Ariyadi Wijaya
a.wijaya@uny.ac.id

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Learning trajectory from a curricular perspective:
A case of number topic in Indonesian and American Curriculum

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Background of the study

4 QUALITY EDUCATION

Indicator		
4.1.1	Proportion of children and young people:	
	(a) in Grade 2 or 3; (b) at the end of primary education; and (c) at the end of lower secondary education who achieve at least a minimum proficiency level in (i) reading and (ii) mathematics, by sex	

(UNESCO Institute for Statistics, 2018)

Table 2.3 Minimum proficiency level alignment for mathematics

Educational level	Descriptor	Assessment PLDs that align with the descriptor	Minimum proficiency level in the assessment
Grades 8 and 9	Students demonstrate skills in computation, application problems, matching tables and graphs, and making use of algebraic representations.	PISA 2015, Level 2	Level 2
		TIMSS 2015, Low International	Intermediate international
Grades 4 and 6	Students demonstrate skills in number sense and computation, basic measurement, reading, interpreting, and constructing graphs, spatial orientation, and number patterns.	SACMEQ 2007, Level 3	Level 3
		SACMEQ 2007, Level 4	
		PASEC 2014, Level 1	Level 2
		PILNA 2015, Level 6	Level 5
		TERCE 2014, Level 1	Level 2
		TIMSS 2015 Intermediate international benchmark	Intermediate international
Grade 2 or 3	Students demonstrate skills in number sense and computation, shape recognition and spatial orientation.	TERCE 2014, Level 2	Level 2
		PASEC 2014, Level 1	Level 2
		PASEC 2014, Level 2	

Source: UNESCO Institute for Statistics (UIS).
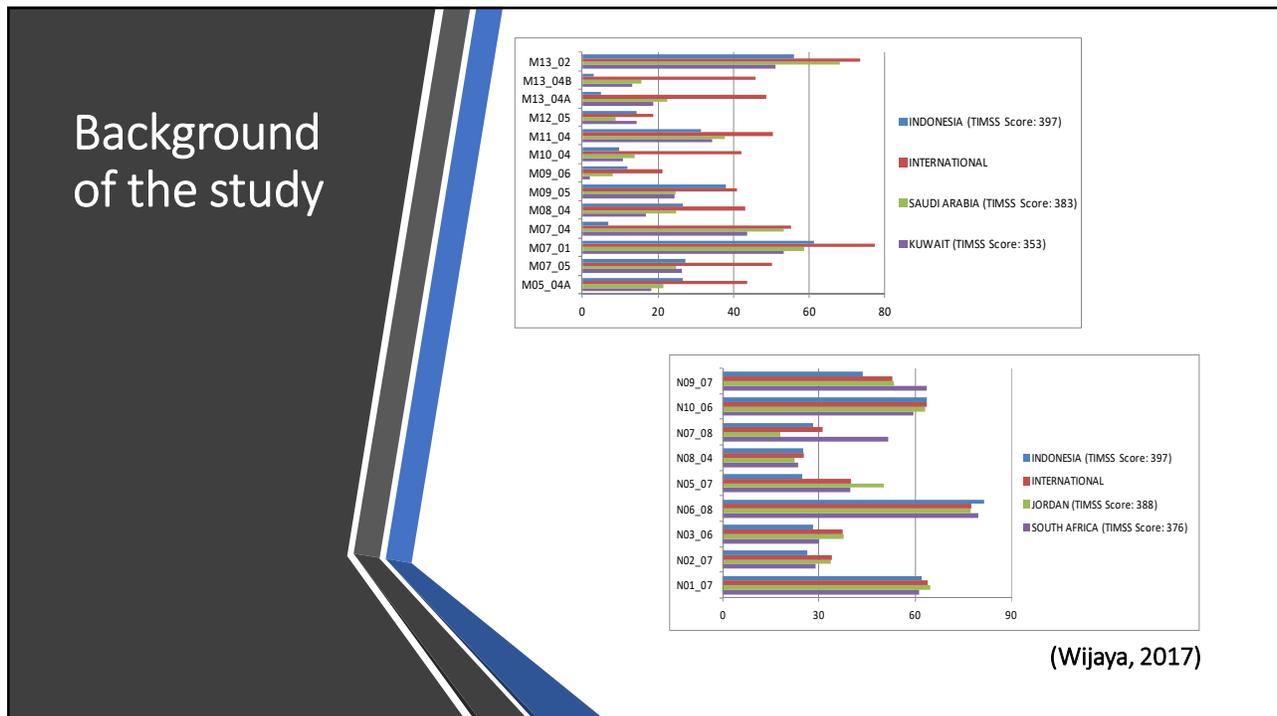
Indonesia participate in TIMSS Grade 4. How about other grades?
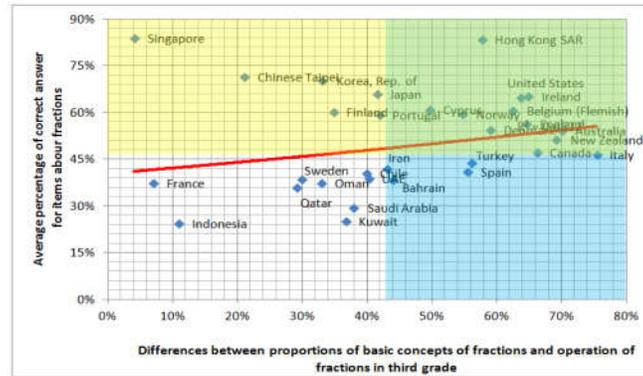
Indonesia has INAP and AKSI

