Investigation and Analysis of Mathematics Anxiety in Middle School Students

Xinbing Luo
Shaanxi Normal University, China
Fengkui Wang
China University of Petroleum in Beijing, China
Zengru Luo
Shaanxi Normal University, China

Mathematics anxiety has become a focus in mathematics education as a passive mathematics learning experience. Through investigation of the relationships between mathematics anxiety, mathematics performance, mathematics interest, self-efficiency, gender difference, and grade difference, we've found that mathematics performance is statistically significant correlated to mathematics anxiety; both mathematics interest and self-efficiency are statistically significant negatively correlated to mathematics anxiety; there exists statistically significant difference between male students and female students in mathematics anxiety, and female students' anxiety level is higher than male students'; there is no statistically significant difference among all the grades in mathematics anxiety, and grade nine students show the highest anxiety level during the middle school stage.

Key words: mathematics anxiety, mathematics performance, mathematics interest, self-efficiency.

Introduction

In recent years, mathematics anxiety, as a kind of passive mathematics learning experience, has become a focus because the mathematics curriculum reform attaches much importance to the emotional experience in the process of mathematics learning. Mathematics anxiety is a kind of disease. It is a cognitively passive mood produced by mathematics. To be specific, mathematics anxiety refers to such unhealthy mood responses which occur when some students come upon mathematics problems and manifest

themselves as being panicky and losing one's head, depressed and helpless, nervous and fearful, and so on. At the same time, it is accompanied by some physiological reactions, such as perspiration of the palms, holding tight the fists, being sick, vomiting, dry lips, and pale face. Students experience a feeling of self-threat in mathematics learning, resulting in the loss of interest in mathematics and the loss of confidence in mathematics learning. Middle school students in our country face much pressure in mathematics learning, which, to some extent, leads to students' mathematics anxiety. Some domestic scholars have researched relevant issues concerning mathematics anxiety. What is the status of middle school students' mathematics anxiety? Which factors are related? This paper tries to give answers through investigative research.

Method

Subjects

The subjects were 311 students from a Middle School attached to a university in west of China. A class was selected at random from grade seven though grade twelve (for the number of males' and females' distribution in every grade, see table 1). 320 questionnaires were distributed, and 311 valid questionnaires were taken back. All subjects were the only child from middle-income families.

Table 1
Number Distribution of Each Grade's Male and Female Students

	Grade 7	Grade 8	Grade 9	Grade 10	Grade 11	Grade 12	Total
Male	24	32	32	20	27	33	168
Female	19	24	24	30	27	19	143
Total	43	56	56	50	54	52	311

Instrument

There were three kinds of questionnaires, which included a mathematics interest questionnaire, a self-efficiency questionnaire and a mathematics anxiety questionnaire, according in which students were requested to answer questions about mathematics learning. Among them, the self-efficiency questionnaire and mathematics anxiety questionnaire were

designed based on the modification of a foreign questionnaire, which is used widely and has good reliability and validity.

(1) Mathematics interest questionnaire. The mathematics interest questionnaire in *Theories and practices of transformation of poor junior mathematics students* written by Du et al. (1999) was adopted, and included three questions. Analysis shows that the questionnaire has a good construct validity, whose inner consistent reliability is 0.8145.

(2) Self-efficiency questionnaire. The self-efficiency questionnaire revised by Li (1999) about mathematics learning was adopted, and it includes seven questions. Its inner consistent reliability is 0.93.

(3) Mathematics anxiety questionnaire. The Mathematics Anxiety Questionnaire (MAQ) written by Wigfield and Meece (1998), and MAQ written by Wang and Lou (2002) were adopted, and it includes twelve questions. Its inner consistent reliability is 0.8518.

Research Procedure

Questionnaires are mainly used in this research. The questionnaires include objective questions and subjective ones, which were finished by students in a relaxed condition in class though individual study. The question-answering time was 15~25 minutes. The self-efficiency questionnaire and mathematics anxiety questionnaire were evaluated using 5 ranks. 1 indicates statistically significant negative correlation, 5 indicates statistically significant correlation, and all the data was analyzed through SPSS software.

Results

Mathematics Performance and Mathematics Anxiety

Through the statistical result of Table 2, we can see that the correlation between mathematics performance and mathematics anxiety is statistically significant negative, and the correlative coefficient is -0.411; the correlative coefficient between the emotional elements of mathematics anxiety and mathematics performance is -0.415; the correlative coefficient between the cognitive elements of mathematics anxiety and mathematics performance is -0.339. These results are consistent with our common knowledge—the better a student's mathematics performance, the less mathematics anxiety they may have; the worse a student's performance is, the more mathematics anxiety they

may have. Thus, mathematics anxiety usually happens among low performing students.

