

# **STUDENTS' ATTITUDE TOWARDS MATHEMATICS: GENDER AND YEAR LEVELS**

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# Contexts

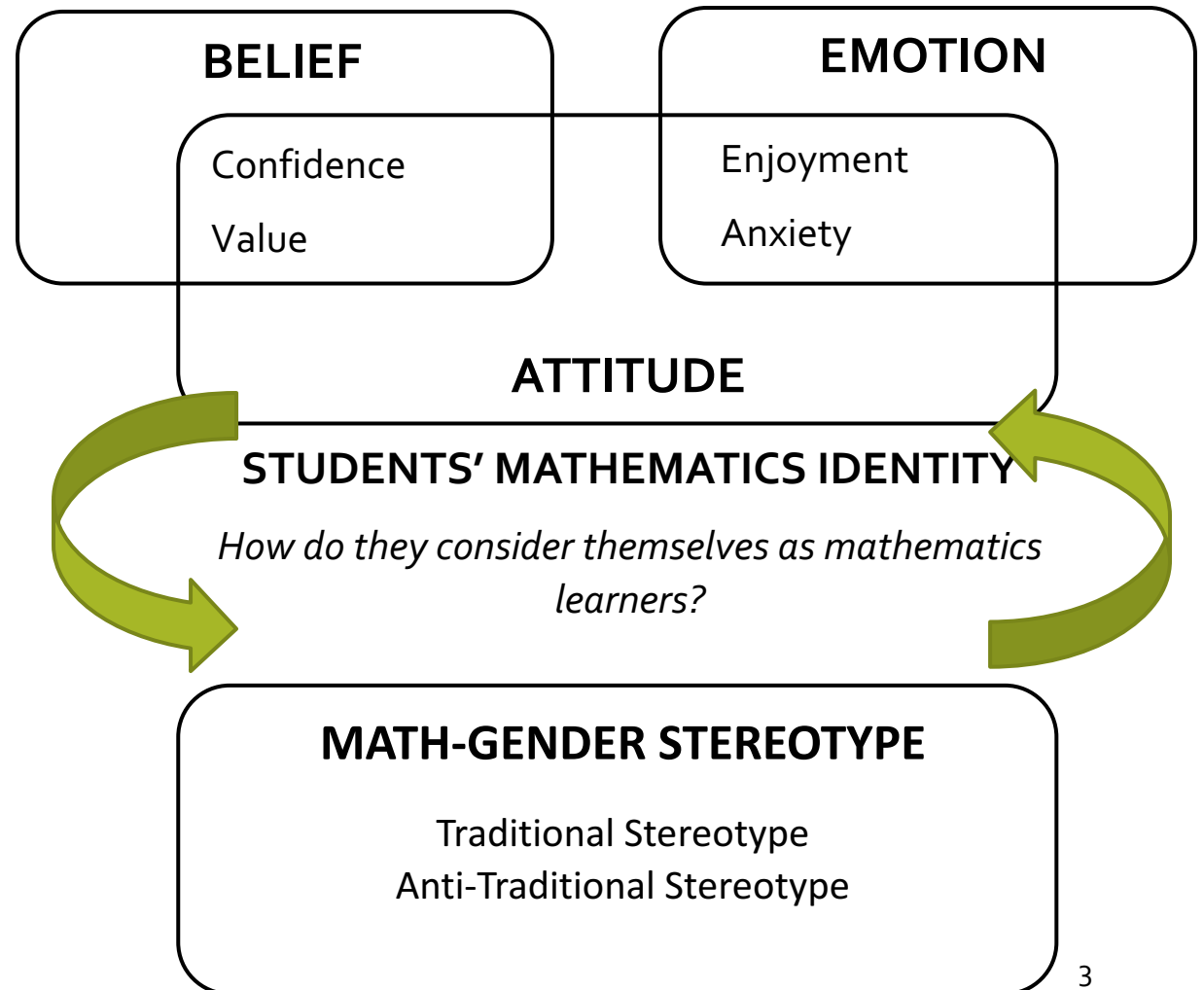
- Mathematics results of PISA 2012: Students from China (Shanghai, Hongkong, Taipei and Macao) outperformed all other nations.
- “It is your attitude, not your aptitude, will determine your altitude.” By Zig Ziglar
- Students’ performance in mathematics (altitude) is determined more by their desire to do maths well (attitude) than by their natural talents in maths (aptitude).
- Research Topic: **Students’ attitude towards mathematics**

# Research Design: Theoretical Framework

Research Questions:

RQ1: What attitudes towards mathematics do students have and how do their attitudes change/differ from year levels?