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Background of the study

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Background of the study
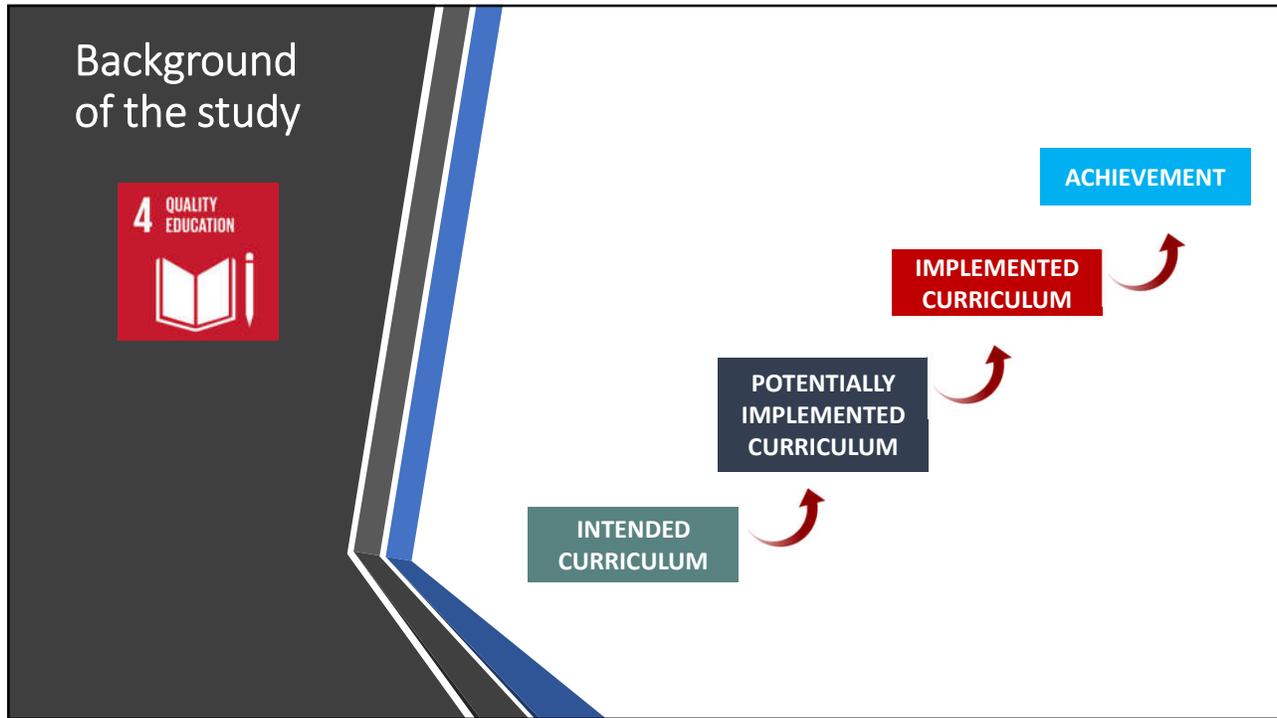
(Wijaya, 2017)

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Background of the study

Curriculum does matter

(Wijaya, 2017)

Background of the study

https://www.csoonline.com

Aim of the study

➢ To describe how the domain of number is presented in Indonesian and American curricula

➢ To make an adjustment to the trajectory of topics in number domain

www.blog.commlabindia.com

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- Bakker, A. (2004): "Design research in statistics education: on symbolizing and computer tools"

- Doorman, M. (2005): "Modelling motion: from trace graphs to instantaneous change"

- Wijaya, A. et al (2011): "Emergent Modelling: From Traditional Indonesian Games to a Standard Unit of Measurement"

