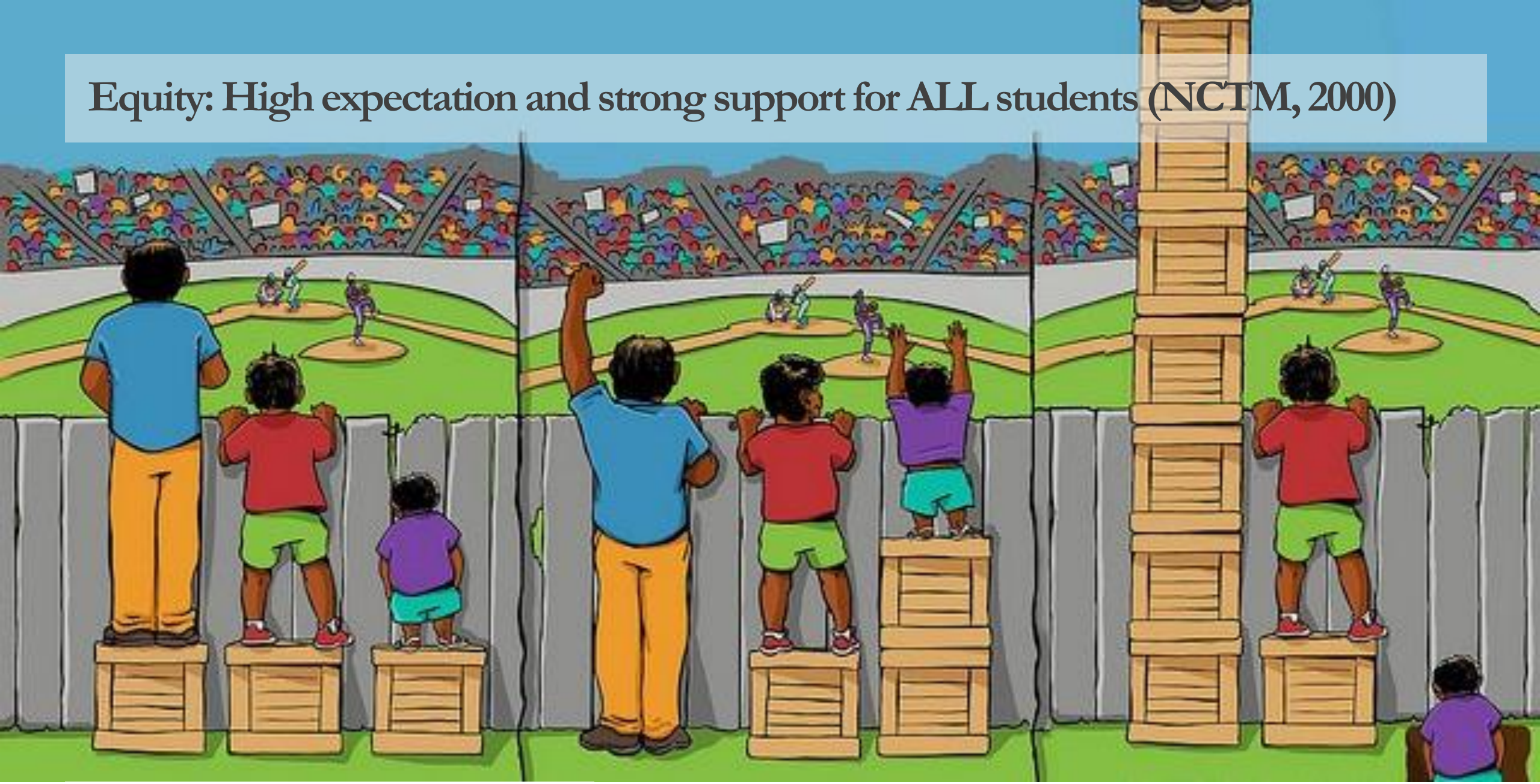
Faculty of Education
THE UNIVERSITY OF HONG KONG

