
Mathematics teacher stress in Chinese secondary schools¹

Lingqi Meng²

*Louisiana State University, College of Education
Baton Rouge, Louisiana, USA*

Shujie Liu

University of Southern Mississippi, Mississippi, USA

Abstract

Since the 1970s studies on teacher stress have become numerous. However, most of the existing research has been the product of western countries. There have been a few studies conducted in the People's Republic of China. This study aims to investigate the general level of Chinese math teachers' stress, its main sources, and the coping methods. The questionnaire, which was used in Taiwan (Kyriacou & Chien 2004), was administered to 211 secondary school math teachers who attended an in-service training program in the summer of 2007. This study revealed that teachers in China experience a higher level of stress compared to their counterparts in western countries and in other Chinese societies (eg Taiwan and Hong Kong). Moreover, rural teachers, young teachers, and teachers with less teaching experience reported being more stressed than their respective peers. This paper provides the possible explanations for the findings and suggestions for Chinese policy makers as well as for future studies in China.

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² Lingqi Meng is the corresponding author for this article. His telephone number is 225-334-5124 and his email address is lmeng1@lsu.edu.

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Since the 1970s studies on teacher stress have become numerous (eg Abel & Sewell 1999; Borg & Riding 1991; Cole & Walker 1989; Dunham & Varma 1998; Fontana & Abouserie 1993; Hui & Chan 1996; Jepson & Forrest 2006; Kokkinos 2007; Kyriacou 2000, 2001; Kyriacou & Chien 2004; Kyriacou & Sutcliffe 1977, 1978a, 1978b; Payne & Furnham 1987; Solman & Feld 1989; Travers & Cooper 1996). However, most of the existing research has been the product of western countries. There have been a few studies conducted in the People's Republic of China (hereafter called China). Thus, we do not know much about teacher stress in China. Moreover, there might be differences in the main sources of teacher stress or the stress coping methods in China as opposed to other countries. Kyriacou (2001, p 30) hinted this when he stated, “. . . there are differences in the main sources of teacher stress between countries based on the precise characteristics of national educational systems, the precise circumstances of teachers and schools in those countries and the prevailing attitudes and values regarding teachers and schools held in society as a whole.” This study aims to investigate the general level of math teacher stress, its sources, and coping methods in China. The main reason math teachers were chosen for this study is that math is regarded very highly as one of the core courses in Chinese secondary schools, so students' math test scores are more important than their scores in other areas, both for the students and for their teachers. Therefore, math teachers are perceived to be under more pressure than teachers who teach other subjects. It is expected that the results from this study will contribute to the enrichment of the field of teacher stress internationally.

Introduction

Studies conducted over the past three decades have revealed that the phenomenon of teacher stress is widespread, and have identified various sources of teacher stress. Travers and Cooper (1996) employed the exploratory factor analysis (EFA) to explore the underlying dimensions for the 98-item scale of pressure sources of teachers' jobs in the United Kingdom. They identified 10 factors: pupil/teacher interaction, organizational structure of the school, class size, changes taking place within education, appraisal of teachers, supervisors' concerns of management, lack of status/promotion, staff shortage, job insecurity, and ambiguity of the teacher's role. The Kokkinos (2007) study was constructed to investigate the relationship between burnout, personality characteristics and job stressors in 447 primary school teachers from Cyprus. An EFA of the 63 job stressors revealed 11 factors: students' behaviors, managing student misbehavior, decision making, relationships with colleagues, role ambiguity, poor working conditions, appraisal of teachers by students, work overload, appraisal of teachers by peers, time constraints, and specific teaching demands. Hui and Chan (1996) surveyed a total of 415 secondary teachers in Hong Kong. The top sources of stress they identified consisted of teaching unmotivated students, students with low or mixed abilities, lack of time for guiding students, and heavy workload. The bottom sources of stress were comprised of

working relationships with colleagues and seniors, relationships with outside professionals, and handling complaints from parents.

Interestingly, different studies identified different demographic variables that contributed to the significant differences on the general teacher stress level or on sources of teacher stress (eg Abel & Sewell 2001; Kyriacou and Chien 2004; Travers & Cooper 1996). In terms of gender, some studies (eg Kyriacou & Chien) showed that there was no significant difference on the general level of teacher stress, but other studies found that there was a significant difference between female and male teachers. Even for the latter, the findings were still inconsistent. For example, Borg and Riding (1991) found that male teachers reported greater stress than female teachers, but Laughlin (1984), as well as Payne and Fumham (1987), found that female teachers reported greater stress than their counterparts. The Travers and Cooper (1996) t-test showed that there was a significant difference between female and male teachers regarding only some factors of sources of stress. For example, female teachers suffered more stress from organizational structure of the school, class size, appraisal of teachers, and job insecurity than male teachers; while male teachers reported greater pressure from supervisors' concerns of management.

