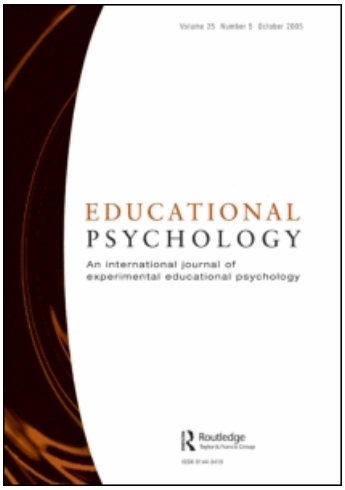

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The Chinese high school student's stress in the school and academic achievement

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The Chinese high school student's stress in the school and academic achievement

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In a sample of 466 Chinese high school students, we examined the relationships between Chinese high school students' stress in the school and their academic achievements. Regression mixture modelling identified two different classes of the effects of Chinese high school students' stress on their academic achievements. One class contained 87% of the students. In this class, the students' stress negatively predicted their academic achievements. For the other 13% of the students, their stress did not predict their academic achievements. Furthermore, we found that gender did not moderate the relationships between Chinese high school students' stress in the school and their academic achievements.

Keywords: academic achievement; Chinese; gender; high school; stress

Over the past decade, researchers on adolescents' stress have become increasingly interested in investigating the effects of adolescents' everyday stressors on their developmental outcomes (Byrne, Davenport, & Mazanov, 2007; Nurmi, 2004; Seiffge-Krenke, Aunola, & Nurmi, 2009). They propose that adolescents are usually faced with mild stressors in their everyday lives and stressors from interpersonal relationships, such as teacher–student relationships and peer relationships, form the majority of their everyday stressors (Seiffge-Krenke et al., 2009). Furthermore, students' poor academic performance, school and leisure conflict, and school attendance are suggested to be some of the causes of their stressful experience in the school settings (Byrne et al., 2007; Kaplan, Liu, & Kaplan, 2005). Moreover, some other stressors during adolescence may possibly stem from home life, concerns about future, financial pressure, emerging adult responsibility and romantic relationships (Byrne et al., 2007; Seiffge-Krenke et al., 2009).

The school as an important context where students spend most of their waking time is consistently emphasised for their developmental outcomes (Brofenbrenner, 1979). In previous research, a growing body of evidence suggests that everyday stressors from the school environment can influence students' adjustment (Kenny, Gallagher, Alvarez-Salvat, & Silsby, 2002), depression (Byrne et al., 2007; Hankin, Mermelstein, & Roesch, 2007) and academic achievements (Kaplan et al., 2005) during adolescence. For the relationships between students' stress and academic achievements, the empirical evidence indicates that interpersonal stress from teacher–student relationships and peer relationships and academic stress are both negatively

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associated with college students' academic achievements (Barnes, Potter, & Fiedler, 1983; Felsten & Wilcox, 1992). However, a limitation of the existing literature is that participants are mainly college students, and few studies have examined the relationships between students' stress and their academic achievements in a high school sample. Furthermore, another limitation is that previous stress theories have been developed and empirically tested by using Western participants. Although the Chinese people represent nearly 20% of the world's population (Lu, Siu, & Lu, 2010), almost no study has examined the effects of Chinese adolescents' everyday stressors on their academic achievements, especially for high school students. In China, the college entrance examination is usually considered to be the most important examination for all Chinese students. When they make the transit into high schools, they are faced with greater academic stress than their Western counterparts at this stage. The third limitation of the previous research is that theories of resiliency suggest that although facing with adversities, many students may overcome them and adjust well over time (Gomez & McLaren, 2006). The theories suggest that student' stressors in the school as risk factors may have different effects on their developmental outcomes. For example, some students' stressful experience can result in a significant decline in their academic achievements. Whereas some other students experience high levels of stress, but we do not see a decline in their academic achievements. However, to our knowledge, no empirical study has examined whether the stressors in the school have different effects on students' academic achievements.

Moreover, the previous research suggests that the school transition is often associated with increased stress levels for students. In the case of a typical school transition, students often enter new school settings where the organisational, instructional and social aspects of schools (e.g. school practice, procedure and policy) are usually changed (Eccles & Midgley, 1988; Reyes, Gillock, Kobus, & Sanchez, 2000), and they must adjust to a number of changes, such as higher grading standard and more difficult learning tasks (Eccles & Midgley, 1990; Reyes et al., 2000). In addition, the school transition often challenges them to establish new interpersonal relationships (Reyes et al., 2000). However, to date, no study has examined the relationships between students' stress and their academic achievements during the school transition period. In this study, we seek to examine the relationships between adolescents' stress and their academic achievements during the high school transition period.