- Wanita, C. T. et al (2014): "Learning Line Symmetry through Batik Exploration"

- *many others*

Learning Trajectory — Design Research

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Approaches to Learning Trajectories

According to Lobato and Walters (2017):

Approach 1: Cognitive Levels
Approach 2: Levels of Discourse
Approach 3: Schemes and Operations
Approach 4: Hypothetical Learning Trajectory
Approach 5: Collective Mathematical Practices
Approach 6: Disciplinary Logic and Curricular Coherence
Approach 7: Observable Strategies and Learning Performances

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Approaches to Learning Trajectories *(cont'd)*

Approach 1: Cognitive Levels
- distinct types of **cognition** (or **ways of reasoning**) that occur within a hierarchy of levels of increasing sophistication

Approach 2: Levels of Discourse
- describes increasingly sophisticated **ways of communicating**

Approach 3: Schemes and Operations
- seek evidence of learning processes involved as **students** use pre-knowledge as a foundation for **modifying their schemes**

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Approaches to Learning Trajectories *(cont'd)*

Approach 4: Hypothetical Learning Trajectory

- focus on learners, but with an emphasis on **instructional supports** for learning

Approach 5: Collective Math Practices

- describes the progress of **community** (instead of individual)

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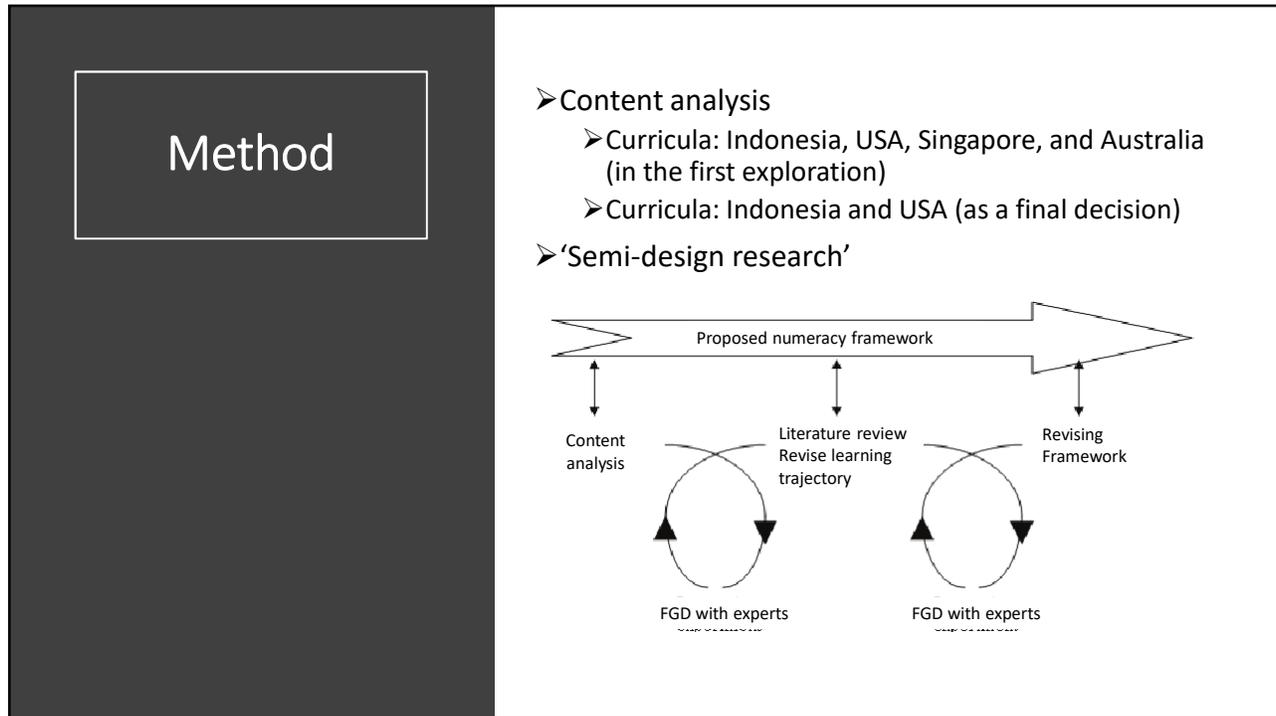## Approaches to Learning Trajectories *(cont'd)*