As for other demographic variables, the Kyriacou and Chien (2004) study showed that there was no significant difference on the general level of stress in terms of length of teaching experience or position held in the school. There was, however, a significant difference in school size with those teachers in large schools reporting a higher level of stress than other teachers. Payne and Fumham (1987) found that teachers with less experience and lower qualifications reported greater stress than their counterparts. Laughlin (1984) found that younger teachers, teachers from secondary schools, and those not in promotion reported more stress. The Abel and Sewell (2001) study examined 51 rural and 46 urban secondary school teachers in the USA. The MANOVA revealed a significant overall difference between urban and rural school teachers on the sources of stress. The univariate tests found significantly greater stress for urban teachers than for rural teachers regarding poor working conditions and poor staff relations, but no significant differences were found between urban and rural school teachers in terms of pupil misbehavior and time pressure.

Although research on teacher stress has been conducted in Hong Kong (eg Hui & Chan 1996) and Taiwan (eg Kyriacou & Chien 2004), there may be sources of teacher stress that are unique to the educational context in mainland China. In this light, let us examine China's educational context more closely. In general, the education system in China can be divided into basic education (K-12) and higher education. There are two high-stakes exams for K-12 students. One is the high school entrance exam, and the other is the college entrance exam. For many years the national uniform college entrance exam (NUCEE) has almost exclusively been the route by which students are accepted by colleges in China. Therefore, the NUCEE exerts a powerful influence on the primary and secondary education systems across the country. Specifically, all educational activities

center on the NUCEE so that teachers “teach to the test” and students “learn to the test.” Teaching to the test is a problem everywhere for various reasons; however, the problem is magnified in China by the competitive nature of school placement. Some schools are considerably better than others. Attending to these schools has a major impact on a child’s future. The main way to get into one of the better schools is to score in the top percentage on the entrance tests. This heightens the temptation on the part of the teachers to “teach to the test” and on the part of the students to “study to the test.” Meanwhile, schools have traditionally been evaluated by all levels of educational departments, which mainly use students’ test scores. The principals also use these test scores to evaluate their teachers. Under such situations, teachers bear more stress. The curriculum reform, which was implemented in 2001, calls for an evaluation system that combines teacher self-evaluation with evaluations by principals, peers, parents, and students. However, Liu and Teddlie’s (2007) study indicated that the current teacher evaluations are primarily based on students’ test scores, and the results still give rise to reward/punishment of teachers. Thus, teachers are currently under great psychological pressure in the context of the curriculum reform.

Against the educational context in China described above, this study was designed to answer the following questions regarding teacher stress in China:

1. What is the general level of math teacher stress in China? Is there a significant difference on the general stress level in terms of gender, age, teaching experience, position, school size, and school location?
2. What do math teachers consider to be the main sources of stress in China?
3. What do Chinese math teachers consider to be effective coping methods used by themselves, their schools and the government to reduce their stress?

Method

Participants

Participants consisted of 211 secondary school math teachers (106 males and 105 females) who attended an in-service training program in the summer of 2007 organized by a teachers college in a middle-sized city in a northeastern Chinese province. In terms of age, 40% of the teachers were less than 31 years, 47% were between 31 and 40, and 13% were older than 40. Among the sampled teachers, 32% had less than 5 years of teaching experience, 31% had 6-10 years, and 37% had greater than 10 years. In terms of positions held in the school, 46% were Banzhuren³ as well as mathematics teachers,

³ A Banzhuren is a position in China which has no direct counterpart in western countries. A Banzheren teacher teaches a subject as all other teachers do, but is also in charge of a class’ management. As a director of a class, a Banzhuren is responsible for the students’ studies,

and 54% were only mathematics teachers. Regarding school size, 40% taught in schools with less than 20 classes, 41% taught in schools with 21-40 classes, 12% taught in schools with 41-60 classes, and 7% taught in schools with greater than 60 classes. As for school location, 49% of teachers taught in urban schools and 51% taught in rural schools.

Instrument

The 62-item teacher stress questionnaire was originally developed by Kyriacou and Chien in 2003 and was used in their study in Taiwan (2004). The main reason for adopting the existing instrument is that China and Taiwan share a similar Confucius culture. Thus, the questionnaire that had been used in Taiwan was supposed to be the most appropriate one for use in China. However, some minor changes were made before it was employed in China due to some differences in educational context between China and Taiwan. The current questionnaire consisted of four parts. Part One included six demographic items. Part Two contained one item, addressing the general level of teacher stress using a five-point Likert scale. Part Three consisted of 21 items regarding sources of teacher stress, with 20 of them on a five-point Likert scale, and one in the form of an open-ended question. Part Four focused on the coping methods used by teachers, and school/government intervention strategies. It included 34 items, with 33 of them on a five-point Likert scale and one in the form of an open-ended question.

Procedure

The questionnaire was given to five math instructors who taught for the in-service teacher training program in the summer of 2007 as described earlier. The instructors then distributed the questionnaire to their students at the beginning of their second class meeting. The total number of students was 220, and 211 answered the questionnaire, with a response rate of 96%.