Finally, in the extant literature, there is extensive evidence that adolescents' experience of stress differ between boys and girls, and the gender differences contribute significantly to differences in the relationships between students' stress and their emotional outcomes (Byrne et al., 2007; Hampel & Petermann, 2006; Hankin et al., 2007; Rudolph, 2002). In previous research, two models are put forward to explain the gender differences (Rudolph, 2002). The stress exposure model suggests that girls show more negative emotional outcomes such as depressive symptoms during adolescence because they experience more stressors than boys, whereas the stress reactivity model suggests that girls respond with higher levels of negative emotional outcomes to stressors than boys (Hankin et al., 2007; Rudolph, 2002). In previous research, several empirical studies find that consistent with the stress exposure model, girls report more stressors than boys during adolescence (Allgood-Merten, Lewinsohn, & Hops, 1990; Byrne et al., 2007; Davies & Windle, 1997; Ge, Lorenz, Conger, Elder, & Simons, 1994; Hankin et al., 2007). The interpersonal stressors are reported more by girls than boys who are more likely to report achievement and self-related stressors (Gore, Aseltine, & Colten, 1993; Leadbeater, Blatt, & Quinlan, 1995; Rudolph, 2002).

Whereas some recent evidence reveals that adolescents' school-related stressors are similar for both girls and boys (Seiffge-Krenke et al., 2009). For the stress reactivity model, the empirical findings are also mixed. Some studies indicate that adolescent girls usually respond with higher levels of negative emotional outcomes to stressors than boys (Ge et al., 1994; MacKinnon, Lockwood, Hoffman, West, & Sheets, 2002; Rudolph, 2002; Wagner & Compas, 1990). Furthermore, the girls react more to interpersonal stressors than boys who react more to school-related stressors (Goodyer & Altham, 1991; Hankin et al., 2007; Leadbeater et al., 1995; Sund, Larsson, & Wichstram, 2003). Contrarily, some other studies do not find significant differences in the stress reactivity between girls and boys (Leadbeater, Kuperminc, Hertzog, & Blatt, 1999; Wagner & Compas, 1990). However, in the extant literature, almost no study has investigated the gender differences in the relationships between adolescents' stressors and their cognitive outcomes such as academic achievements. In the present study, we seek to reduce these research gaps.

The present study

The present study aims to investigate whether Chinese high school students' stress has different effects on their academic achievements during high school transition, and whether gender can moderate the relationships between students' stress in the school and academic achievements. We expect that there are different effects of Chinese high school students' stress on their academic achievements, and gender will moderate the relationships between Chinese high school students' stress in the school and their academic achievements.

Method

Participants

Participants were recruited from two urban senior high schools (11 classes) located in Nanjing, Jiangsu province, People's Republic of China. These schools were randomly chosen; one had an above-average achievement level, whereas the other had a below-average achievement level. In the present study, there were 466 students (263 females) of Grade 10 who agreed to participate in our study. The mean age was 16.66 years (SD = .61) for males and 16.63 years (SD = .53) for females. Data from school records indicated that the students were primarily from working- and middle-class families and their abilities and socio-economic status were similar.

Procedure

In the present study, data were collected nearly at the end of the first high school term in order that the students were familiar with the academic stress in their new school settings. During the investigations, the students completed a 20-minute survey during classroom time. The administration of the measures was carried out by graduated students of psychology. In this study, we collected the students' final examination scores of the first high school term from school records. In addition, in order to know the students' prior records of academic achievements, we collected the students' scores of high school entrance examination, which can represent their academic achievements before high school years.

Measures

Adolescents' stress in the school

Students' stress was assessed with a 26-item Chinese measure with some items adapted from Byrne et al.'s (2007) adolescent stress questionnaire (ASQ). The scale had five subscales which measured students' perceptions of stress from school performance (five items; e.g. I have to study things I do not understand), peer pressure (five items; e.g. I have disagreements with my peers), teacher interaction (nine items; e.g. our teachers respect us [reverse coded]), future uncertainty (two items; e.g. I feel stress to meet my future goals) and school/leisure conflict (five items; e.g. I have not enough time for activities outside of school hours). The students were asked to respond on a four-point scale ranging from 1 (*strongly disagree*) to 4 (*strongly agree*). The negatively keyed items were reverse-coded and average scale scores were computed. The confirmatory factor analysis indicated that the factor loadings of the subscales were all significant and the construct validity was good; $X^2/df = 2.69$, comparative fit index (CFI) = .90, root mean square error of approximation (RMSEA) = .06. The internal consistency reliability of this scale was also adequate ($\alpha = .81$ for school performance, $\alpha = .82$ for peer pressure, $\alpha = .90$ for teacher interaction, $\alpha = .67$ for future uncertainty and $\alpha = .88$ for school/leisure conflict, respectively).

