

Supporting the Learning and Teaching of Mathematics for Non-Chinese Speaking (NCS) Students in Primary Schools



cldmaths.edu.hku.hk





SERVICE HIGHLIGHTS

About the Project	2
About the People	4
Students' Values	5
Experience and Achievements	6
Modes of Delivery	8
Five Themes	12
Activities First	14
Beyond Algorithm	15
Culture Matters	16
Depth With Fluency	17
Exercise Counts	18
Recommended Storybooks	19
Statistics of Students in 2019-20	20



ABOUT THE PROJECT

Background Information / Rationale

Increasing number of Culturally and Linguistically Diverse (CALD) learners in mainstream primary schools.

Teachers believing they are not adequately prepared to teach students from CALD backgrounds (Gao & Shum, 2010).

Pressing need for research and related work (including support services) on the teaching mathematics in multicultural and multilingual classrooms.

Gao, F., & Shum, M. S. K. (2010). Investigating the role of bilingual teaching assistants in Hong Kong: An exploratory study. *Educational Research*, 52(4), 445-56.





Project Objectives

1. **Embrace Cultural and Linguistic Diversity (CALD)** and enable NCS students to achieve their full potential in learning mathematics;
2. **Develop suitable school-based curriculum**, in alignment with the revised 2017 mathematics curriculum, to cater for CALD of school population of varying proportion of ethnic minority students amongst local Chinese students;
3. **Develop effective and diversified pedagogical strategies** (put under the five themes in this booklet) to cater for the diverse learning needs of NCS students in classrooms of increasing CALD; and
4. **Design effective learning, teaching and assessment (LTA) materials** that facilitate NCS students' learning in mathematics, with more emphasis on their mathematical development and language acquisition.

ABOUT THE PEOPLE



Project Leader

Mr. WONG Ka Lok



Organisation-in-charge

Dr. MOK Ah Chee Ida



Other Core University Members

Dr. KI Wing Wah

Dr. LEE Man Sang Arthur

Prof. LEUNG K S Frederick



Project Manager

Ms. LO Siu Yu Agnes



Curriculum Development Officers

Dr. CHENG Wing Kin

Dr. POON Ying Ming Queenie

Dr. SUM Sze Wan Emily

Mr. TAM Chi Leung Samuel

Ms. WU Chi Cherry



Senior Research Assistant

Ms. YIP Yu Ting Antonia

STUDENTS' VALUES

What Ethnic Minority Primary Students in Hong Kong Value in Mathematics Learning

Activities

Mathematics Games

**Stories about
Mathematics/
Mathematicians**

**Outdoor
Mathematics
Activities**

Practices

**Practising with
lots of Questions**

**Doing a lot of
Mathematics Work**

**Mathematics
Homework**

Tools

**Using
Diagrams**

**Using
Concrete Materials**

EXPERIENCE AND ACHIEVEMENTS

2015-2017

USP Programme:

Supporting the Learning and Teaching of Mathematics for NCS Students in Secondary Schools

- Explored the learning characteristics of NCS students
- Developed an understanding of the challenges/difficulties NCS faced

2017-2019

USP Programme:

Supporting the Learning and Teaching of Mathematics for NCS Students in Primary Schools

- Tried out a few pedagogical strategies to cater for NCS in Numbers dimension
- Obtained preliminary research findings on students' values in mathematics learning



2019-2020

QTN-T Project:

Supporting the Learning and Teaching of Mathematics for NCS Students in Primary Schools

- Developed the five pedagogical themes to enhance teachers' knowledge and build their teaching capacity through different strategies/tools in ALL dimensions.
- Conducted research in culturally responsive mathematics education.