Results

The general level of math teacher stress

SPSS Version 13 was used for all the statistical analyses in this study. Teacher responses to the question on the general level of stress they experienced showed that about 42% reported a lot of or extreme stress. The one-way ANOVAs showed that there were no significant differences were obtained on the general stress level in terms of gender, position, school location, or school size, but there were significant differences in terms

behaviors, ethics education, health, safety, and so forth. Usually, a principal assigns a teacher to be a Banzhuren.

of age ($F(2, 207) = 7.033, p < .001$) and teaching experience ($F(2, 207) = 8.545, p < .001$). The Post Hoc tests for age showed that there was a significant difference between “less than 31” and “31-40” groups and between “less than 31” and “41-50” groups, with the “less than 31” group reporting a higher stress level than the other two groups. The Post Hoc tests for teaching experience showed that there was a significant difference between “0-5 year” and “6-10” groups and between “0-5 year” and “greater than 10 year” groups, with the “less than 0-5 year” group reporting a higher stress level than the other two groups.

The main sources of math teacher stress

The percentages of math teachers’ responses. Percentages of teachers’ responses to the 20 items on sources of teacher stress were calculated. We then created a sixth point, “A lot of or extreme stress” by calculating the mean of the scores in “A lot of stress” and “Extreme stress.” Table 1 presented the percentages of responses from the teachers for each item. We set a subjective criterion: If the percentage of the sixth point was less than 6%, the item was deleted, since a low percentage indicated that the item was not a main source of teacher stress in China.

Table 1: Sources of Teacher Stress (Percentages, N=211)

<i>Source of stress</i>	<i>No stress</i>	<i>A little stress</i>	<i>Some stress</i>	<i>A lot of stress</i>	<i>Extreme stress</i>	<i>A lot of or extreme stress</i>
<i>III1. Students who lack motivation</i>	1.4	4.3	32.9	44.3	17.1	61.4
<i>III2. Communications to and from parents</i>	19.7	23.1	34.6	18.3	4.3	22.6
<i>III3. Public’s attitude and misunderstanding about teachers’ workload</i>	6.3	20.3	38.6	23.7	11.1	34.8
<i>III4. Students’ misbehavior</i>	2.4	10.0	32.4	36.7	18.6	55.3
<i>III5. Management style of the school principal</i>	11.5	21.2	33.2	21.6	12.5	34.1
<i>III6. Additional administrative work</i>	26.7	22.4	26.7	17.6	6.7	24.3
<i>III7. Competition between classes/colleagues</i>	14.8	26.7	29.0	20.5	9.0	29.5

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III18. Instructing students who take part in local or national competition	22.9	25.7	23.8	20.5	7.1	27.6
III19. Too many students in one class	25.7	26.7	27.1	13.3	7.1	20.4
III10. Poor working conditions	21.4	30.5	26.7	14.8	6.7	21.5
III11. Having to join too many teacher research and study seminars	18.7	27.8	28.7	19.6	5.3	24.9
III12. Sundry class duties (e.g. collecting money for lunch/tuition fee)	40.5	26.7	13.8	13.8	5.2	19.0
III13. Subject or grade taught does not fit expectations or self ability	29.0	27.6	24.3	12.4	6.7	19.1
III14. Changeable education policy of the government	11.4	22.4	32.9	20.0	13.3	33.3
III15. Special students in the class (e.g. with autism, attention deficit and hyperactivity disorder, low ability or low emotional intelligence)	11.9	49.0	34.3	4.3	.5	4.8
III16. Not enough teaching resources	6.7	18.6	39.5	25.2	10.0	35.2
III17. Students' poor attitudes toward classroom tasks	2.9	9.0	29.5	39.5	19.0	58.5
III18. Being observed by colleagues, student teachers, college tutors or parents	33.8	45.2	17.6	1.9	1.4	2.9
III19. Too much subject matter to teach	15.8	37.3	30.6	15.3	1.0	16.3
III20. Break time is too short	41.4	37.1	17.6	3.3	.5	3.8

Based on the last column, the five most stressful items were as follows: “Students who lack motivation,” “Students’ poor attitudes toward classroom tasks,” “Students’ misbehavior,” “Not enough teaching resources” and “Public’s attitude and misunderstanding about teachers’ workload.” The five least stressful items were as follows: “Being observed by colleagues, student teachers, college tutors or parents,” “Break time is too short,” “Special students in the class,” “Too much subject matter to

teach” and “Sundry class duties.” According to the predetermined criterion, we deleted the three items with a percentage lower than 6%: items III18, III20, and III15.

