

Mathematics anxiety, attitudes and performance in Hong Kong primary school children

Ann Dowker¹ and Winifred Mark²

¹*University of Oxford*, ²*Hong Kong University*

The study investigated mathematics performance and attitudes among first- and third-grade pupils in a Chinese-medium and an English-medium school in Hong Kong. The participants included 47 children in the Chinese-medium school (22 first-graders, 25 third-graders) and 43 children in an English-medium school (27 first-graders, 16 third-graders). They were given the Mathematics Attitude and Anxiety Questionnaire and the British Abilities Scales Basic Number Skills (BNS) test. The attitude questionnaire contains four scales: Self-rating, Liking for maths, Anxiety and Unhappiness at failure. Third-graders scored higher than first-graders on the BNS arithmetic test. They showed more Unhappiness at Failure (but no other attitude differences). Chinese-medium school pupils scored higher than English-medium school pupils on BNS. They showed more Anxiety and a lower Self-rating, but greater Liking for maths than the English-medium school pupils did. There were no School/ Grade interactions. All attitude variables correlated with one another, but none with BNS.

Keywords: Chinese/English-medium school; attitudes to mathematics; mathematics anxiety

Introduction

The PISA international comparisons (OECD, 2014, 2023) have shown that Hong Kong pupils, and those elsewhere in the Pacific Rim, perform better in mathematics than those in most other countries. On the other hand, they report less enjoyment and confidence in mathematics than those in most other countries. Nevertheless, within Pacific Rim countries, as in others, mathematics performance is significantly correlated with mathematics anxiety.

Most studies have not looked at Chinese children in early primary school. The aims of the present study were to investigate attitudes and performance in a sample of first- and third-grade children in two Hong Kong schools: specifically, to see whether anxiety and other attitudes differed between age groups, and whether, and to what extent, they were related to actual performance. Moreover, we wished to see whether attitudes and performance would differ between a Chinese-medium school and an English-medium school. It seemed possible that the Chinese-medium school would be more aligned with Chinese cultural attitudes, and the English-medium school with Western cultural attitudes.

Method

Participants

Participants were Hong Kong children in a Chinese-medium school (22 first-graders, 25 third-graders) and an English-medium school (27 first-graders, 16 third-graders).

Materials and Procedure

The children completed a standardised arithmetic test: the Basic Number Skills subset of the British Ability Scales, 2nd edition (Elliot & Smith, 1997). The measure used in the analyses was the Raw Score rather than the Standard (scaled) Score. The inability, due to confidentiality rules, to obtain exact ages from individual Hong Kong pupils would have made it impossible to obtain standard scores.

They were also given the Mathematics Attitude and Anxiety Questionnaire (Thomas & Dowker, 2000; Dowker, Bennett & Smith, 2012; Dowker et al., 2019). They rated seven school mathematical activities (e.g., written sums; mental maths; understanding the teacher) on four 5-point pictorial scales:

- (i) how much they liked the activity.
- (ii) how good they thought they were at the activity.
- (iii) how unhappy they would be if they couldn't do it.
- (iv) how anxious they would feel if they couldn't do it.

The scales all point toward more positive attitudes, with higher scores. Thus, higher scores on the Unhappiness at Failure scale indicate lower unhappiness at failure, and lower scores on the Anxiety scale indicate lower anxiety.

Prediction

We predicted that:

- (1) Third-graders would perform better in arithmetic than first-graders.
- (2) Third-graders would have more negative attitudes than first-graders. In particular, they would rate themselves lower in maths.

More tentatively, we predicted that:

- (3) Chinese-medium pupils would perform better in arithmetic than English-medium pupils.
- (4) Chinese-medium pupils would have more negative attitudes than English-medium pupils. They would rate themselves lower in mathematics and would show more mathematics anxiety.
- (5) Based on previous findings with young children (e.g. Dowker, Bennett & Smith, 2012), arithmetic performance in the group as a whole would correlate with self-rating.
- (6) Arithmetic performance would not correlate with other attitudes, including Anxiety.

Results

For the descriptive statistics, see Table 1 below.

A between-participants ANOVA was carried out with Grade (1st Grade versus 3rd Grade) and School (1 = Chinese Medium versus 2 = English Medium) as the grouping factors.

British Ability Scales Basic Number Skills (BNS) Raw Score, Self-rating, Liking, (Non)-Unhappiness at failure, and (Non)-Anxiety were the dependent variables.

Effects of Grade

There was a highly significant effect of Grade on Basic Number Skills (BNS) raw score. Third-graders scored higher than first-graders on BNS ($F(1, 86) = 76.19$; $p < 0.001$; $\eta^2 = 0.47$).

Third-graders showed more Unhappiness at Failure than first-graders ($F(1, 86) = 5.16$; $p = 0.025$; $\eta^2 = 0.057$).