Equity for Language Learners (LLs) in Mathematics Lesson

Emily Sum, PhD

Equity: High expectation and strong support for ALL students (NCTM, 2000)



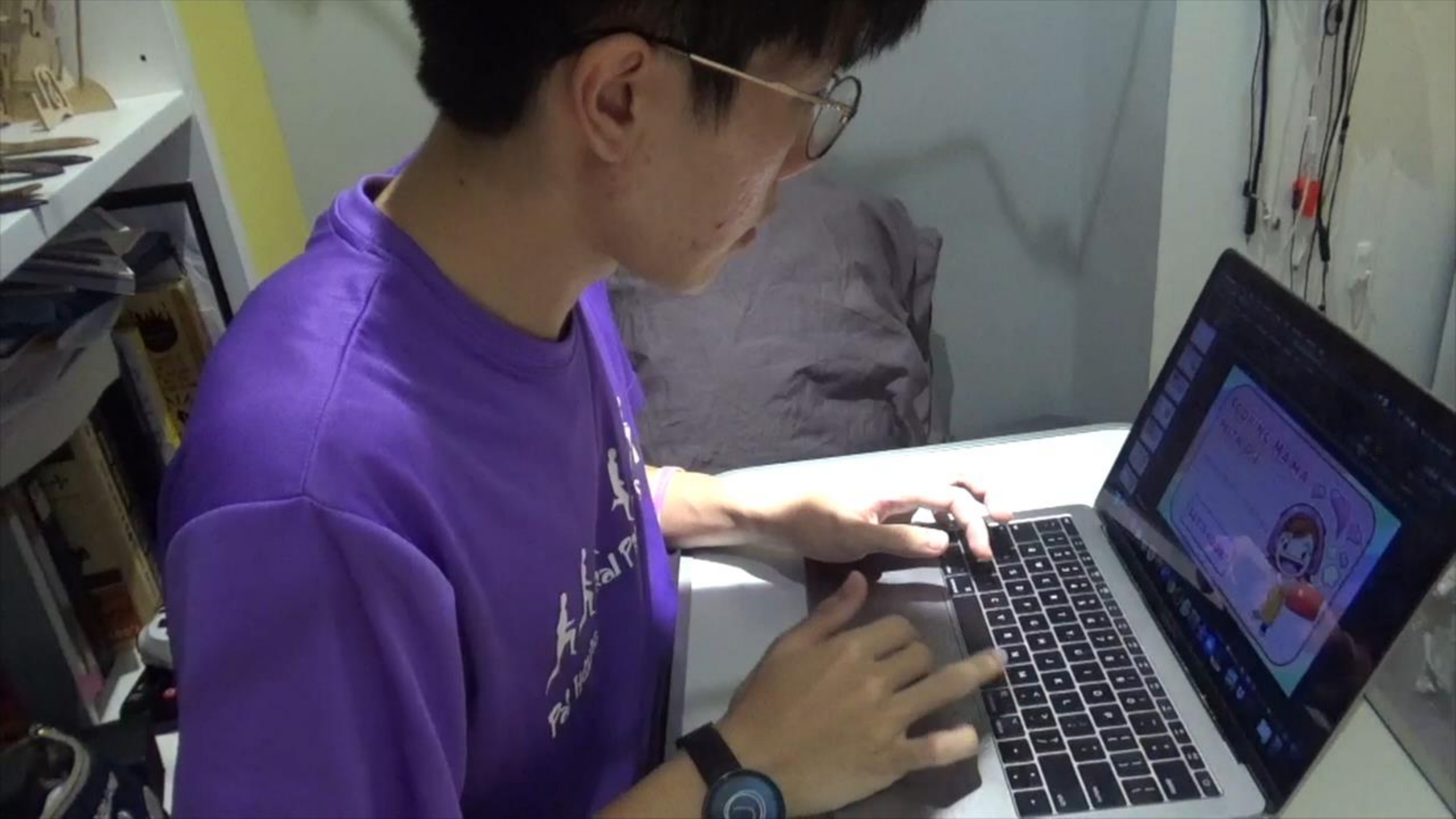
Equity in Mathematics Lesson

How Can I Make My Lessons More Accessible to English/Chinese Language Learners (E/CLLs), without simplifying the mathematical content?