The EFA results. For the remaining 17 items on Part Three of the questionnaire, an EFA was used to examine the factor structure of this sub-questionnaire. A principal components analysis with varimax rotation rather than the oblique rotations (e.g., Direct Oblimin) was employed since it was difficult to find any studies on teacher stress which revealed a high correlation between the stress factors (eg Kokkinos, 2007; Travers & Cooper, 1996). A scree plot was used to determine the number of factors underlying the data, and it suggested a two-factor solution. Table 2 presented the rotated matrix from the two-factor solution, together with the Cronbach’s internal consistency alpha coefficients and proportion of variance explained. Although .40 has been used as a normal threshold for factor loadings in education, .35 and .30 were also used by some researchers (eg Isemonger & Sheppard, 2007; Lau, 2004; Worrell & Mello, 2007). The significance of a factor loading depends on the sample size (Stevens, 1992) and the rotation method (Comrey & Lee, 1992). Since the sample size for the current study was 211 and an orthogonal rotation method was used, the threshold was set at .30, which met the minimal level suggested by Comrey and Lee.

Table 2: Two-Factor Model for Sources of Stress

Item	Factor 1	Factor 2	Total
<i>III12. Sundry class duties</i>	.703		
<i>III11. Having to join too many teacher research and study seminars</i>	.679		
<i>III10. Poor working conditions</i>	.624		
<i>III8. Instructing students who take part in local or national competition</i>	.614		
<i>III9. Too many students in one class</i>	.599		
<i>III7. Competition between classes/colleagues</i>	.586	.312	
<i>III6. Additional administrative work</i>	.581		
<i>III14. Changeable education policy of the government</i>	.566	.308	
<i>III13. Subject or grade taught does not fit expectations or self ability</i>	.476	.309	
<i>III5. Management style of the school principal</i>	.460	.346	
<i>III16. Not enough teaching resources</i>	.423	.293	
<i>III19. Too much subject matter to teach</i>	.285		

<i>III1. Students who lack motivation</i>		.764	
<i>III4. Students' misbehavior</i>		.609	
<i>III3. Public's attitude and misunderstanding about primary teachers' workload</i>		.599	
<i>III2. Communications to and from parents</i>		.584	
III17. Students' poor attitudes toward classroom tasks		.549	
Alpha	.828	.6297	.838
% Variance	23.26	15.21	38.47

As can be seen from Table 2, twelve items were loaded on the first factor, to which we gave the subjective name “the teachers’ working environment” for convenient reference; and five items were loaded on the second factor, which was named as “the teachers’ relationships with students and parents.” Although the loading coefficient for Item III19 was lower than .30, we chose to keep it because it is one of the few pedagogical sources of stress in the survey.

In order to see whether there were significant differences in the two factors regarding of gender, school size, and so forth, several one-way ANOVAs were conducted, with the mean of the items loading on the factor as the dependent score. The ANOVAs results, as well as the means and standard deviations in the two factors in terms of age, teaching experience, and location, were presented in Table 3 and Table 4:

Table 3: The Means and Standard deviations on the Two Factors in Terms of Age, Teaching Experience, and Location

	Factor 1		Factor 2	
	Mean	SD	Mean	SD
Age				
Less than 31	2.90	.78	3.45	.57
31-40	2.55	.58	3.33	.64
Greater than 41	2.35	.58	3.02	.74
Teaching Experience				
0-5 years	3.00	.79	3.53	.51
6-10 years	2.47	.54	3.34	.68
Greater than 10 years	2.53	.60	3.18	.66

School Location				
Rural	2.80	.74	3.49	.56
Urban	2.53	.61	3.17	.68
Total	2.67	.69	3.34	.64

The ANOVAs showed that there were no significant differences in either of the two factors in terms of gender, school size, or position, but there were significant differences in both of the two factors regarding age, teaching experience, and location, respectively. Teachers less than 31 years old and teachers with teaching experience less than five years were more stressed in both factors than other teachers; rural teachers reported a higher stress level in both factors than their urban peers.

Results from the qualitative data. Part Three of the questionnaire used in this study contained an open-ended question: "Please list below anything else that has caused you stress." 150 out of 211 participants responded to this question. In addition to the responses that were consistent with the ratings discussed earlier, four new themes emerged from the qualitative data analysis: (1) the unfair teacher evaluation system, (2) inadequate breaks and holidays, (3) teaching methods required by the curriculum reform that were contrary to teaching methods required by the examinations (e.g., NUCEE), and (4) too many inspections from all levels of educational departments. Among these, the unfair teacher evaluation system was regarded as the main source of stress. Many teachers mentioned, "The principal evaluates the teachers using the students' test scores;" "The school is always pursuing the proportion of students entering schools of a next higher level, and the pressure that is put on teachers is too heavy;" and "The NUCEE is so hard that it makes teachers stressed."

Stress coping methods

The percentages of teachers' responses. Table 5 presented the percentages of responses from the teachers for each item. Based on the last column, which was the mean of "Very effective" and "Extremely effective," the five most effective coping methods were as follows: "Having a healthy home life," "Ensuring that you understand the material you are about to teach," "Learning how to control your emotions," "Seeing the humor in the situation" and "Getting to know your students as individuals." The five least effective coping methods included "Practicing religion," "Taking absences," "Changing schools," "Psychological counseling" and "Spending alone." According to the predetermined criterion, we deleted the following items: items IV13, IV4, IV23, IV6, and IV14.