RQ2: To what extent, do students' math-gender stereotype interact/influence their attitudes towards mathematics? And what mathematics identity do students build up?



# Research Design: Collected Data

- Phase One – Pilot Study

Questionnaire: 91 returned and valid copies

Focus-group Interview: 4 students (2 boys and 2 girls) from Year 4

- Phase Two – Main Study

Main Study Questionnaire		
	Returned copies of Questionnaire	Completed and Valid copies of Questionnaire
Year 4	175 (87.5%)	167 (83.5%) Including 83 boys and 84 girls
Year 5	163 (81.5%)	155 (77.5%) Including 82 boys and 73 girls
Year 6	191 (95.5%)	179 (89.5%) Including 93 boys and 86 girls
<b>In Total</b>	<b>529 (88.2%)</b>	<b>501 (83.5%) Including 258 boys and 243 girls</b>
Main Study Interview		
	Each Year Level	6 students including 3 boys and 3 girls
	<b>In Total (Year 4, 5 and 6)</b>	<b>18 students including 9 boys and 9 girls</b>

# Research Design: Final Instruments (1)

## Questionnaire

- was originally created based on *PISA 2012 Student Questionnaire*, *The Math and Me Survey* (Adelson, 2006), *The Modified Fennema-Sherman Attitude Scales* (Doepken, Lawskey, & Padwa, 2004), *The Mathematics and Technology Attitudes Scale* (Barkatsas, 2005; Pierce, Stacey, & Barkatsas, 2007), and *Abbreviated Math and Anxiety Scale* (Hopko, Mahadevan, Bare, & Hunt, 2003);
- was determined after reliability and validity analysis, as well as triangulating analysis with interview data and research question;
- had **TWO** scales that Attitude Scale (including Confidence, Enjoyment, Value and Anxiety sub-scales) and Math-Gender Stereotype Scale (including Traditional Stereotype and Anti-Traditional Stereotype)

## Examples:

Item 9: I have a maths mind. [Confidence]

Item 13: Solving maths problem is full of fun. [Enjoyment]

Item 19: Learning maths makes me smarter [Value]

# Research Design: Final Instruments (2)

## **Semi-structured interview**

- included **FIVE** main interview questions, and each question had at least two sub-questions
- each interview question focused on particular scale/sub-scale

## **Interview Question Example:**

Question 4:

Could you describe your attitude towards maths this year?

How different it is compared with last year?

Why do you think you have such changes, or why not?

# Data Analysis: Overview

## 501 copies of questionnaire:

- Descriptive Statistics
- In-depth Statistics: two-way ANOVA

## 9 focus-group interviews:

- Thematic Analysis

Combination  
of Quan and  
Qual findings

# Survey Data Analysis: Descriptive Statistics (1)

	Attitude Scale (21 items)			
	Confidence (9 items)	Enjoyment (4 items)	Value (3 items)	Anxiety (5 items)
	Highest score	5*9 = 45	5*4 = 20	5*3 = 15
Lowest score	1*9 = 9	1*4 = 4	1*3 = 3	1*5 = 5
Distance	7	3	4	4
SN*	9-16**	4-7	5-9	5-9
Score Ranging	Negative	16-23	7-10	9-13
	Neutral	23-30	10-13	13-17
	Positive	30-37	13-16	17-21
	SP	37-45	16-20	21-25

	Attitude Scale							
	Confidence		Enjoyment		Value		Anxiety	
	Score/ Range	Percentage (%)	Score/ Range	Percentage (%)	Score/ Range	Percentage (%)	Score/ Range	Percentage (%)
Boys	35.457/ Positive	78.8	17.081/ SP*	85.4	13.837/ SP	92.2	10.384/ Negative	41.5
Girls	34.951/ Positive	77.7	16.617/ SP	83.1	14.066/ SP	93.8	10.399/ Negative	41.6
Total	35.212/ Positive	78.2	16.856/ SP	84.3	13.948/ SP	93.0	10.391/ Negative	41.6