- Ensure E/CLLs have the language to understand instruction and to express/demonstrate knowledge;
- Construct activities that maximize opportunities for E/CLLs to interact with others; and
- Provide contextual support: Verbal scaffolding, visual clues and physical manipulatives to aid understanding.

Gamification: Fostering students' multi-level understanding of fractions

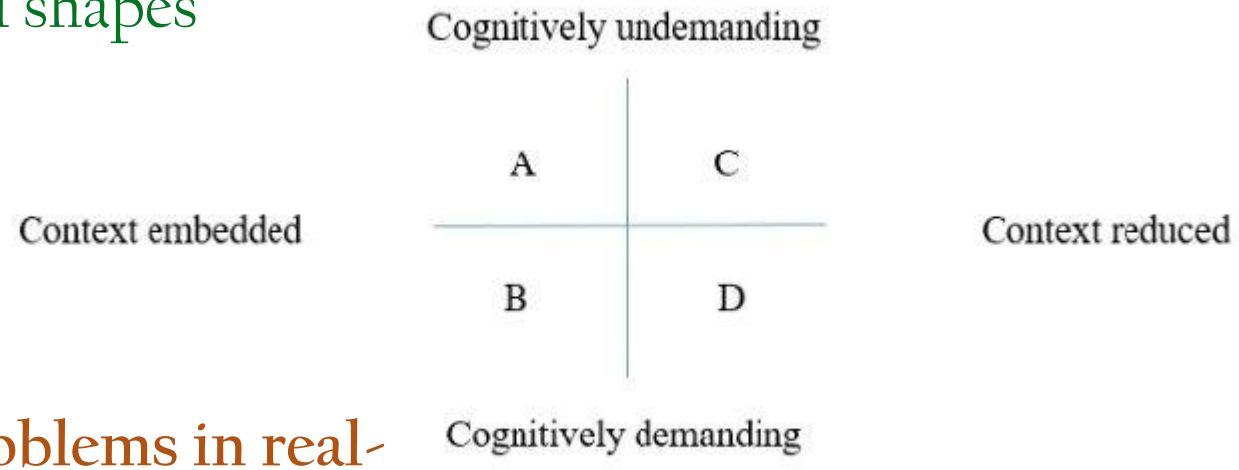
Mr. Johnathan, Pat Heung



Cummins' Quadrant Model (1984, 2000)

Introducing geometrical shapes

Remembering times tables
Performing direct computations



Solving problems in real-world context

Lecture of complex analysis

Students achievement is promoted by activities that place a significant emphasis on Quadrant B (Gibbons 1998; Vincent, 1996)

Pedagogical Approaches in Second Language Acquisition (I & Chang, 2014)

Strategies		Examples
High-order thinking questions	Open-ended questions	• Posing questions; writing and solving problems based on children's literatures
Visual/physical activity	Games, diagrams, manipulatives, gestures and other multisensory tools	• Gamification: *Cooking mama*
Scaffolding	Paraphrasing, slowing speech, contextual definitions, wait time, speaking in familiar context	• Using general and specific sentence frames to build English/Chinese sentences. • Students use everyday language prior to mathematical formal language.
Group activity	Partnering, group activity/ discussion/presentation, role playing	
Graphic organizer		• Vocabulary charts

