed no significant differences.

The five most endorsed life events were Item 9 (“Heavy Study Burden”; 321 students; mean = 2.50, SD = 1.12), Item 25 (“Learning Pressures from Family Members”; 317 students; mean = 2.18, SD = 1.43), Item 3 (“Examination Failure”; 291 students; mean = 2.19, SD = 1.05), Item 8 (“Far Away from Family Members”; 275 students; mean = 2.45, SD = 1.34), and Item 6 (“Did not Like to Go to School”; 234 students; mean = 2.03, SD = 1.09). The mean score of the perceived life events was 1.66 (SD = 0.56, range = 1.04–3.42). These results implied that most participants in the study indeed experienced academics-related stressful events within the last 12 months.

Descriptive statistics and correlation

The mean and standard deviation of each variable are displayed in Table 1. Interpersonal strength has the highest mean score (mean = 5.99), whereas temperance strength has the lowest (mean = 5.00). These results indicate the downward trend of mental health with an increment in stress. Among the three strengths, both temperance strength and interpersonal strength show significantly negative relationships with depression ($r = -0.11$ to -0.20) and positive relationships with flourishing ($r = 0.22$ – 0.46) at two time points. Temperance strength has a significantly negative association with anxiety at Time 1 ($r = -0.11$), while interpersonal strength has the same association with anxiety at Time 2 ($r = -0.15$). Perceived stress at Time 2 is negatively related to the three strengths ($r = -0.10$ to

Table 1 Descriptive statistics and correlations among the researched variables at Time 1 and Time 2

	1	2	3	4	5	6	7	8	9	10
1 Temperance strength	–									
2 Intellectual strength	0.30**	–								
3 Interpersonal strength	0.40**	0.53**	–							
4 Perceived stress_T2	–0.17**	–0.10	–0.21**	–						
5 Depression_T1	–0.20**	–0.02	–0.11*	0.16**	–					
6 Depression_T2	–0.16**	–0.08	–0.19**	0.51**	0.36**	–				
7 Anxiety_T1	–0.11*	0.04	–0.04	0.09	0.66**	0.21**	–			
8 Anxiety_T2	–0.09	–0.01	–0.15**	0.48**	0.26**	0.73**	0.30**	–		
9 Flourishing_T1	0.46**	0.39**	0.42**	–0.20**	–0.44**	–0.30**	–0.28**	–0.13**	–	
10 Flourishing_T2	0.32**	0.21**	0.22**	–0.37**	–0.22**	–0.52**	–0.13**	–0.33**	0.45**	–
Mean	5.00	5.76	5.99	1.66	0.62	0.70	0.83	0.85	5.51	5.23
SD	0.97	0.83	0.71	0.56	0.55	0.65	0.58	0.61	0.92	1.16

T1 Time 1, T2 Time 2

* $p < 0.05$; ** $p < 0.01$

–0.21). All the relationships between perceived stress and mental health outcomes are significant in the expected directions. Comparisons between participants' gender, marital status, and age in terms of studied variables were not significant, except for the differences among two genders in terms of temperance strength at Time 1 and perceived stress at Time 2. Specifically, female participants shower higher scores on interpersonal strength (mean = 6.09, SD = 0.70) than male participants (mean = 5.90, SD = 0.71), and lower scores on temperance strength (mean = 4.89, SD = 0.93) and perceived stress (mean = 1.60, SD = 0.52) than male participants (temperance strength: mean = 5.10, SD = 0.99; perceived stress: mean = 1.72, SD = 0.60).

Regression analyses

The first groups of linear regression using the cross-sectional variables at Time 1 suggest that temperance strength is the only significant contributor to depression ($B = 0.11$, $p < 0.001$), anxiety ($B = -0.07$, $p < 0.05$), and flourishing ($B = 0.11$, $p < 0.001$). Under low-level stress, only temperance strength shows significant and protective functions to psychological symptoms. All three strengths significantly explain the 30.00 % variance of flourishing (Table 2).