2020-2021

QTN-T Project:

Catering for Culturally and Linguistically Diverse Learners in Primary Mathematics Classrooms



USP: University-School Support Programmes

QTN-T: Quality Education Fund Thematic Networks — Tertiary Institutes

MODES OF DELIVERY

Onsite School-based Support	2015-2017	2017-2019	2019-2020
Primary and secondary schools	14	15	16
CLD classes	38	82	59
Students	759	1661	1066
Teachers	46	100	90
Meetings with students	19	26	8*
Collaborative Lesson Planning (CLP) meetings, lesson observation, post-lesson evaluation meetings	260	233	201

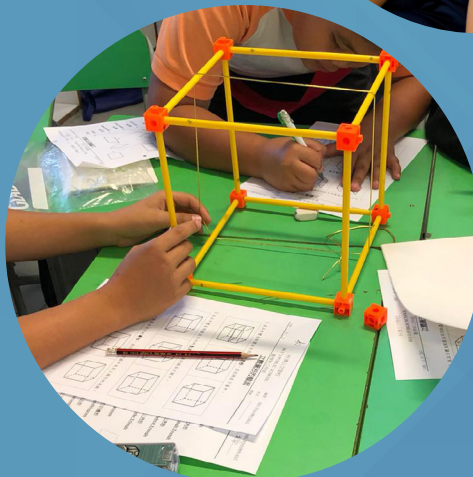
* Some of the scheduled meetings with students were not possible owing to the COVID-19 pandemic.



Professional Learning for Teachers	2015-2017	2017-2019	2019-2020
Orientation sessions	1	1	1
Thematic workshops	–	2	2
Joint-school workshops	14	3	2
Territory-wide disseminations	1	1	1
Mini online workshops	–	–	7
Maths book club meetings	–	–	2

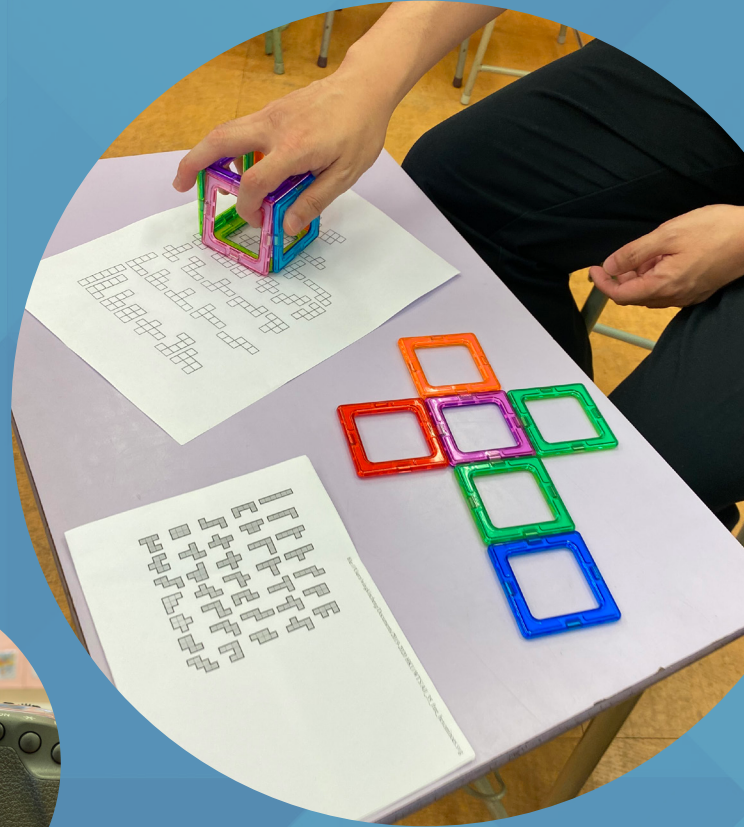


ONSITE SCHOOL-BASED SUPPORT



STUDENT/TEACHER INTERVIEWS

11



FIVE THEMES

Activities first:

Learning mathematics through games and activities to increase NCS students' participation in classroom discussions; involving students in using the language (both spoken and written; and in multiple ways) to enhance second-language acquisition.