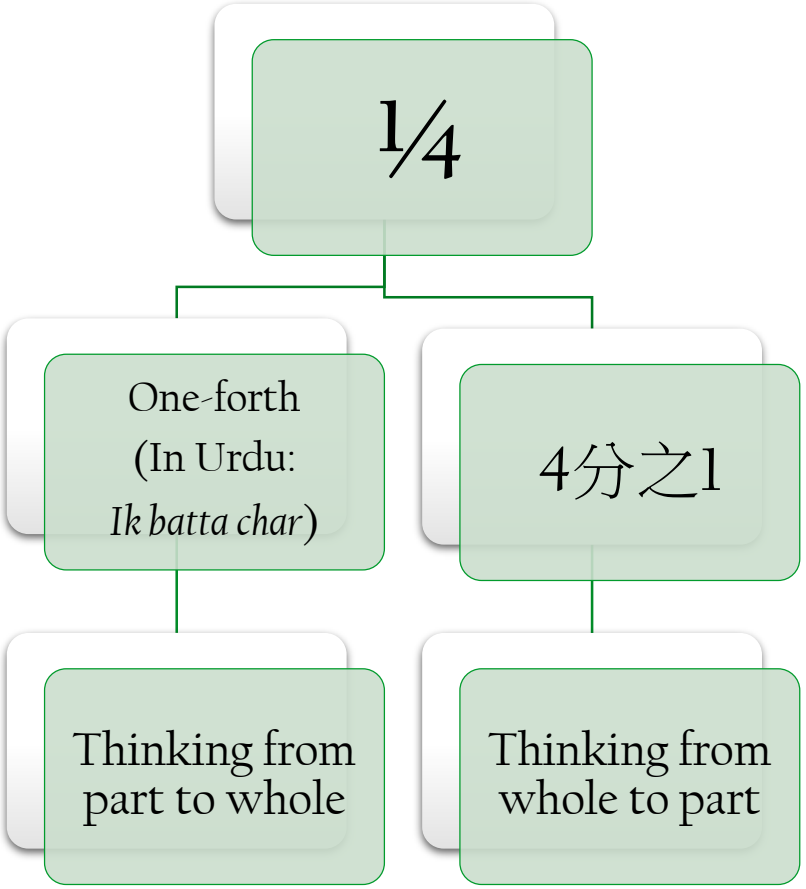
Lesson Planning

How can we accommodate students with different levels of language proficiency?

- Analyze *the language requirements* of the texts/tasks
  - Mathematics-specific language [including words and symbols] that teachers would use during instruction
  - Vocabulary terms and language that students would need to articulate their mathematical reasoning and understanding
- Choose precise language that matches the mathematical content to make learning more observable to all

Connecting Content & Language Objectives

Reading fractions in 2 languages



Language of Fractions

- The part-whole concept is a good example of how languages can provide different conceptualisations (Bartolini Bussi et al., 2014);
- Use *ths* instead of OVER/OUT OF (Bay-Williams, 2013; Siebert & Gaskin, 2006);
- Use unit fractions to help students connect their understanding of counting (units), then of addition and subtraction.
- Use language, " ½ is equivalent to 2/4," or " ½ is the same amount as 2/4," and avoid statements such as, " ½ is the same as 2/4" or " ½ looks like 2/4."

Incorporate Meaningful Language Practice into Lessons

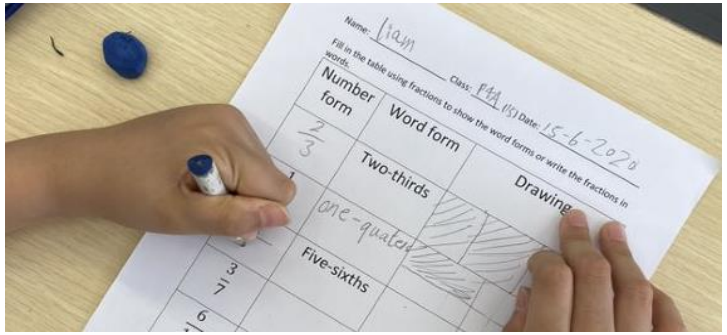
Instructional Approach

Focus on developing conceptual understanding, rather than applying the necessary algorithms/rules

- *What* they are solving rather than *how* they are solving, with opportunities to write/speak in developing language proficiency.
- Tasks should be open-ended and presented within a problem solving context to enhance comprehension.
- Emphasis on students' own interpretations, explanations and justifications, for content and language development.