Table 4: ANOVAs on the Two Factors in Terms of Gender, School Size, Position, Age, Teaching Experience, and Location

	Factor 1	Factor 2
Gender	F(1, 203)=.441 p=.507	F(1, 203)=.7844 p=.377
Age	<i>F(2, 202)=9.473***</i> <i>p <.001</i>	<i>F(2, 202)=4.922*</i> <i>p=.008</i>
Teaching Experience	<i>F(2, 202)=13.749***</i> <i>p <.001</i>	<i>F(2, 202)=5.485**</i> <i>p=.005</i>
Positions	F(1, 203)=.316 p=.574	F(1, 203)=1.892 p=.171
School Size	F(3, 201)=.437 p=.727	F(3, 201)=1.725 p=.163
School Location	<i>F(1, 203)=8.346**</i> <i>p=.004</i>	<i>F(1, 203)=13.525***</i> <i>p <.001</i>

*** $p < .001$

** $p < .01$

* $p < .05$

Table 5: Stress Coping Actions (Percentages, N = 211)

<i>Coping action</i>	<i>Ineffective or never used</i>	<i>A little effective</i>	<i>Moderately effective</i>	<i>Very effective</i>	<i>Extremely effective</i>	<i>Very or extremely effective</i>
IV1. Discussing your problems with colleagues or friends	16.7	51.4	20.5	9.5	1.9	11.4
IV2. Starting the term with clearly defined classroom rules and expectations	5.2	20.5	41.0	29.0	4.3	33.3

<i>IV3. Relaxing after work</i>	<i>8.1</i>	<i>12.9</i>	<i>23.3</i>	<i>39.5</i>	<i>16.2</i>	55.7
<i>IV4. Taking absences</i>	<i>87.1</i>	<i>10.2</i>	<i>.5</i>	<i>1.1</i>	<i>1.1</i>	2.2
<i>IV5. Analysing and trying to keep problems in perspective</i>	<i>6.2</i>	<i>17.1</i>	<i>35.5</i>	<i>33.6</i>	<i>7.6</i>	41.2
<i>IV6. Psychological counselling</i>	<i>90.5</i>	<i>5.7</i>	<i>.5</i>	<i>2.8</i>	<i>.5</i>	3.3
<i>IV7. Deep breathing</i>	<i>40.3</i>	<i>45.0</i>	<i>8.1</i>	<i>5.2</i>	<i>1.4</i>	6.6
<i>IV8. Ensuring that you understand the material you are about to teach</i>	<i>1.0</i>	<i>8.6</i>	<i>12.9</i>	<i>46.2</i>	<i>31.4</i>	77.6
<i>IV9. Devoting oneself to free-time activities</i>	<i>35.7</i>	<i>14.8</i>	<i>24.3</i>	<i>18.6</i>	<i>6.7</i>	25.3
<i>IV10. Getting to know your students as individuals</i>	<i>2.8</i>	<i>13.3</i>	<i>22.7</i>	<i>46.4</i>	<i>14.7</i>	61.1
<i>IV11. Spending more time communicating with parents</i>	<i>15.6</i>	<i>41.2</i>	<i>29.9</i>	<i>11.4</i>	<i>1.9</i>	13.3
<i>IV12. Thinking about the coming vacation</i>	<i>20.5</i>	<i>26.2</i>	<i>22.9</i>	<i>25.2</i>	<i>5.2</i>	30.4
<i>IV13. Practising religion</i>	<i>88.6</i>	<i>10.5</i>	<i>1.0</i>			.0

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IV14. Spending time alone	50.2	30.6	13.9	4.3	1.0	5.3
IV15. Forgetting things that happened in school after work	34.9	35.4	12.0	14.8	2.9	17.7
IV16. Having a healthy home life	1.4	5.2	7.1	25.6	60.7	86.3
IV17. Learning how to control your emotions	3.3	15.2	16.7	33.8	31.0	64.8
IV18. Seeing the humour in the situation	9.0	12.3	14.7	37.0	27.0	64.0
IV19. Avoiding confrontations	18.1	34.8	19.5	20.5	7.1	27.6
IV20. Continuing further education	8.1	9.5	23.2	38.4	20.9	59.3
IV21. Sharing your failures	20.9	31.8	23.2	17.5	6.6	24.1
IV22. Ensuring someone understands you and stands by you	8.1	23.8	33.3	23.3	11.4	34.7
IV23. Changing schools	87.6	6.7	2.9	1.4	1.4	2.8
IV24. Planning ahead and prioritising	6.6	17.5	25.1	39.8	10.9	50.7
IV25. Reading books about stress	18.5	22.3	28.4	23.2	7.6	30.8