Academic achievement

In China, high school students' academic achievements were mainly evaluated by a sum score of Chinese, mathematics and English courses. Hence, the standardised scores of Chinese, mathematics and English courses were used in the present study. The scores of these courses were based on objective examinations conducted by the two schools. The maximum score for each course was 100, and a score below 60 meant a failure.

Analytic strategy

In the present study, regression mixture model was used to examine the differences in the effects of adolescents' stress in the school on their academic achievements. We firstly found the number of latent classes that best fitted the data and determined whether the effects of students' stress on academic achievements differed in each subgroup. We investigated models from one to three latent classes in order to determine the optimal number of classes. The fit indices, class proportions, classification efficiency and interpretability were examined in each class. Bayesian information criterion (BIC) and Akaike information criterion (AIC) were used to determine the optimal model. Lower BIC and AIC values suggested a better fit of the model (Muthén & Muthén, 2004). In addition, we used the Lo–Mendell–Rubin likelihood ratio test which compared the estimated model with a model that had one less class (Lo, Mendell, & Rubin, 2001). A low *p*-value yielded in the Lo–Mendell–Rubin test usually indicated that the estimated model should be preferred (Booth-LaForce & Oxford, 2008; Muthén & Muthén, 2004). For testing the gender differences, gender was entered into the regression mixture model as a predictor of latent class membership by using the multinomial regression (Van Horn, Jaki, Masyn, & Ramey, 2009). In the analysis, missing values for the study variables were imputed by the EM algorithm (Dempster, Laird, & Rubin, 1977) and the students' academic achievements before high school years were entered into the model as a control variable.

Results

Descriptive results

Descriptive data indicated that the students experienced a high level of stress from school performance (M = 2.81, SD = .60), uncertainty regarding their future (M = 3.30, SD = .61) and a lack of free time to play (M = 2.41, SD = .70), whereas they experienced interpersonal stress from teacher–student relationships (M = .61, SD = .49) and student–student relationships (M = .69, SD = .54). Inter-correlations of the variables were listed in Table 1. A series of ANOVAs indicated that the students' stress is similar for both girls and boys.

Identification of latent classes

To determine the optimal number of classes, we investigated models from one to three latent classes. Table 2 indicates fit indices and estimates of the proportion of students in each class from one-class model to three-class model. We found that although the BIC dropped from two-class model to one-class model, the other information available all supported the two-class model than the other two models. Hence, the two-class model was preferred to form the basis for the rest of the analysis of the present study. For the meanings of the two classes, one class contained about 87% of the students. For this class, it was clear that the students' stress from school performance negatively predicted their academic achievements (β = –0.19, p < .05).

Table 1. Intercorrelations among adolescents' stress and academic achievements.

Variable	1	2	3	4	5	6
1. Stress from school performance						
2. Stress from peer pressure	.16**					
3. Stress from teacher interaction	.17**	.56**				
4. Stress from future uncertainty	.33**	–.14**	–.14**			
5. Stress from school/leisure conflict	.56**	.24**	.28**	.16**		
6. Academic achievement (high school)	–.05	.01	–.02	.04	–.06	
7. Academic achievement (middle school)	.06	.05	.05	.03	.00	.41**

Note: N = 466; *p < 0.05, **p <0.01.

Table 2. Fit indices for regression mixture model.

Criterion	One class	Two class	Three class
Log-likelihood	–611.41	–603.21	–600.00
AIC	1238.83	1238.42	1247.99
BIC	1271.95	1304.66	1347.56
LMRT (p value)		<.05	>.05
Class 1 (%)	100	13	14
Class 2 (%)		87	8
Class 3 (%)			78

Note: N = 466; AIC, Akaike information criterion; BIC, Bayesian information criterion; LMRT, Lo–Mendell–Rubin test.

Because this class was characterised by the significant effects of adolescents' stress on their academic achievements, it was denoted as the *significance* class. For the other class comprising about 13% of the participants, the results indicated that all the dimensions of the students' stress measured in present study did not significantly predict their academic achievements. Contrary to the first class, this class was thus termed the *no-significance* class.