Writing Activities

Dictation



Problem Writing

Aditya , Chloe Li. Lester

6. Tom's weight is $\frac{1}{5}$ of his dad. His dad's weight is $1\frac{1}{2}$ of his mum. If Tom's mum is 60 kg, how heavy is tom?

Tom's Dad

Aditya

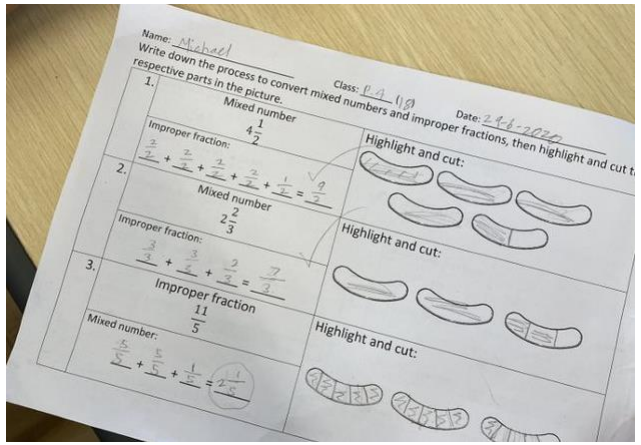
6. Tom's weight is $\frac{5}{6}$ of his mum. His dad's weight is $1\frac{1}{2}$ of his mum. If Tom's dad weighs 81 kg, how heavy is Tom?