IV26. Institutionalise and make transparent personnel matters in school	9.5	20.5	31.0	30.0	9.0	39.0
IV27. Change education policy less frequently	2.4	9.6	22.5	48.8	16.7	65.5
IV28. Reduce extra activities during school time	16.6	37.4	29.4	13.3	3.3	16.6
IV29. Improve working conditions	.9	8.5	16.6	38.9	35.1	74.0
IV30. Increase teaching resources	2.4	9.0	23.7	46.4	18.5	64.9
IV31. Provide professional administrators	9.0	32.9	29.0	23.3	5.7	29.0
IV32. Decrease teachers' workload	3.3	7.6	28.6	40.5	20.0	60.5
IV33. Increase teachers' salary	1.9	1.9	6.6	39.8	49.8	89.6

The EFA results. For the remaining 28 items of Part Four of the questionnaire, a principal components analysis with varimax rotation was employed. The scree plot suggested a three-factor solution. Table 6 presented the EFA results:

Table 6: Three-Factor Model for Stress Coping Actions

Item	Factor 1	Factor 2	Factor 3	Total
IV20. Continuing further education	.716			
IV17. Learning how to control your emotions	.704			
IV18. Seeing the humour in the situation	.677			
IV24. Planning ahead and prioritising	.626			
IV10. Getting to know your students as individuals	.594			
IV25. Reading books about stress	.474		.331	
IV2. Starting the term with clearly defined classroom rules and expectations	.469			
IV8. Ensuring that you understand the material you are about to teach	.463	.433		
IV16. Having a healthy home life	.423	.326		
IV22. Ensuring someone understands you and stands by you	.393		.357	
IV3. Relaxing after work	.351		.300	
IV5. Analyzing and trying to keep problems in perspective	.340			
IV9. Devoting oneself to free-time activities	.324			
IV27. Change education policy less frequently		.660		
IV32. Decrease teachers' workload		.592		
IV30. Increase teaching resources		.585		
IV33. Increase teachers' salary		.584		
IV26. Institutionalize and make transparent personnel matters in school		.580		
IV29. Improve working conditions		.535		
IV31. Provide professional administrators		.407		
IV28. Reduce extra activities during school time		.349		

IV15. Forgetting things that happened in school after work			.653	
IV19. Avoiding confrontations			.552	
IV1. Discussing your problems with colleagues or friends			.498	
IV12. Thinking about the coming vacation			.490	
IV7. Deep breathing			.484	
IV21. Sharing your failures	.400		.435	
IV11. Spending more time communicating with parents	.250		.262	
Alpha	.806	.676	.588	.821
%Variance	14.788	10.603	8.706	34.097

As can be seen from Table 6, thirteen items were loaded on the first factor, which was named as coping with stress by improving professional skills/personal life; eight items were loaded on the second factor, which was named as methods used by schools and the government; and seven items were loaded on the third, which was named as coping with stress by sharing/ forgetting. Although the loading coefficient for Item IV11 was lower than .30, we chose to keep it because seeking support was regarded as one of the coping strategies (eg Chan, 1998).

In order to see whether there were significant differences in the three factors in terms of gender, school size, and so forth, several one-way ANOVAs were conducted with the mean of the items loading on the factor as the dependent score. The results were presented in Table 7:

Table 7: ANOVAs on the Three Factors in Terms of Gender, School Size, Positions, Age, Teaching Experience, and Location

	Factor 1	Factor 2	Factor 3
Gender	F(1, 206)=.006 p=.939	F(1, 206)=.075 p=.785	F(1, 206)=.018 p=.895
Age	F(3, 204)=.762 p=.517	F(3, 204)=.660 p=.578	F(3, 204)=2.444 p=.065
Teaching Experience	F(2, 205)=4.353 p=.014*	F(2, 205)=1.141 p=.321	F(2, 205)=1.855 p=.159

Positions	F(1, 206)=.021 p=.884	F(1, 206)=1.339 p=.249	F(1, 206)=.948 p=.331
School Size	F(3, 204)=.906 p=.439	F(3, 204)=.259 p=.855	F(3, 204)=1.796 p=.149
School Location	F(1, 206)=.135 p=.714	F(1, 206)=.207 p=.649	F(1, 206)=.696 p=.405

* $p < .05$

The ANOVAs showed no significant differences in any of the three factors in terms of gender, age, position, school size, or location. As for teaching experience, there were no significant differences in Factor 2 or Factor 3, but there was a significant difference in Factor 1. Teachers with teaching experience of less than five years were more stressed than the other two groups.

Results from the qualitative data. Part four of the questionnaire used in this study also contained an open-ended question: “Please list below anything else you or others can do that could reduce your stress effectively.” Four new themes emerged from the qualitative data analysis: (1) reform the NUCEE and cancel the entrance examination for high schools, (2) establish a fair teacher evaluation system, (3) reduce the unnecessary inspections from above, and (4) cancel all the tutoring classes and let the teacher have a break.