The grades did not differ significantly on any other attitude measure.

Effects of School

There was a modest but significant effect of School on Basic Number Skills (BNS) raw score. Chinese Medium pupils scored higher than English Medium pupils on BNS ($F(1, 86) = 6.21$; $p = 0.015$; $\eta^2 = 0.067$).

There was a significant effect of School on Self-rating ($F(1, 86) = 8.33$; $p = 0.005$; $\eta^2 = 0.088$). English Medium pupils reported higher Self-rating than Chinese Medium pupils.

There was a significant effect of School on Liking for Maths ($F(1, 86) = 23.6$; $p < 0.001$; $\eta^2 = 0.215$). Chinese Medium pupils reported a greater Liking for Maths than English Medium pupils.

There was a significant effect of School on (Non)-Anxiety ($F(1, 86) = 6.21$; $p = 0.015$; $\eta^2 = 0.057$). Chinese Medium pupils obtained lower (Non)-Anxiety scores than English Medium pupils: i.e. the Chinese Medium pupils were more anxious.

Lack of School-Grade Interactions

There were no School-Grade interactions for arithmetic performance or for any attitude variables

Correlations

The attitudes- Self-rating, Liking for Maths, Self-rating, Unhappiness at Failure and Anxiety- all correlated significantly with one another. However, none correlated significantly with the BNS score.

Table 1: BAS mathematics raw scores and attitude scores by grade and school

Descriptive Statistics

	Grade	School	Mean	Std. Deviation	N
BNSRawScore	1	1	18.09	5.406	22
		2	16.96	4.100	27
		Total	17.47	4.713	49
	3	1	26.92	2.827	25
		2	23.62	3.845	16
		Total	25.63	3.604	41
	Total	1	22.79	6.111	47
		2	19.44	5.128	43
		Total	21.19	5.877	90
SelfRating	1	1	22.4545	3.67394	22
		2	19.1852	6.10194	27
		Total	20.6531	5.36404	49
	3	1	21.5200	3.53695	25
		2	19.1875	3.65548	16
		Total	20.6098	3.72074	41
	Total	1	21.9574	3.59321	47
		2	19.1860	5.27463	43
		Total	20.6333	4.66267	90
Liking	1	1	23.2727	3.19496	22
		2	19.5556	6.39912	27
		Total	21.2245	5.48963	49
	3	1	23.3600	4.34818	25
		2	17.0000	4.24264	16
		Total	20.8780	5.28770	41
	Total	1	23.3191	3.81135	47
		2	18.6047	5.77408	43
		Total	21.0667	5.37117	90
Unhappiness	1	1	12.8182	5.01081	22
		2	13.1111	7.55662	27
		Total	12.9796	6.47588	49
	3	1	10.5600	5.23673	25
		2	9.6250	4.45533	16
		Total	10.1951	4.91029	41
	Total	1	11.6170	5.20265	47
		2	11.8140	6.73391	43
		Total	11.7111	5.94968	90
Anxiety	1	1	11.1818	5.65379	22
		2	14.6296	7.28089	27
		Total	13.0816	6.76029	49
	3	1	9.5200	5.58361	25
		2	12.7500	6.01664	16
		Total	10.7805	5.90132	41
	Total	1	10.2979	5.61796	47
		2	13.9302	6.82571	43
		Total	12.0333	6.45198	90

Discussion

As predicted, third-graders performed significantly better than first-graders on an arithmetic test.

There was limited support for the prediction that third-graders would have more negative attitudes than first-graders. They showed more unhappiness at failure, but did not differ on any other attitude.

As more tentatively predicted, Chinese Medium pupils performed better on the arithmetic test than English Medium pupils.

The prediction that Chinese Medium pupils would have more negative attitudes than English Medium pupils was partially supported, but the results were more complex than expected. Chinese Medium pupils showed more anxiety and lower self-rating, but also liked maths more.

These findings, combined with the Chinese medium school pupils' better performance, may be consistent with findings in previous studies, m with older children, which suggest that mathematics anxiety and mathematics motivation (of which liking for maths is one aspect) are different constructs, and that differences in levels of maths motivation may explain why some highly maths-anxious individuals avoid doing maths while others in turn approach it and invest greater effort in it, (Wang et al., 2015; Chang & Beilock, 2016).

Limitations of the present study include the relatively small sample size and the inclusion of only two schools. More research is needed to determine whether the differences in attitudes and performance relate to Chinese Medium versus English Medium pupils in general, or specifically to these two schools.

It would also be desirable to conduct studies across more age groups, ideally including longitudinal designs, to investigate when and under what circumstances relationships between attitudes and performance might be found, and whether these vary cross-culturally.

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