his mum's weight

Incorporate Meaningful Language Practice into Lessons

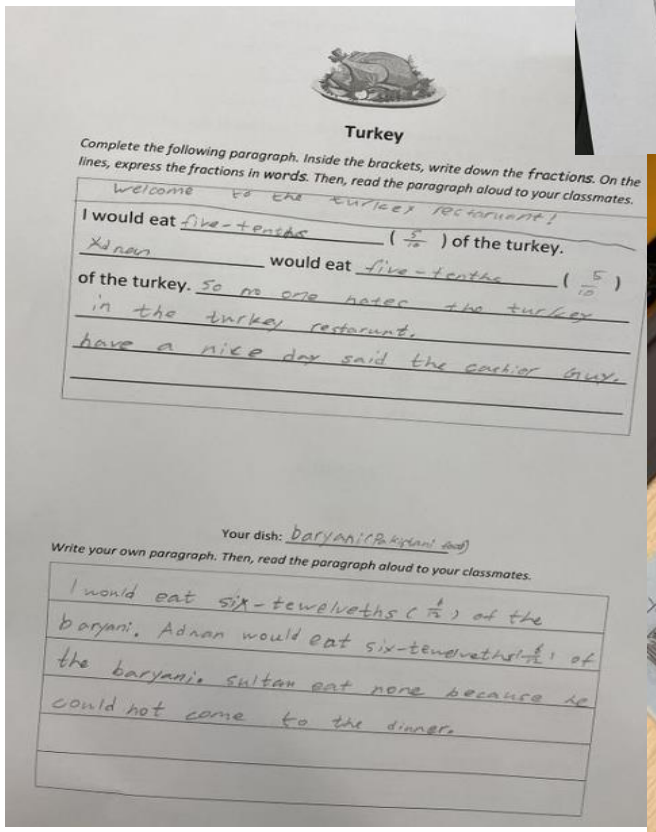
Instructional Approach

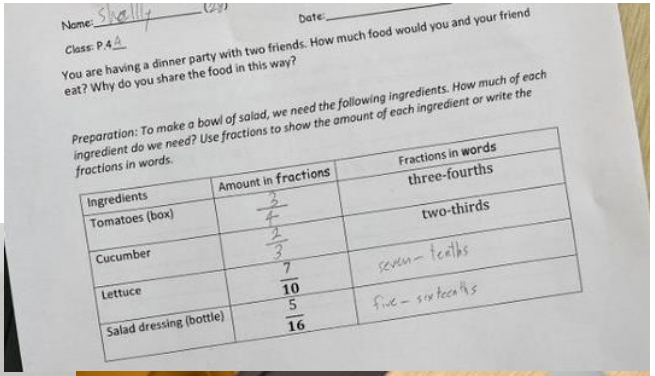
- Recognize/draw on students' informal knowledge & background experiences; connecting past learning and new concepts
- Select multiple representations such as number line, area (bar) model and set model to convey meanings and allow students to understand the mathematics better