Discussion

The first research question addressed

The study consists of three research questions. The first question is, “What is the general level of math teacher stress in China? Is there a significant difference on the general stress level in terms of gender, age, teaching experience, position, school size, and school location?” The study revealed that about 42% of the teachers reported being very or extremely stressed. This is a much higher level of teacher stress than the 26% reported in Taiwan (Kyriacou & Chien 2004) and that in western countries where about a quarter of school teachers regard teaching as a very stressful job (Kyriacou 2001). This might be due to the teacher evaluation practices in China. As mentioned earlier, students’ test scores are a main criterion to teacher evaluation. However, it is not only a teacher’s responsibility to improve his/her students’ scores. Improvement depends on the cooperation of students and parents with teachers. Sometimes parents do not cooperate, and sometimes students do not study hard. Thus, even if a teacher works very hard, his/her students’ scores might be low.

This study showed that no significant differences were obtained on the general stress level in terms of gender, positions held, or school location. However, significant differences were found in China in terms of ages and teaching experience. The further analyses showed that young teachers (less than 31) have a higher stress level than those older than age 30, and the teachers with less teaching experience (0-5 years) have a higher stress level than those who have been teaching for more than five years. Interestingly, the results for age and for teaching experience are consistent. This is understandable since Chinese teachers traditionally stay in the same school for a long time, and most teachers do not leave the school throughout their careers. In this situation, young teachers actually refer to those teachers with less teaching experience. Teachers with less teaching experience need to learn how to teach, how to manage a class as a Banzhuren, and so on. They want to improve their students' test scores to receive a good evaluation result, but sometimes they do not know how. All of these factors make the teachers more stressed.

The second research question addressed

The second research question of the study is, "What do math teachers consider to be the main sources of stress in China?" The findings from this study are consistent with those reported in western countries and in other Chinese societies. For example, "Student lacking motivation" is also ranked the main source of teacher stress in Hong Kong (eg Hui & Chan, 1996), "Public's attitude and misunderstanding about teachers' workload" is reported as one of most stressful items in Taiwan as well (Kyriacou & Chien 2004). Similarly, "Student misbehavior" is considered to be a major source of teacher stress in western countries (eg Borg & Riding 1991; Payne & Furnham 1987).

"Being observed by colleagues, student teachers, college tutors or parents" is one of the least stressful item in China because classroom observation is common there. The study of Cheng (2001) compared peer classroom observation practices in schools in Hong Kong and Guangzhou, one of the most developed cities in China. The results from the study indicated a big difference between (1) Guangzhou teachers who perceived peer observation to be a useful means for improving themselves and (2) Hong Kong teachers who were unhappy about imposing peer observation on teachers, although no one openly resisted the practice.

"Sundry class duties" is another item that is not stressful to teachers in China. This can be explained by the role of a Banzhuren. In order to increase students' test scores, classroom hygiene, students' behaviors, and so forth, a Banzhuren does much more work than a regular teacher. Nevertheless, most teachers like to be a Banzhuren, since a Banzhuren has a higher status and a greater chance to be promoted than a regular teacher.

As for the structure of Part Three of the questionnaire, the EFA revealed two factors: the teachers' working environment and the teachers' relationships with students

and parents. These findings are consistent with those from other studies (eg Kokkinos, 2007; Travers & Cooper, 1996) where poor working conditions and relationship with students and parents were also identified as dimensions of teacher stress.

The ANOVAs showed that there were no significant differences in either of the two factors in terms of gender, school size, or position, but there were significant differences in both of the two factors in terms of age, teaching experience, and location. Young teachers, less experienced teachers, and rural teachers reported higher stress in both factors, when compared to their respective peers. Some of the results support those reported in western countries. For example, Payne and Fumham (1987) also found that teachers with less experience reported greater stress than their counterparts. Laughlin (1984) found that younger teachers reported more stress. However, rural teachers are more stressed, which is inconsistent with the results from western countries (eg Abel & Sewell 2001; Tokar & Feitler 1986) but consistent with the results from China (eg Liu, 2006).

There are several reasons why rural teachers experience more stress than their urban peers in China. One main factor contributing to the significant difference between rural and urban teachers' stress level might be the poor working conditions. Liu's (2006) study reported that both rural and urban schools have poor school conditions in China, but rural schools' conditions are worse. This may explain why rural teachers are more stressed. Abel and Sewell (2001) also attributed the different stress level between urban and rural teachers to the working conditions in the USA. Interestingly, their study revealed significantly greater stress for urban teachers than for rural teachers since urban school teachers have poorer working conditions.

Another factor contributing to the significant difference between rural and urban teachers' stress level might be the teacher evaluation practices and parents' involvement in China. Liu's study showed that students' test scores play an important role in teacher evaluation in both rural and urban schools, but the scores play a more important role in rural schools than in urban schools. In urban schools, self-, peer- and student-evaluation are considered in teacher evaluation, but in rural schools, students' test scores are almost the sole criterion. Moreover, urban parents often communicate with teachers, buy supplementary materials, and even hire tutors for their children. In rural areas, however, not many parents often contact the school, since they are not well educated and are busy with fieldwork. They think that it is the school's responsibility to take care of their children and improve the students' test scores. This may put rural teachers under more pressure.