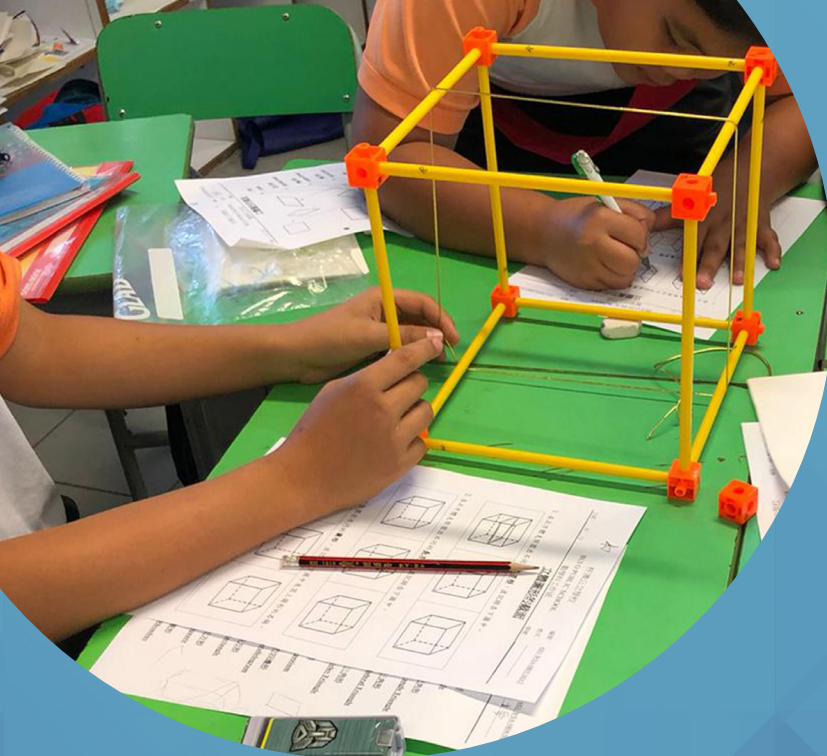
Beyond algorithm:

Developing conceptual understanding as well as procedural knowledge of arithmetic operations, using multiple representations and concrete materials in sense making and knowledge construction, regardless of students' language proficiency.

Culture matters:

Exploring cultural and linguistic diversity (CALD) of ethnic minority students to prepare teachers for diversity in the classroom, and to develop culturally responsive mathematics education in Hong Kong.



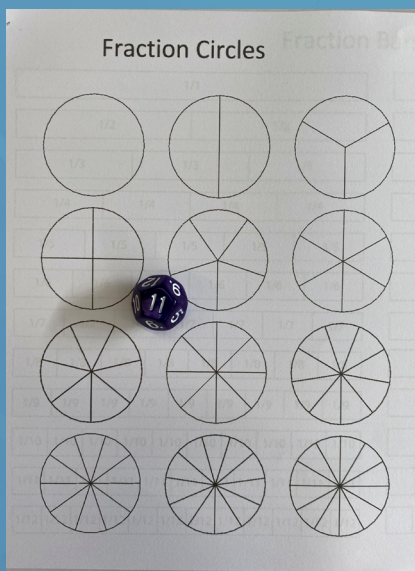


Depth with fluency:

Developing proficiency with mathematics facts through practices that are designed and developed to cater for students with different linguistic background and prior experiences/understanding of numbers, geometry, data handling, etc.

Exercise counts:

Illustrative examples and intelligent practice to improve students' understanding through multiple representations for those who are struggling with the instructional language, and to increase students' motivation in learning based on their cognitive skills and affective disposition.



ACTIVITIES FIRST



Activities, especially those games of fun, provide more opportunities to engage students. Without much limitation due to language, NCS students can be more motivated to learn by doing and through playing. We have tried activities that can get students to be more actively involved, to collaborate more with their peers, to practise more and to talk more about mathematics.