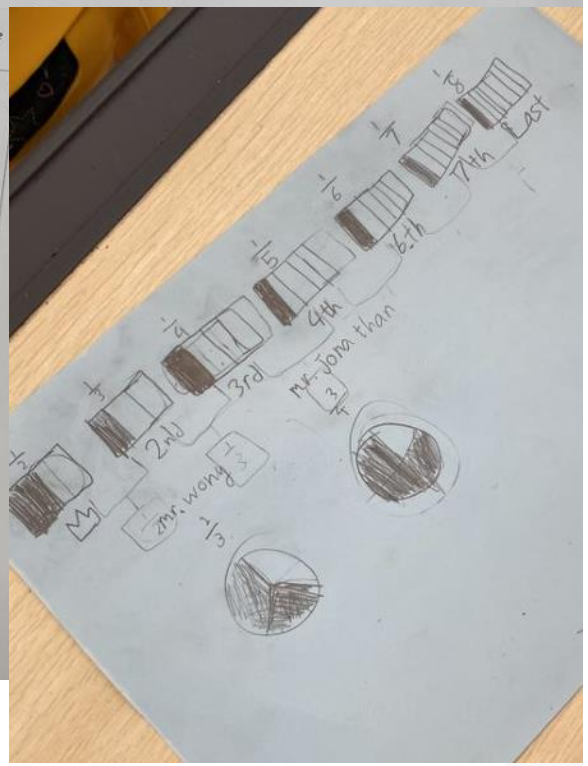


Writing Activities

Writing Story







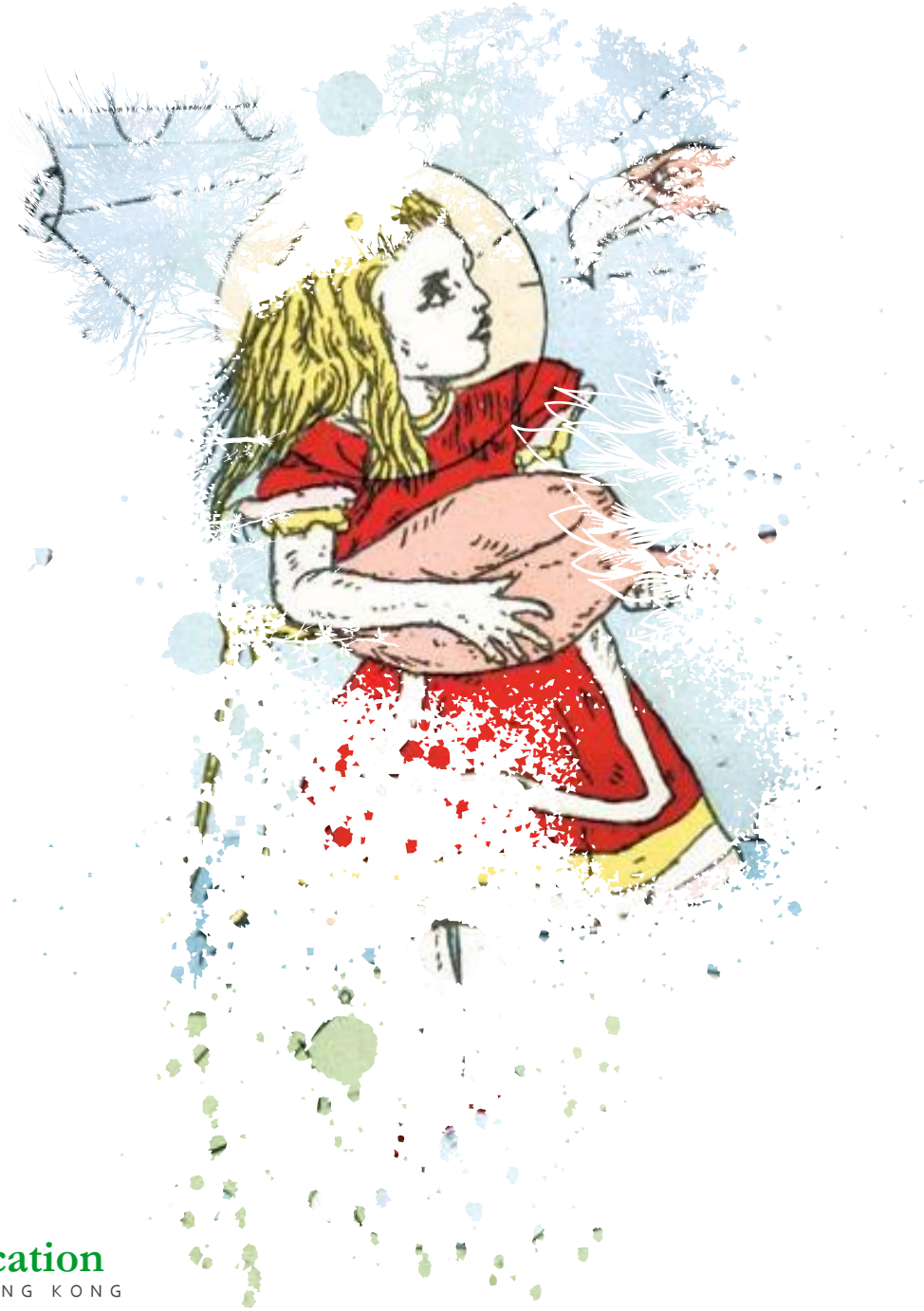
Supporting Classroom Talk

- Design tasks that allow differentiated responses to questions;
- Sentence frame is a powerful tool for learners at different levels of language acquisition to practice in expressing their thinking;
- Students need lots of practices of the vocabulary terms and sentence frames before using academic language to solve word problems; and
- Do NOT teach keywords to solve word problems, the meaning of words in mathematics is often determined by the context.

Storytelling & Multicultural Mathematics Instruction

Use children's world literatures to create multicultural mathematics classroom

- Provides a context (+ visual scaffolds) where concepts/patterns can be explored and a much broader range of learners can be catered for;
- Connects students' cultures/everyday experiences with school mathematics;
- Offers multiple entry points for students to engage/participate, to pose questions and solve problems;
- Helps students to express their mathematical ideas/thinking in an informal and conversational manner, as they develop problem solving skills and learning the language.



HKU Book Club

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

Reflect and Discuss: Equity for Language Learners (LLs)

- What role does language play in learning mathematics?
- List some challenges that Language Learners face during instruction.
- State important points to remember when modifying a lesson for LLs
- How can teachers differentiate instruction for LLs with varying levels of proficiency in Chinese/English?
- Which mathematical language must students understand and use during the lesson?
- For what purpose will students use language (e.g., to describe, to categorize, to hypothesize, to sequence, to compare and contrast)?
- What strategies will you use to help LLs understand mathematical content and generate language?
- How will you differentiate the lesson for students whose Chinese/English language proficiency levels vary?
- Are there any opportunities for discussion during the lesson?

Adapted from, Bresser, R., Melanese, K., & Sphar, C, Equity for Language Learners (2009)

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Thank You

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