The qualitative data analyses revealed four new themes. The first one is the teacher evaluation system, which is consistent with Travers and Cooper's (1996) study where "appraisal of teachers" was also identified as a source of teacher stress. The other three themes included inadequate breaks and holidays, teaching methods required by the curriculum reform is contrary to the methods required by the exams (eg NUC EE), and

too many inspections from all levels of educational departments. Among these, the pressure from the teacher evaluation system is the main source of stress, and the entrance exam for high schools and that for the NUCEE are the root reason. The curriculum reform purports to change the traditional system that overemphasized knowledge delivery and passive learning and calls for a new teacher evaluation system that can meaningfully assess how well teachers deliver the new curriculum. However, in reality students' test scores still play an important role in teacher evaluation. Moreover, the current teacher evaluation practices might have little positive or sometimes negative effect on teaching. As reported by Tian and Zhang (2004), 32% of the surveyed teachers think that there is a negative effect of the teacher evaluation practices on their own teaching. Qi (2004) concurred that the current evaluation motivates teachers to improve teaching only to a very limited extent.

Starting in 1993, there was a national call for "quality education" in China, which was intended to reduce the emphasis on exam-oriented education and thus to alleviate the enormous exam pressure faced by students. However, the social function of the NUCEE and the limited space in higher education lead to intense competition among students. As Qu (1999) noted, the NUCEE not only decides if a student could enter a college but also plays a role of the first option of the societal job classification for a high school graduate. Entering a college means he/she will become a professional person; otherwise, he/she will probably become a laborer. Thus, the competition from the NUCEE is unavoidable. Strong competition related to the NUCEE leads to students' and teachers' excessive burden of studying and teaching. To meet the demands of exams, in the final years of secondary school, a large percentage of students' and teachers' leisure time, including evenings and weekends, is devoted to exam preparation. Students' and teachers' lives were overwhelmed by the pressures of examination preparation.

The third research question addressed

The last research question addressed by the study is, "What do Chinese math teachers consider to be the effective coping methods used by themselves, their schools and the government to reduce their stress?" Some of the most effective coping methods identified in this study are the same as those reported in Taiwan. For example, "Have a healthy home life" and "Ensure that you understand the material you are about to teach" are reported as the most effective coping methods in Taiwan and in mainland China (Kyriacou & Chien 2004). As for the least effective coping methods, none of the teachers in China selected "Practising religion," while in Taiwan 24% of the teachers selected this choice. Items such as "Taking absences," "Changing schools" and "Psychological counseling" are also unpopular coping methods in Taiwan. Ultimately, taking absences, changing schools, and psychological counseling are unpopular choices in both societies.

The EFA for stress coping methods revealed three factors: methods by improving professional skills/personal life, methods used by schools and the government, methods

by sharing/forgetting. The ANOVAs revealed a significant difference in terms of teaching experience on the first factor, with teachers with teaching experience less than five years considering improving professional skills as a more effective coping method than the other two groups. This implies teaching is a big challenge for less experienced teachers.

The qualitative data analyses reveal four themes that teachers consider to be most effective methods to reduce their stress: reform the NUCEE and cancel the entrance examination for high schools, establish a fair teacher evaluation system, reduce the unnecessary inspections from above, and cancel all the tutoring classes, thereby allowing teachers adequate rest. Since schools are evaluated based on the proportion of students entering schools of the next higher level, teachers have to give students extra tutoring after class, on weekends, or even on winter and summer vacations. Thus teachers do not have adequate rest. It seems all these methods are not the ones teachers can control. This implies that the change of the societal and the school environment is crucial for teachers to reduce stress.

Contributions and suggestions

As one of the few studies exploring math teacher stress in China, this study has revealed the general level of teacher stress, at least among math teachers, as well as their sources of stress, and the coping methods common among secondary school teachers in China. The study has also examined the factors underlying the questionnaire by utilizing EFA. Based on this study's findings, we propose some suggestions for Chinese policy makers as well as some recommendations for future studies in China. Firstly, Chinese policy makers should continue to reform the NUCEE while also establishing a fair teacher evaluation system. Secondly, an atmosphere should be created wherein all of society takes the responsibility for educating the young generation, rather than teachers alone. Within schools, principals should give teachers adequate time to rest, especially on weekends and holidays. They should also establish a regular on-campus young teacher professional training program and create a psychological counseling program to help teachers reduce their stress. Lastly, two suggestions for future studies: First, based on the results of the EFA conducted during this study, a confirmative factor analysis should also be conducted to confirm the structure of the questionnaire. Second, since this study only focuses on secondary school math teachers, further studies in China should explore all K-12 level teachers and compare the stress levels across schooling phases and for teachers of different subjects.

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