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

Culture and Language

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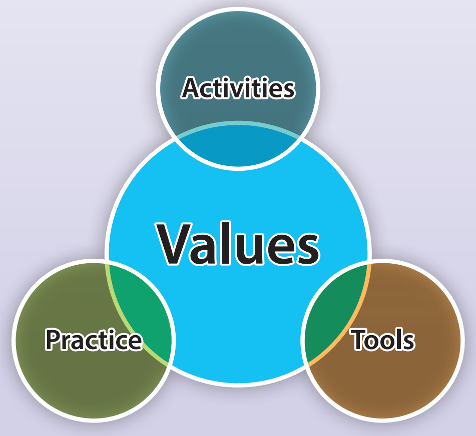
Cultural neutrality of mathematics is debatable. One reason for the underachievement of ethnic minority students is that mainstream schooling based on the dominant culture advocates values possibly different from those in the minority culture. The discord is rooted in the differences between the cultural values that are embraced by the students themselves, their parents, their peers, the teachers, the principals in school, as well as the communities they live in. Cultural differences – with the different underlying values – may influence how the same mathematical content might be taught through different approaches and assessments (Seah, 2003). Identifying and understanding these cultural differences allow us to improve our pedagogy and to develop a more culturally responsive curriculum in multicultural and multilingual contexts.

Ethnic Minorities and Their Values

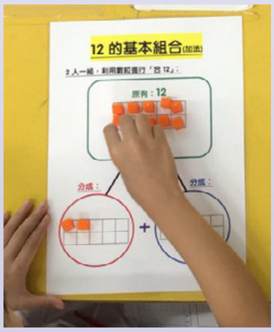
Our research study shows that activities, practice and tools are more valued by ethnic minority students than ethnic Chinese students in Hong Kong.



Language and Mathematics Integrated Intervention

Language is more than a tool for representation and communication; it is a tool for thinking and constructing knowledge via constructing meanings (Prediger & Wessel, 2013). Ethnic minority students learn mathematics in a second, and at times a third or fourth language. They faced the challenge of learning the mathematical content as well as the language of instruction at the same time. Both influence their attainment. Different languages can provide different conceptualisations for mathematical concepts (Barton, 2008), and knowing the differences in language-related nuances allows us to design instruction that aims at fostering students' conceptual development through language acquisition.

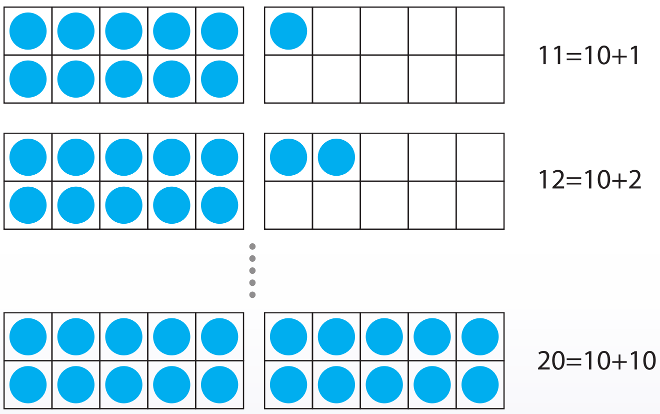
Number words



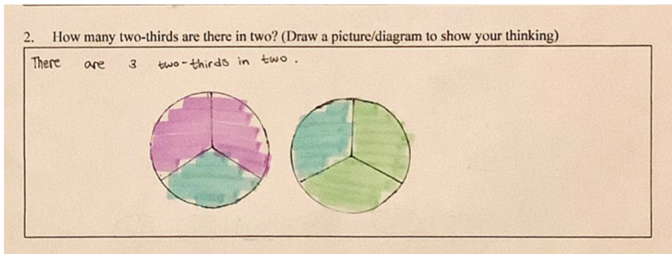
Chinese number words have clear tens and ones that represent composition of numbers, e.g. 'ten one', 'two ten', thus, Cantonese-speaking teachers make less emphasis on the number that makes ten with a given number. Many South-East Asian languages including Nepali, Urdu, Punjabi and Hindi have irregular number-word systems, and students from less regular counting systems have poorer understanding of base-ten system (Mark & Dowker, 2015). They would have difficulties in acquiring a new set of number words and are more likely to make mistakes in place-value tasks and in multi-digit addition and subtraction. In order to develop students' understanding that teen numbers are made up of 'ten and ones', particular attentions must be placed in linking number words and symbols using 10-frame and other multi-representations.