Gender differences

The next analysis assessed the moderating effects of gender on the relationships between Chinese high school students' stress and their academic achievements. In the analysis, gender was entered into the regression mixture model as a predictor of latent class membership by using the multinomial regression. The results indicated that with the inclusion of gender, the entropy of the model and the parameter estimates for each class changed slightly. Furthermore, the effects of students' stress from school performance remained significant for the significance class, while the influences of stress on academic achievements were still not significant for the no-significance class. The findings suggested that the results of the model were robust. Finally, the results indicated that gender did not significantly predict the class membership, which suggested that the gender did not moderate the relationships between Chinese high school students' stress and their academic achievements.

Discussion

In the present study, we expand the existing literature by examining the relationships between adolescents' stress and their academic achievements not only during the high school transition period, but also in a Chinese high school sample. Although earlier research usually focuses on the average effects and ignores the differences in the effects of adolescents' stress on their academic achievements, the present study provides strong evidence for the differential effects of Chinese high school students' stress on their academic achievements by using the regression mixture model which can identify the latent subgroups in which the effects of predictors on outcomes are usually different (Muthén & Muthén, 2004; Van Horn et al., 2009). Moreover, we examine the moderating effects of gender on the relationships between Chinese adolescents' stress and their academic achievements by using the regression mixture model which is suggested to have some advantages over the traditional method of product terms (Van Horn et al., 2009).

In descriptive analysis, we find that Chinese high school students experience a high level of stress from school performance, uncertainty regarding their future and a lack of free time to play rather than the interpersonal stress, which is inconsistent with the findings from German adolescents that stressors from interpersonal relationships constitute the majority of the adolescents' everyday stressors (Seiffge-Krenke, 2006), but is in line with the notion proposed by some researchers that as students grow up, they are more likely to report school-related stressors (Seiffge-Krenke et al., 2009; Wagner & Compas, 1990).

According to the stress exposure model and some previous American findings, girls report a greater number of stressors overall during adolescence than boys (Allgood-Merten et al., 1990; Byrne et al., 2007; Davies & Windle, 1997; Ge et al., 1994; Hankin et al., 2007), and interpersonal stressors are more likely to be reported

by girls than boys (Gore et al., 1993; Leadbeater et al., 1995; Rudolph, 2002). In the present study, ANOVAs indicate that no difference existed in the self-reported stress between Chinese boys and girls. The results do not support the stress exposure model and the previous findings in American adolescents (Hankin et al., 2007), but are in line with the recent findings that students' school-related stressors do not vary across different gender (Seiffge-Krenke et al., 2009).

For the first hypothesis of the present study, we expect that there were different effects of Chinese high school students' stress on their academic achievements. As listed in Table 2, the regression mixture model identifies two different classes for the effects of Chinese high school students' stress on their academic achievements, which supports the hypothesis and the theories of resiliency as well. The results suggest that for the majority of our sample (87%), a higher level of academic stress from school performance is associated with lower academic achievement. Furthermore, we find that for nearly 13% of the students in our sample, though these students have the same stressors in their schools as the previous class, the stressors as risk factors seem to not significantly influence their academic achievements. In addition, the findings imply that there are some moderators between the relationships of Chinese high school students' stress in the school and their academic achievements.

After the first hypothesis is confirmed, secondly, the present study aimed to test gender as a moderator on the relationships between Chinese high school students' stress and their academic achievements. However, our findings do not support the second hypothesis. The results suggest that although some previous studies find gender differences in relationships between the effects of adolescents' stressors and their emotional outcomes such as depressive symptoms (Byrne et al., 2007; Hampel & Petermann, 2006; Hankin et al., 2007; Rudolph, 2002), the effects of adolescents' stressors on their cognitive outcomes are similar across different gender. The results also do not provide support to the stress reactivity model, but support some previous empirical findings which reveal no significant gender differences in the stress reactivity between girls and boys (Leadbeater et al., 1999; Wagner & Compas, 1990).

Although this study adds to the literature by testing the different effects of the Chinese high school students' stress on their academic achievements during the high school transition period, there are some limitations that point to important directions for further research. As the present study is cross-sectional, the cause–effect of the relationships between Chinese high school students' stress and their academic achievements can not be examined here. Longitudinal study may be useful to provide more information on the cause–effect of these relationships. Furthermore, when testing our first hypothesis, the results imply that there are some moderators between the relationships of Chinese high school students' stress and their academic achievements; however, the results show that gender cannot serve as a moderator. Hence, further research that aims to examine the other moderators of the stress–academic achievement relationships is necessary.

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