Learning Mathematics through Games

- Promoting learner autonomy
- Increasing motivation
- Playing games and learning mathematics proactively

Learning Mathematics through Activities in Class

- Creating a fun learning environment
- Making space for student talk
- Developing generic skills
- Developing skills in assessment



Math Fun Activities

- Appreciating the beauty of mathematics
- Engaging in collaborative problem-solving tasks
- Creating hands-on crafts related to mathematics

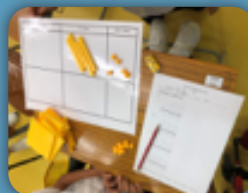
BEYOND ALGORITHM

Like many other children, NCS students are curious about 'why'. They do not want to follow rules and formulas that do not make sense to them. Mathematics usually appears abstract; but the abstract process can always start with manipulations and operations with concrete objects. In this way, even NCS students, who may have difficulties in comprehending verbal explanations of the abstract process, can follow easily.

Here are a few examples of the development from concrete operations to abstract thinking.

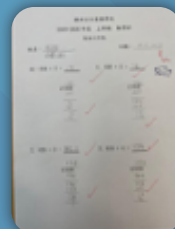
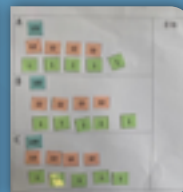
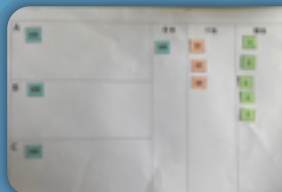
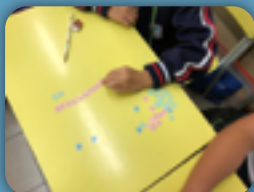
Example 1

P2 Three-Digit Addition & Two-Digit Subtraction



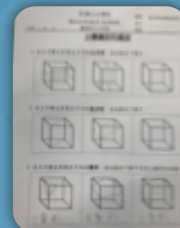
Example 2

P3 Division



Example 3

P6 3D Shapes



'Mathematising' puts emphasis on engaging students in the process through which mathematics evolves, from nothing to something primitive, and from something primitive to something refined. This process should rest upon concrete practical experience that is accessible to students, and ultimately brings students to the next level of abstract thinking.



CULTURE MATTERS

Children literatures can be used in class to explore and present mathematical concepts and ideas of different cultures (Zaslavsky, 1996). Storytelling serves as a pedagogical strategy to support teaching in a multicultural-multilingual classroom.

Stories

- offer a cultural context for mathematical problem-solving, with multiple entry points for students to engage in posing questions and solving problems;
- allow informal and conversational manner that supports language learners at all levels of language development to access the mathematical content;
- provide multiple representations that support students' comprehension in problem-solving and understanding textual information/data, in which they learn to mathematise situations;
- help students transit from their home language to mathematical language, and improve learning through language especially for those who are struggling with the instructional language; and
- connect students' home cultures and experiences with highly literate culture of school mathematics.

Zaslavsky, C. (1996). *The multicultural mathematics classroom*. Portsmouth, NH: Heinemann.

DEPTH WITH FLUENCY



Multiple ways in making meaning to strengthen students' understanding while building up their fluency in mathematics

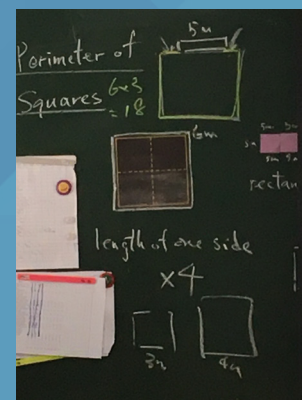
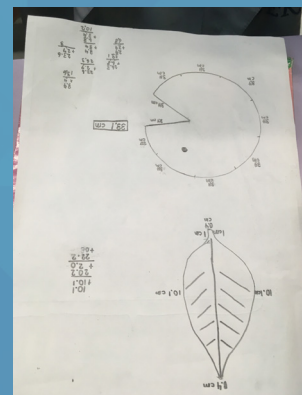
Remembering certain mathematical formulae is inevitable in learning mathematics. However, memory and concepts can be better linked if students are granted opportunities to connect formulae with a pictorial representation, to find rules via hands-on experience, and to discover the meaning of mathematical rules in the real world. Despite having language barriers and diverse learning habits, NCS students still benefit from opportunities of this kind, thus developing gradually their mathematical understanding along with fluency.