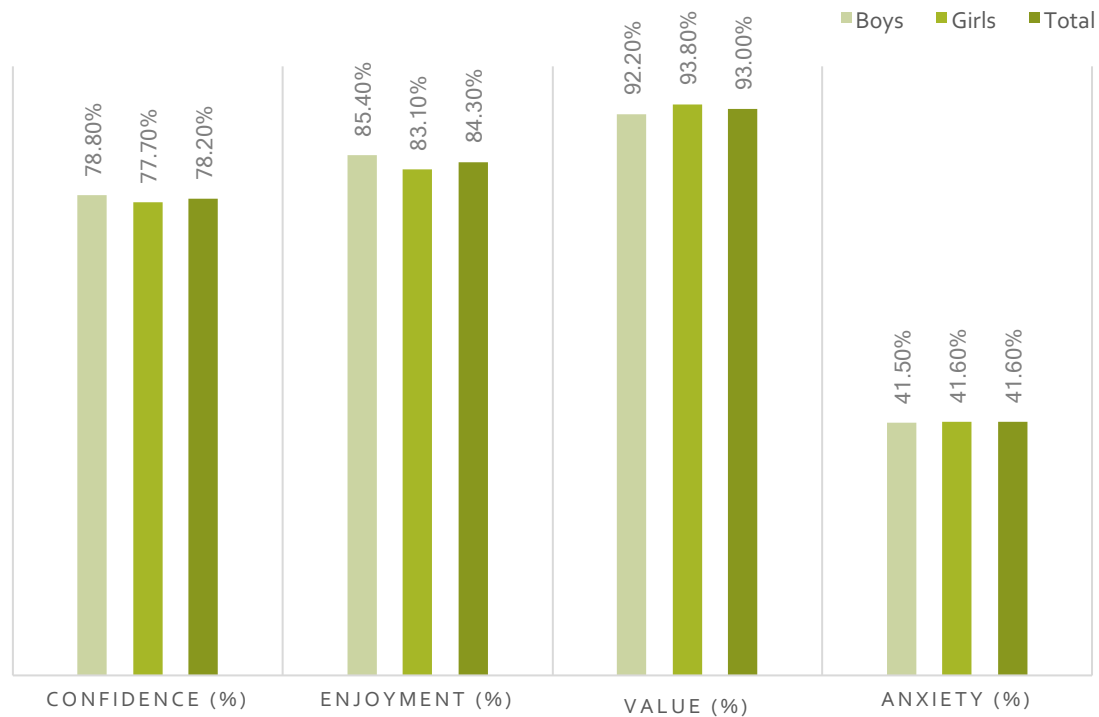
Table Left: Scoring ranges on *Attitude Scale*