The second groups of linear regression analyses further explore the role of the strengths under high-level stress. Both variables at Time 1 and Time 2 are involved. The results are shown in Table 3. The baselines of depression ($B = 0.43$, $p < 0.001$), anxiety ($B = 0.32$, $p < 0.001$), and flourishing ($B = 0.58$, $p < 0.001$) at Time 1 significantly contribute to their corresponding levels at Time 2. After the three strengths are entered in the third step, the baseline mental health outcomes still have significant influences on

their levels at Time 2, whereas the three strengths show different roles. Specifically, after the baselines of the outcomes at Time 1 are controlled for, interpersonal strength significantly explains depression ($B = -0.12$, $p < 0.05$) and anxiety ($B = -0.15$, $p < 0.01$) at Time 2, while temperance strength ($B = 0.16$, $p < 0.01$) significantly explains flourishing at Time 2.

Mediation effect analysis

The main results of mediation effects generated using PROCESS are displayed in Table 4. A total of nine mediation models are constructed with the three strengths (i.e., interpersonal strength, intellectual strength, and temperance strength) as independent variables and the three outcomes (i.e., depression, anxiety, and flourishing) as dependent variables. The indirect effects between the three strengths and the two psychological symptoms (i.e., depression and anxiety) are significant, reflecting the mediation role of perceived stress on the strengths–depression and strengths–anxiety relationships. Furthermore, temperance strength and interpersonal strength show significant indirect effects on flourishing. The mediation models are capable of explaining 0.29–0.34 of variances in the different health outcomes. These results support the main hypothesis, which is based on the transactional model of stress and coping, of this study.

Discussion

This study conducted a two-wave longitudinal investigation to explore the protective role of individual strengths (i.e., interpersonal strength, intellectual strength,

Table 2 Regression analysis of the strengths on mental health outcomes using cross-sectional variables at Time 1

	Mental health outcomes					
	Depression		Anxiety		Flourishing	
	Step 1	Step 2	Step 1	Step 2	Step 1	Step 2
<i>Unstandardized B with significance</i>						
Gender	-0.01	0.01	0.01	0.01	0.05	0.05
Age	-0.03	-0.03	-0.05	-0.04	0.03	0.03
Relationship status	-0.09	-0.08	-0.09	-0.08	0.21*	0.21
Temperance strength		-0.11**		-0.07*		0.05**
Intellectual strength		0.05		0.07		0.03**
Interpersonal strength		-0.06		-0.03		0.21**
R^2	0.01	0.05**	0.01	0.02	0.01	0.31**

* $p < 0.05$; ** $p < 0.01$ **Table 3** Regression analysis of the strengths on mental health outcomes at Time 2 with the controlling of baselines

	Mental health outcomes								
	Depression			Anxiety			Flourishing		
<i>Unstandardized B with significance</i>									
Gender	0.11	0.11	0.09	0.07	0.06	0.03	0.10	0.07	0.03
Age	-0.02	-0.01	-0.01	-0.06	-0.04	-0.05	0.02	0.01	0.01
Relationship status	-0.02	0.01	0.02	0.03	0.05	0.07	0.08	-0.05	-0.03
Baseline		0.43**	0.40**		0.32**	0.30**		0.58**	0.49**
Temperance strength			-0.03			-0.01			0.16**
Intellectual strength			0.01			0.06			0.03
Interpersonal strength			-0.12*			-0.15**			-0.01
R^2	0.01	0.14**	0.16**	0.01	0.10**	0.12**	0.01	0.21**	0.22**

* $p < 0.05$; ** $p < 0.01$ **Table 4** Main results of mediation effects using PROCESS

Models	R^2	F	Direct effect		Indirect effect	
			Effect	95 % C.I.	Effect	95 % C.I.
Tem-Str-Dep	0.34	68.27**	-0.02	[- 0.07, 0.04]	-0.04	[- 0.07, -0.01]
Intel-Str-Dep	0.34	68.41**	-0.02	[- 0.09, 0.04]	-0.03	[- 0.08, -0.01]
Inter-Str-Dep	0.34	69.37**	-0.06	[- 0.14, 0.02]	-0.08	[- 0.13, -0.03]
Tem-Str-Anx	0.29	54.75**	0.01	[- 0.05, 0.06]	-0.02	[- 0.07, -0.02]
Intel-Str-Anx	0.29	54.97**	0.02	[- 0.04, 0.09]	-0.03	[- 0.07, -0.01]
Inter-Str-Anx	0.29	55.17**	0.04	[- 0.11, 0.04]	-0.08	[- 0.14, -0.04]
Tem-Str-Flo	0.30	55.90**	0.14	[0.02, 0.25]	0.03	[0.01, 0.07]
Intel-Str-Flo	0.29	53.46**	0.05	[- 0.08, 0.17]	0.01	[- 0.03, 0.05]
Inter-Str-Flo	0.29	53.27**	-0.02	[- 0.17, 0.13]	0.07	[0.02, 0.15]