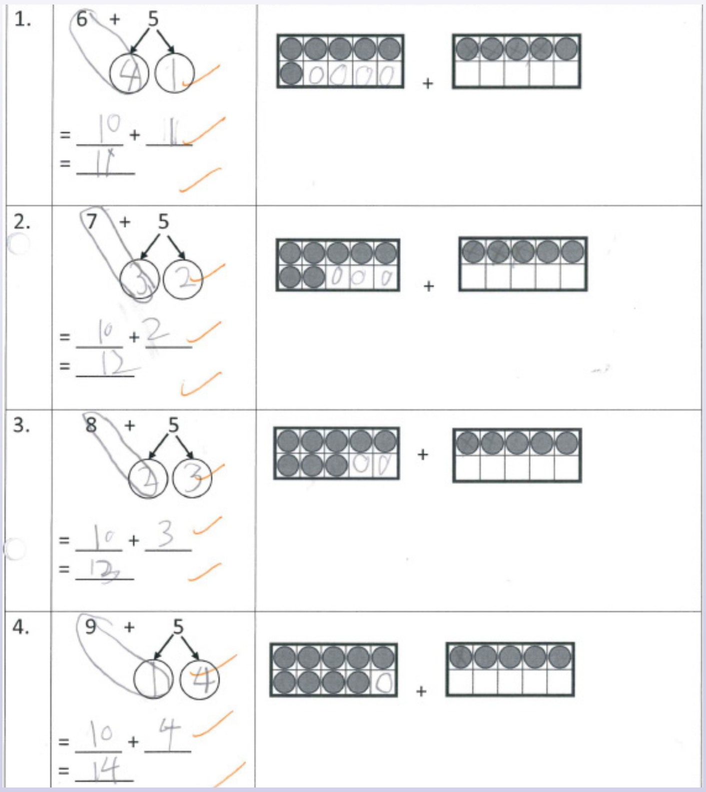
Value components and the items associated with each component

Value component	Items associated with each component	
Activities	17 Stories about mathematics 18 Stories about recent developments in mathematics 61 Stories about mathematicians	25 Mathematics games 34 Outdoor mathematics activities 32 Using mathematical words
Practice	36 Practising with lots of questions 37 Doing a lot of mathematics work	57 Mathematics homework
Tools	47 Using diagrams to understand mathematics 48 Using concrete materials to understand mathematics	



Representing teen numbers using 10-frames





Language of fractions, part-whole relationship

Part-whole relationships are taught differently in different cultures, and fraction words reflect the fraction concepts they represent. In Chinese, the denominator of a fraction is read first, the word 分 signifies partitioning, and 4分之1 literally means "one of the four partitions". In English, the counting number (numerator) signifies "how many" while the ordinal number (denominator) signifies what is being counted. Gunderson and Gunderson (1957) suggested that at the beginning of fraction instruction, we should write out the fraction words rather than use standard notations. For example, we should write (and read) "3-fourths" (read as "three fourths") instead of the simple numerical form "$\frac{3}{4}$" (read as "three over four").

How many eighths are in four?

Iterating or counting parts can be used to develop the understanding of division of fractions which is one of the least understood algorithms in primary mathematics. Partition four wholes into eighths and then iterate (emphasising the eighths as you read), 1-eighth, 2-eighths, …, 32-eighths. Consider that there are 8-eighths in a whole, then 32-eighths in 4 wholes, and by counting the fractional parts (the denominator), students begin to notice why we multiply the denominator in the standard algorithm for division of fractions (Bay-Williams, 2013). They will see why "invert and multiply" works. Emphasising on "ths" for fractions and iterating can help students understand division of fractions, as well as other operations with rational numbers (Van de Walle, Karp, & Bay-Williams, 2013).

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