Table Right: Gender Differences and Similarities of *Attitude Scale*

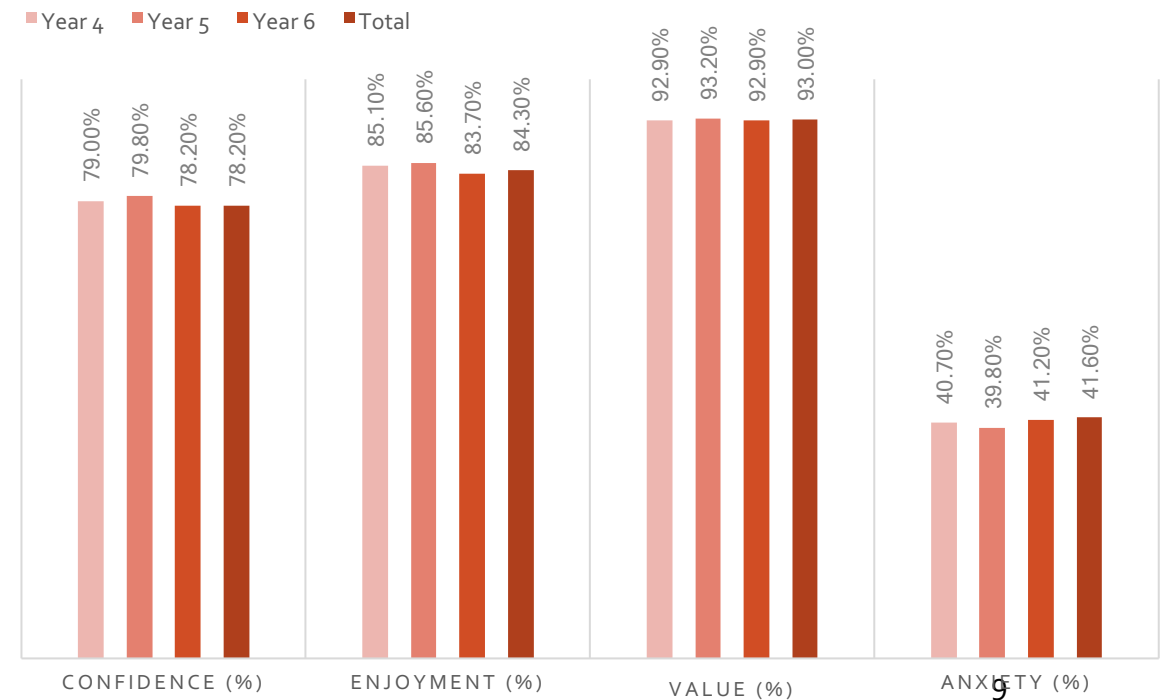


# Survey Data Analysis: Descriptive Statistics (2)

- Gender differences and similarities of Attitude Scale



- Year Level differences and similarities of Attitude Scale



# Survey Data Analysis: Two-way ANOVA

Two-way ANOVA results of each sub-scale within Attitude Scale

Statistical Significance of the Two-way ANOVA					
		df	F	Sig. (p-value)	Partial Eta Squared ( $\eta^2$ )
Confidence	Gender	1	.716	.398	.001
	YearLevel	2	1.903	.150	.008
	Gender *				
	YearLevel	2	6.595	<u>.001</u>	.026
Enjoyment	Gender	1	2.480	.116	.005
	YearLevel	2	1.938	.145	.008
	Gender *				
	YearLevel	2	2.248	.107	.009
Value	Gender	1	2.112	.147	.004
	YearLevel	2	1.698	.184	.007
	Gender *				
	YearLevel	2	1.357	.258	.005
Anxiety	Gender	1	.005	.942	.000
	YearLevel	2	.618	.539	.002
	Gender *				
	YearLevel	2	8.006	<u>.000</u>	.031

Simple effect analysis of Confidence sub-scales

Year_Level		df	Mean Square	F	Sig. (p-value)
Grade 4	Contrast	1	265.257	5.815	<u>.016</u>
	Error	495	45.616		
Grade 5	Contrast	1	283.902	6.224	<u>.013</u>
	Error	495	45.616		
Grade 6	Contrast	1	80.916	1.774	.184
	Error	495	45.616		

Simple effect analysis of Anxiety sub-scales

Year_Level		df	Mean Square	F	Sig. (p-value)
Grade 4	Contrast	1	234.139	9.867	.002
	Error	495	23.729		
Grade 5	Contrast	1	126.856	5.346	.021
	Error	495	23.729		
Grade 6	Contrast	1	18.946	.798	.372
	Error	495	23.729		

# Data Analysis: Summary of Statistics Analysis

- There was **no huge gender and year level differences** of students' attitudes towards mathematics.
- **BOTH boys and girls** valued maths the most, followed with their enjoyment of and interest in maths, and confidence to do maths well. Their anxiety was at negative level.
- Students from **three year levels** had similar attitude towards these four sub-scales, while **Year 5 students**, comparatively, showed (a little bit) more positive attitudes than other two year levels.
- There were **statistically significant interaction effect** (Gender \* YearLevel) on **Confidence and Anxiety** sub-scale.
- **Significant gender differences** of Confidence and Anxiety existed at Year 4 and Year 5.

# Interview Data Analysis: Thematic Analysis (1)

- Attributions of Dislikeliness/Likeness for Mathematics
  - Usefulness of Maths

BB2Y6: I think I love maths more than before, as I always believe maths will **contribute a lot** at my **most successful moment in the life**.

GM3Y5: I love maths, as it can be used **in different aspects of daily life**. Sometimes, I am surprised that even a very tiny issue needs maths as well.

- Difficulty/Challenges of Maths

BB1Y4: Learning maths is like climbing stairs, one step by one step. **The higher, more difficult maths**. I enjoy the process. I love maths, as I know I have been surpassing myself and challenging myself, and making myself stronger.

GM3Y6: Now, we are learning **transforming maths** including secondary maths knowledges. They are **quite difficult**. I don't like it.

# Interview Data Analysis: Thematic Analysis (2)

- Achievement of Maths
- Confidence of Maths
- The way of teaching Maths
- Maths Classes Activities

BB2Y5: Excuse me, maths activities?

- Pure love for Math

BM3Y6: I always love maths, no special reason for this love. I just love it.

# Data Analysis: Combination of Survey and Interview Data Findings

## Gap between the survey and interview data: (Limitation of this study)

- Interview participants were **anonymous**.
- Survey data informed the **differences** of students' attitudes. However, interview data informed the **changes** of students' attitudes.
- The patterns/sub-themes from interview data informed that four subs-scales in Attitude (in Survey) could be **mutual causes**. (eg. Value & Enjoyment; Achievement & Confidence)

# Methodological Challenges

- **Quantitative analysis:**

How to justify the appropriateness to use average/percentage/two-ANOVA for ordinal data (Likert scale)?

- **Qualitative analysis:**

How to use thematic analysis appropriately?

Does qualitative data tell the truth?

- **The combining analysis of survey and interview data**

Is it more appropriate to make quan-qual balanced or quantitative analysis in a dominant role?

How to make quan and qual data interact with each other properly?

**THANK YOU VERY MUCH!  
HOPE TO RECEIVE  
SUGGESTIONS.**

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