Table 2

Correlation among Mathematics Interest, Self-efficiency, Mathematics Performance and Mathematics Anxiety of Middle School Students

	Self-efficiency	Math performance	Math interest	Math anxiety	Emotional elements of math anxiety	Cognitive elements of math anxiety
Self-efficiency	1.000	0.434**	0.622*	−0.576**	−0.603**	−0.451**
Mathematics anxiety	−0.576**	−0.411**	−0.549**	1.000	0.928**	0.913**
Mathematics performance	0.434**	1.000	0.459**	−0.411**	−0.415**	−0.339**

N   Note: *<0.05, **<0.005

Mathematics Interest and Mathematics Anxiety

Through the statistical result evident in Table 2, we can see that the correlation between mathematics interest and mathematics anxiety is statistically significant negative, and the correlative coefficient is -0.549. The result is also consistent with our common knowledge—the more interest a student has in mathematics, the less mathematics anxiety they may have; the less or absence of interest a student has in mathematics, the more anxiety they may have.

Self-efficiency and Mathematics Anxiety

Through the statistical results of Table 2, we can see that the correlation between self-efficiency and mathematics anxiety is statistically significant negative, and the correlative coefficient is -0.576. The result indicates that the more confidence students have, the less mathematics anxiety they may have; the less confident students feel of mathematics, the more mathematics anxiety they may have.

Gender Difference and Mathematics Anxiety

From Table 3 we can see male students and female students have statistically significant differences in mathematics anxiety. Female students' anxiety level is statistically significant higher than male students', especially in the cognitive aspect; female students have higher performances than male students, but are lower in self-efficiency and mathematics interest; in the interest, efficiency and performance aspects, the difference between them is not statistically significant.

Table 3

Gender Difference in Mathematics Interest, Self-efficiency, Mathematics Performance and Mathematics Anxiety of Middle School Students

|	Sex	*n*	Mean	SD	t
Mathematics performance	Male	168	68.5521	20.7669	−1.133
	Female	143	71.0816	17.9940	
Mathematics interest	Male	168	0.5338	0.2104	0.981
	Female	143	0.5124	0.1680	
Self-efficiency	Male	168	3.8740	0.7948	1.786
	Female	143	3.7261	0.6399	
Mathematics anxiety	Male	168	2.5084	0.7146	−2.328
	Female	143	2.6791	0.5506	
Emotional elements of mathematics anxiety	Male	168	2.3297	0.6943	−1.766
	Female	143	2.4558	0.5387	
Cognitive elements of mathematics anxiety	Male	168	2.7585	0.8563	−2.552
	Female	143	2.9916	0.7350	

Grade Difference and Mathematics Anxiety

From Table 4 we can see that there is no statistically significant difference between all the grades for mathematics anxiety. But from variance's data analysis and Table 1 we can see the mathematics anxiety in every grade displays a certain tendency; grade seven students have the lowest anxiety level, which increases in the senior stage, and grade nine students have the highest anxiety level during the middle school stage; students' anxiety level in grade ten lowers to some extent, but reaches a new climax in grade eleven, and the anxiety level descends again in grade twelve. In the middle school stage, the anxiety level ranged from the lowest to the highest as follows: grade seven, grade eight, grade twelve, grade nine, grade ten, and grade eleven. The result is consistent with what we predicted before investigation, which also basically

corresponds to the actual situation of our country's middle school students in mathematics learning.

Table 4

Grade Difference in Mathematics Performance, Mathematics Interest, Self-efficiency and Mathematics Anxiety of Middle School Students

	Grade 7	Grade 8	Grade 9	Grade 10	Grade 11	Grade 12	*F*
Performance	87.7±14.9	70±18.5	73.9±19.5	60.3±16.3	73.2±13.6	55.2±17.6	21.4**
Interest	0.64±0.17	0.59±0.18	0.47±0.19	0.46±0.20	0.53±0.15	0.45±0.17	8.67**
Efficiency	4.09±0.77	3.92±0.60	3.68±0.91	3.57±0.59	3.81±0.71	3.80±0.67	3.09*
Anxiety	2.38±0.66	2.57±0.73	2.70±0.65	2.60±0.54	2.65±0.67	2.57±0.61	1.26
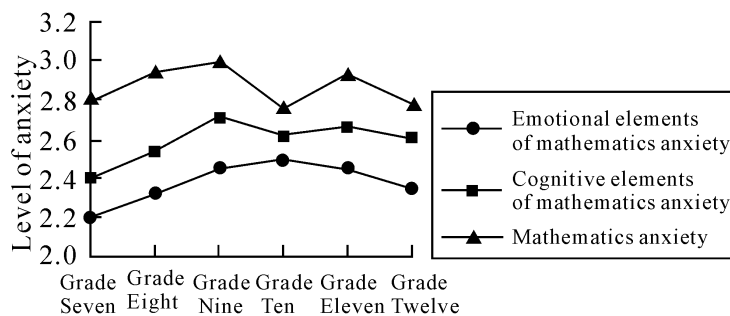
Figure1. **Math anxiety level charts of every grade in middle school stage.**