Examples:

Perimeter formulae: Exploratory activities empower NCS students, even those with weaker computation skills, to learn more effectively both the concept of and the formulae for perimeter.

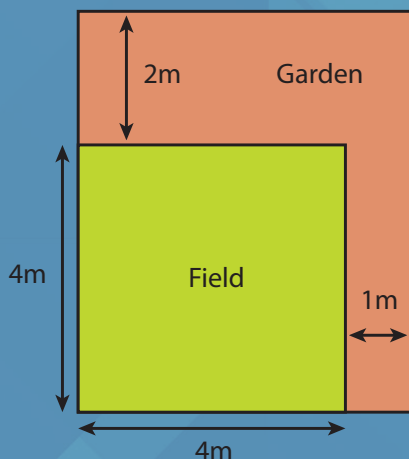
Addition of fractions: Using fractions of a square or a circle gives a better sense to why only the numerators are added while the denominators are the same. Students find it easier to understand why finding a common denominator is necessary before adding fractions.

Times table: Reference to patterns (e.g. geometric configuration of dots) connects addition with multiplication and provides a visual memory of the times table for NCS students.



EXERCISE COUNTS

Low Threshold High Ceiling (LTHC) Exercises for NCS Students



Very often, typical mathematical problems expect students to practise certain target mathematical skills, which NCS students might not have grasped yet, because of their different learning backgrounds. Below is such an exercise problem which appears in a Primary 4 textbook.

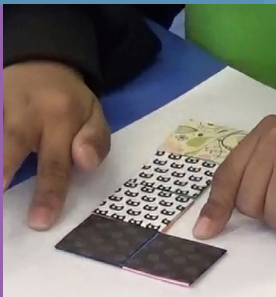
[Typical problem] There is a field in a piece of land. The rest is a garden, in orange. Find the perimeter of the garden.

In contrast, problems with a “low threshold” are hurdle-less, anxiety-free and accessible. Once started and being engaged, students will construct their own paths to the solution, or even beyond, extending to some “high ceiling” of this type of problems.

For example, the above typical problem can be re-designed as an LTHC problem with two parts.

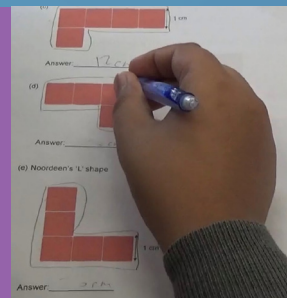
Exercise (1)

Let there be 5 square tables. Place them adjacently together to form at least 3 shapes. You are provided with 5 square cards to simulate the tables.



Exercise (2)

Find the perimeter of the shapes formed.