Baseline outcomes were set as the controlled variables in the models

95 % C.I. 95 % confidence interval, *Tem* temperance strength, *Intel* intellectual strength, *Inter* interpersonal strength, *Str* perceived stress, *Dep* depression, *Anx* anxiety, *Flo* flourishing** $p < 0.01$

and temperance strength) in affecting the mental health of stressed undergraduate students. The results indicated that strong individual strengths temporally associate with

low perceived stress and, ultimately, better mental health (i.e., lower depression, lower anxiety, and higher flourishing).

The results suggested the protective role of individual strengths in the perceived stress and the capability of individual strengths to provide a subjective report of mental health. The strengths showed small but significant explanations for mental health across a 12-month period after the baselines were controlled for. Under high-level stress (Time 2), the strengths associated with low levels of depression and anxiety and high levels of flourishing through the perceived stress within the last 12 months. Under low-level stress (Time 1), the strengths contributed significantly in explaining the variances in mental health. These results are consistent with the transactional model of stress and coping [25], which suggests that the perceived stress depends on the appraisal of current psychological resources and the objective stressors. Other empirical studies likewise support these results [39–41], which are further discussed in detail in this section.

Generally, two stressors occur, namely, daily stress and traumatic stress [42]. The former usually refers to minor life events, such as “Missing the Bus,” while the latter refers to major life events, such as “Diagnosed with Cancer.” However, this traditional classification is not suitable for the current study. As mentioned at the beginning of this paper, different individuals perceive the same stressor, or the objective stressor, at different levels depending on their personal resources [25]. The main stressful events indicated in the current study (i.e., Heavy Study Burden, Learning Pressures from Family Members, Examination Failure, etc.) should be regarded as major life events rather than minor life events for students, as some studies identified academics-related stress as a major stressor for students [28, 43]. The participants involved in the current study were carefully screened. All the students did not report any perceived serious stress at the beginning, but experienced some major events in the following 12 months. As the results indicated, interpersonal and temperance strengths, rather than intellectual strength, benefited mental health against major life events. This result is similar to those in previous studies conducted in low-stressful contexts [26] and high-stressful contexts [29]. Accordingly, this study actually examined the true roles of strengths in a highly stressful environment.

Promoting complete mental health refers to enhancing psychological well-being (i.e., flourishing in this study) and decreasing psychological symptoms (i.e., depression and anxiety in this study) [31, 44, 45]. The present study revealed that individual strengths have positive effects on both aspects of mental health. At Time 1, when most students experienced low-level stress, their temperance strengths explained the 5.00 % variance of depression, and all the three strengths explained the 30.00 % variance of flourishing. At Time 2, when most students experienced high-level stress, the three strengths showed significant

indirect effects on depression and anxiety ($R^2 = 0.29\text{--}0.34$), and the interpersonal and temperance strengths showed significant indirect effects on flourishing with $R^2 = 0.30$. Temperance strength also demonstrated significant direct effects on flourishing. These cross-sectional and longitudinal results, which are consistent with the results of previous studies [8, 24, 46, 47], suggested the important contributions of personal strengths to mental health.

Importantly, as reflected by the results, the strengths showed more direct effects on psychological well-being and more indirect effects on psychological symptoms. These results reflect the nature of individual strength. Seligman [48] recognized that “psychological health [refers to positive aspects of mental health] is the presence of the strengths” (p. 2), whereas the absence, excess, or opposite of the strengths are psychological symptoms or disorders. The direct effects of personal strengths on psychological well-being can be partly explained by the health behavior model [49, 50]. This model suggests that the characteristics of a personality directly or indirectly (i.e., through self-belief, self-control, and self-efficacy) influence health-related behaviors, which, in turn, facilitate health-related outcomes [50, 51]. For instance, Proyer et al. [46] found that numerous personal strengths are positively related to health-related behaviors, such as healthy eating and regular exercise, which are critical facilitators of mental and physical health.