Approach 6: Disciplinary Logic and Curricular Coherence

- a macro view of how student thinking and proficiency in a domain may **develop over** several **years**
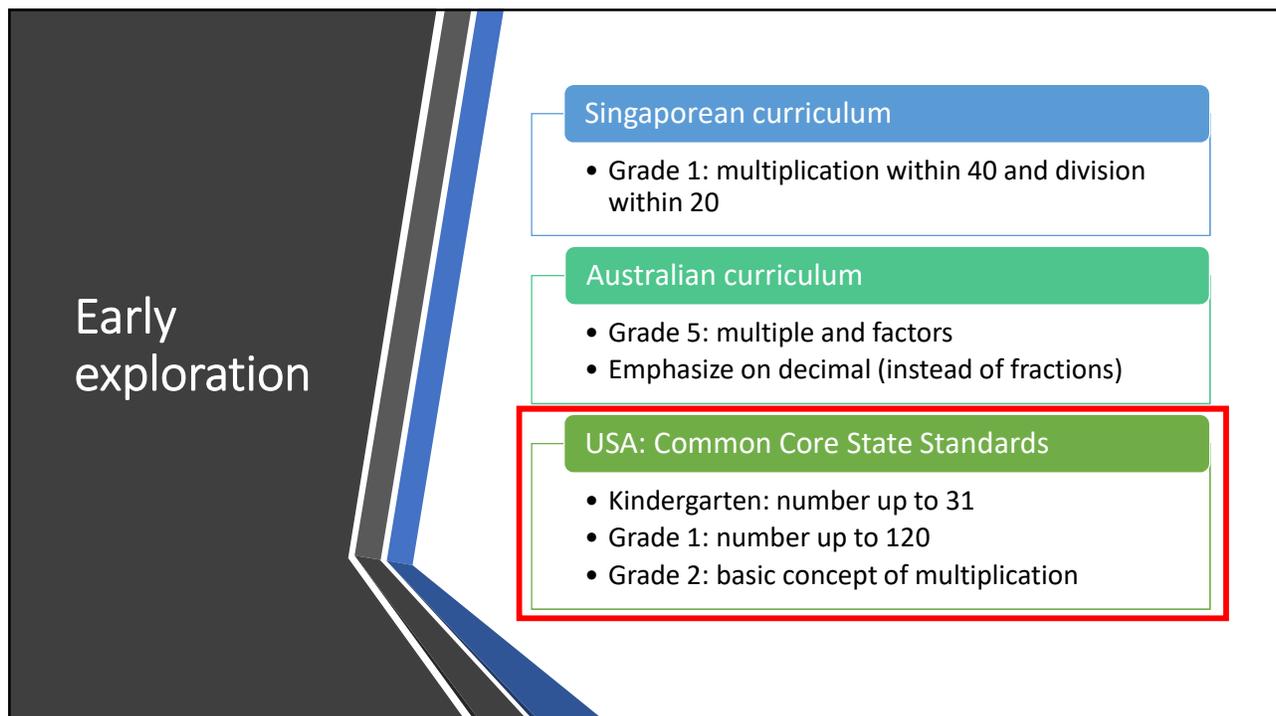
Approach 7: Observable Strategies and Learning Performances

- **strategies** and observable **behavior** are described using **action verbs** rather than the language of mental conceptions

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Method

- Content analysis
  - Curricula: Indonesia, USA, Singapore, and Australia (in the first exploration)
  - Curricula: Indonesia and USA (as a final decision)
- 'Semi-design research'

Proposed numeracy framework

Content analysis | Literature review / Revise learning trajectory | Revising Framework

FGD with experts | FGD with experts

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Early exploration

Singaporean curriculum
- Grade 1: multiplication within 40 and division within 20

Australian curriculum
- Grade 5: multiple and factors
- Emphasize on decimal (instead of fractions)

USA: Common Core State Standards
- Kindergarten: number up to 31
- Grade 1: number up to 120
- Grade 2: basic concept of multiplication

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Indonesian curriculum and Minnesota CCSS

Indonesian curriculum

- No explicit distinction of sub-domain
- Limitation of number across grade: based on place value only; e.g. G-1 up to 99, G-2 up to 999

Minnesota CCSS

- A clear distinction of sub-domain: counting & representation, operations (for whole numbers); representation & relationships, operations (fractions and decimals)
- Limitation of number across grade: based on place value, representation (e.g. K up to 31), and factorization (e.g. up to 120)

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Indonesian curriculum and Minnesota CCSS (*cont'd*)

Indonesian curriculum

- Focus on content-related competences; e.g. "*Explain and perform addition and subtraction …*"
- A clear distinction of knowledge and skills domain

Minnesota CCSS

- Focus on skill-related competences (mostly for lower grades); e.g. "*Use a variety of models and strategies to solve addition and subtraction …*"
- A clear distinction of knowledge and skills domain

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Numeracy framework: A proposed learning trajectory

- Cycle 1
- Focus group discussion with expert
- Cycle 2

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Thank you

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