Discussion

Mathematics performance is statistically significant related to mathematics anxiety, which is consistent with the results that Maher (2000) have discovered. That is to say, over-anxiety usually occurs among poorly-achieving students. It inspires us that in the teaching process, teachers should pay more attention to low-achieving students, help them improve learning methods and improve learning efficiency, and thus lower their mathematics anxiety. In addition, there do existing differences in mathematics anxiety among every middle school grade. As for what factors resulted in these differences, this research was not covered, so it leaves room for further research.

Mathematics interest and self-efficiency are both statistically significantly related to mathematics anxiety. It indicates that in the mathematics teaching process, various measures should be taken to stimulate students' interest, to raise students' self-confidence, and thus to make it possible to lower students' mathematics anxiety level. Therefore, it is very necessary and timely for mathematics curriculum reformers to pay attention to students' emotional experience.

There exists a statistically significant difference in mathematics anxiety between male students and female students; female students' anxiety level is higher than male students'. This conclusion is consistent with the research results of Hembree (1990), but is not consistent with result of "no statistically significant difference in mathematics anxiety exists between male students and female students." We have found from our research that female students have a statistically significant higher anxiety level than male students in the cognitive aspect. It is consistent with Ho, Chiu, and Wang's (2000) conclusion that "American female students have a higher anxiety level than male students from the same country in the cognitive aspect; similarly, Taiwan's female students have a higher anxiety level than male students," but is not consistent with "mathematics anxiety level of China's mainland' students, where there does not exist gender difference."

There is no statistically significant difference among all the grades in mathematics anxiety. Grade nine students have the highest anxiety level during the middle school stage. This conclusion is consistent with Allan's results that "grade nine students experienced the most mathematics anxiety" and is also consistent with Randolph's (1998) results that "grade seven students have a conspicuous lower mathematics anxiety level than average." This suggests to us that teachers need to give students psychological assistance along with their mathematics learning; in the open-ended questions, quite a number of students hope that the teacher had psychological knowledge and could instruct them as how to make psychological adjustment. As teachers, they should pay attention to students' mathematics learning experience as well as to students' final learning results. Research from psychology indicates that moderate anxiety does promote student learning; as for those who have a high mathematics anxiety level, effective measures should be taken actively to lower their anxiety level properly. Only in this way mathematics anxiety can facilitates mathematics learning.

References

Du, D. S., Yang, Y. D., & Zhu, G. H. (1999). *Theories and practices of transformation of poor junior mathematics students* written. Physics Review, *60*, 37 -52

Hembree, R. (1990). The nature, effects, relief of mathematics anxiety. *Journal for Research in Mathematics Education*, *1*, 33–46.

Ho, H., Chiu, Z., & Wang, C. (2000). The affective and cognitive dimensions of math anxiety: A cross study. *Journal for Research in Mathematics Education*, *3*, 362–379.

Li, X. (1999). Academic help-seeking: Its relation to efficiency, value, classroom context and academic achievement. *Journal of Chinese Psychology Acta Psychological Sinica. 31*, 435–443.

Maher, A. (2000). Structural model for predicting mathematics achievement: Its relation with anxiety and self-conception in mathematics. *Psychological Reports*, *8*, 835–847.

Randolph, T. (1998). *An assessment of mathematics anxiety in students from grades four through eight.* Cambridge, MA: Cambridge Information Group.

Wang, F. & Luo, Z. (2002). Review on the study in external math anxiety. *Journal of Mathematics Education*, *11*(1), 39-42.

Wigfield, A. & Meece, J. L. (1998). Math anxiety in elementary and secondary school students. *Journal of Educational Psychology*, *2*, 210–216.

Authors:

Xinbing Luo
Shannxi Normal University, China
Email: xbluo@snnu.edu.cn

Fengkui Wang
China University of Petroleum in Beijing, China
Email: Fengkuiw@sohu.com

Zengru Luo
Shannxi Normal University, China
Email: zrluo@ snnu.edu.cn