RECOMMENDED STORYBOOKS

Multiplication and Division

One Hundred Hungry Ants, Elinor J Pinczes

Remainder of One, Bonnie Mackain

Bean Thirteen, Matthew McElligott

Minnie's Diner, Dayle Ann Dodds

The Doorbell Rang, Pat Hutchins

Anno's Mysterious Multiplying Jar, Masaichiro Anno and
Mitsumasa Anno

Amanda Bean's Amazing Dream, Liza Woodruff

Fractions

The Lion's Share, Matthew McElligott

Fractions in Disguise, Edward Einhorn

Perimeter and Area

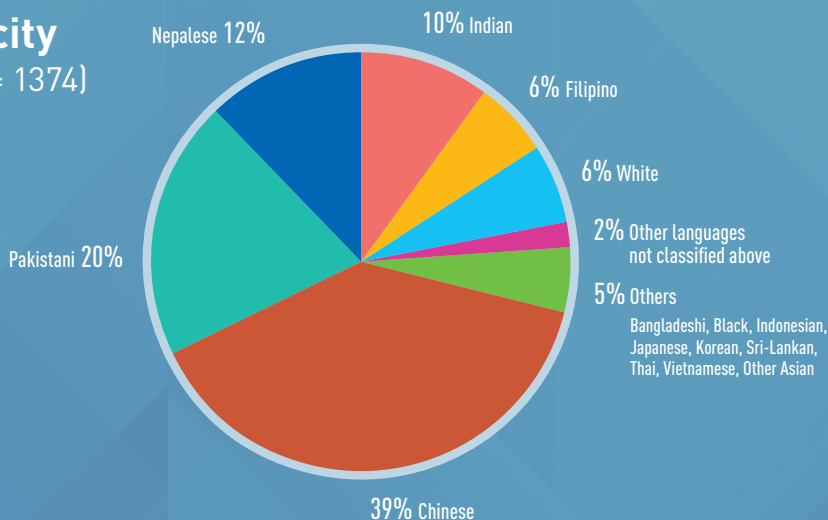
Sam's Sneaker Squares, Nat Gabriel

Spaghetti and Meatballs for All!, Marilyn Burns

STATISTICS OF STUDENTS IN 2019-20

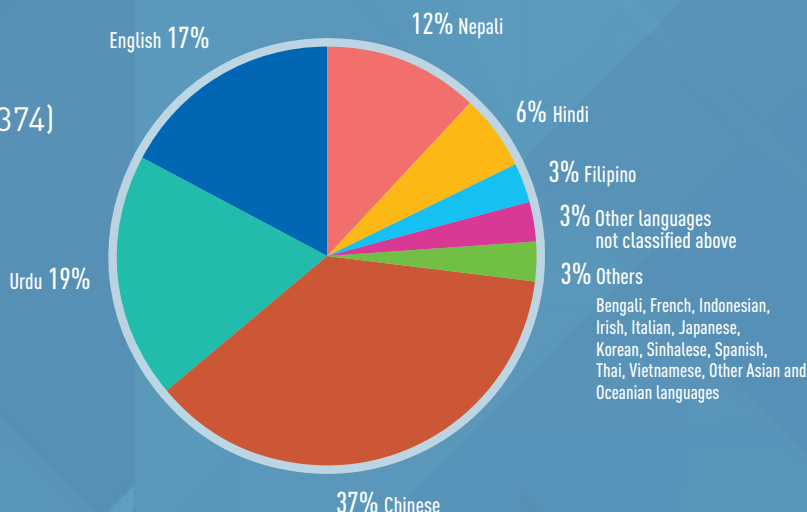
Distribution of Ethnicity

(Total number of students = 1374)



Distribution of Spoken Language at Home

(Total number of students = 1374)



This booklet is a deliverable of ‘*Quality Education Fund Thematic Networks-Tertiary Institutes (QTN-T): Supporting the Learning and Teaching of Mathematics for Non-Chinese Speaking (NCS) Students in Primary Schools*’ which is funded by Quality Education Fund.

.....

ACKNOWLEDGEMENTS

1. Bui O Public School
2. Catholic Mission School
3. CNEC Ta Tung School
4. Delia (Man Kiu) English Primary School
5. HKFEW Wong Cho Bau School
6. Hong Kong Christian Service Pui Oi School
7. Hong Kong Taoist Association Wun Tsuen School
8. Islamic Primary School
9. Kam Tin Mung Yeung Public School
10. Man Kiu Association Primary School
11. Pat Heung Central Primary School
12. Po Leung Kuk Gold & Silver Exchange Society Pershing Tsang School
13. Sir Ellis Kadoorie Primary School
14. SKH Wei Lun Primary School
15. St. Margaret’s Co-educational English Secondary and Primary School
16. Tsuen Wan Trade Association Primary School



HKU NCS Math



3910 2412



cldmaths@hku.hk