Through the *Strath Haven Positive Psychology Curriculum*, a 2-year intervention for improving the mental health of students in a normal campus environment, researchers found that improved strengths are associated with enhanced social skills and psychological well-being, but do not have any effects on the changes in depression and anxiety symptoms [4]. Accordingly, perceived stress can be suggested as one of the internal mechanisms between the relationship of personal strengths and psychological symptoms. The roles of strengths in affecting psychological symptoms are only seemingly explicit under stressful situations. Thus, can the strengths be recognized as context-dependent resources, like trait resilience, which indicates the ability to resist negative outcomes [52]? We believe that personal strengths are not context-dependent resources, because individuals with high levels of strengths remain stable before, during, and after they experience stressful events. Schueller et al. [53] adopted 31,429 samples from various countries in the online database of VIA Institute to compare the strengths before and after three tragedies. Their results showed that only one tragedy resulted in slight changes in some personal strengths, whose levels became either higher or lower. Nevertheless, the differences were inconsistent across follow-up periods [53]. Therefore, relatively stable strengths should be

recognized as facilitators of mental health during each stage, i.e., before, during, or after stressful events.

The findings of the current study have meaningful implications for mental health professionals in the field of education. Previous studies demonstrated that cultivating strengths is a potential path to improving the well-being of students [54], including school-related affects and school functioning, regardless of whether they will face stressful events. Accordingly, additional efforts should be devoted to developing intervention programs aimed at enhancing the strengths of college students for improved mental health. For instance, a recent study implies that mindfulness training or mindfulness-based interventions can be expected to help participants be aware of and enhance their strengths [55]. Second, a comprehensive education policy can likewise be developed to construct a positive academic environment for cultivating students by focusing on their strength development [56] beyond providing traditional education. Third, with the findings of this study as the foundation, a strength-based stress reduction program can be developed in future studies. Alternatively, strength-based intervention strategies can be integrated into classical therapies to improve efficacy [57].

Limitations

The major limitation of the present study is the effect size of the results. The additional contributions made by strengths and the mediation results only revealed small effect sizes. Although the findings are interesting, the strengths did not independently explain more than 2 % of the variances of mental health outcomes after controlling the mental health baselines. The source of bias sampling method (i.e., convenience sampling) and the loss of subjects may be two of the potential causes. As studies on strengths and stress are limited, more replications should be operated to reexamine the results in the future. In addition, some other limitations should be motioned. First, because psychological well-being and psychological symptoms were self-reported, participants could have possibly shown more conservative responses to the questionnaire items. Giving such responses may suggest mental health stigma. However, few studies found a negative relationship between some personal strengths (e.g., interpersonal and temperance strength) and stigma [58]. Future studies should adopt more objective methods to assess health-related outcomes. Physical health indicators can also be added to examine whether strengths have any positive effects on physical health. Second, although the mediation model for strengths and health was validated, additional mediators and moderators should be examined. The mediators could help us identify the mechanisms behind strengths–health relationships, and the moderators could

increase the efficacy of strength-based interventions. Third, the “major life events” described in this study were limited in the context of college; these events are not the same as “traumatic events.” Thus, the findings cannot be generalized to non-education contexts.

Conclusions

Interpersonal strength, intellectual strength, and temperance strength are important individual strengths against perceived stress and are protective factors of mental health. Under normal circumstances, these strengths maintain mental health by enhancing psychological well-being. Under stressful circumstances, they maintain mental health by enhancing psychological well-being and reducing psychological symptoms. Educators or mental health professionals should harness the individual strengths of students to help the latter maintain a healthy psychological well-being before, during, and after stressful events.

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Compliance with ethical standards

Conflict of interest Wenjie Duan has received research grants. Wenjie Duan declares that he has no conflict of interest.

Ethical approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

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