ShiDa Institute for Mathematics Education (SDiME)

JUST DO MATH Project

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Tai-Kor Bilateral Symposium on Mathematics Education
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An Overlook of SDiME

- Shi-Da Institute for Mathematics Education (SDiME), since 2016.08
  (former: **Mathematics Education Center** (MEC) since 2014.08–2016.07)

- Dean of the Institute: Prof. Fou-Lai Lin

- http://mec.math.ntnu.edu.tw/ (old)
- http://www.sdime.ntnu.edu.tw/main.php (new)

- **JUST DO MATH** Project (2014–2018)– The 1st nationwide project
  - for enhancing students' mathematics ***learning attitudes***
  - for ***mathematics teacher professional development***

TW Students' Affective Problems in Learning Math: e.g. TIMSS 2007 & 2011

Attitude / Grades	Not confident in mathematics		Do not value mathematics		Do not like learning mathematics	
	2007	**2011**	2007	**2011**	2007	**2011**
4th (Int. Avg.)	27% (11%)	**38% (21%)**	--	--	29% (14%)	**32% (16%)**
8th (Int. Avg.)	46% (20%)	**67% (41%)**	16% (5%)	**46% (15%)**	45% (26%)	**53% (31%)**

How we Tackle the Problem…

Mathematics Grounding Activity

JUST DO MATH (JDM) Project

- Meaningful learning (***concrete experiences*** **before** abstract learning)
- Raising math learning ***motivation***

	2014 Developed Modules	2015 Developed Modules	2016 Expected Modules	2017 Expected Modules
Grades 3-6	45	29	13	12
Grades 7-9	19	15	7	6
Total	64	44	20	18

Video 1_貪心賓果

Video 2_空間大師

Structure of the JDM Project (nationwide project)

Mathematics Grounding Activity (MGA)

Expected Role of Teacher

Mathematics Spreader Teacher	MGA Designer	Lecturer of Mathematics Spreader Teacher

Context (for PD & Practice)

Workshop	Quality Control	Quality Control	Quality Control
Math Camp		Workshop	Workshop
Terminal Report			

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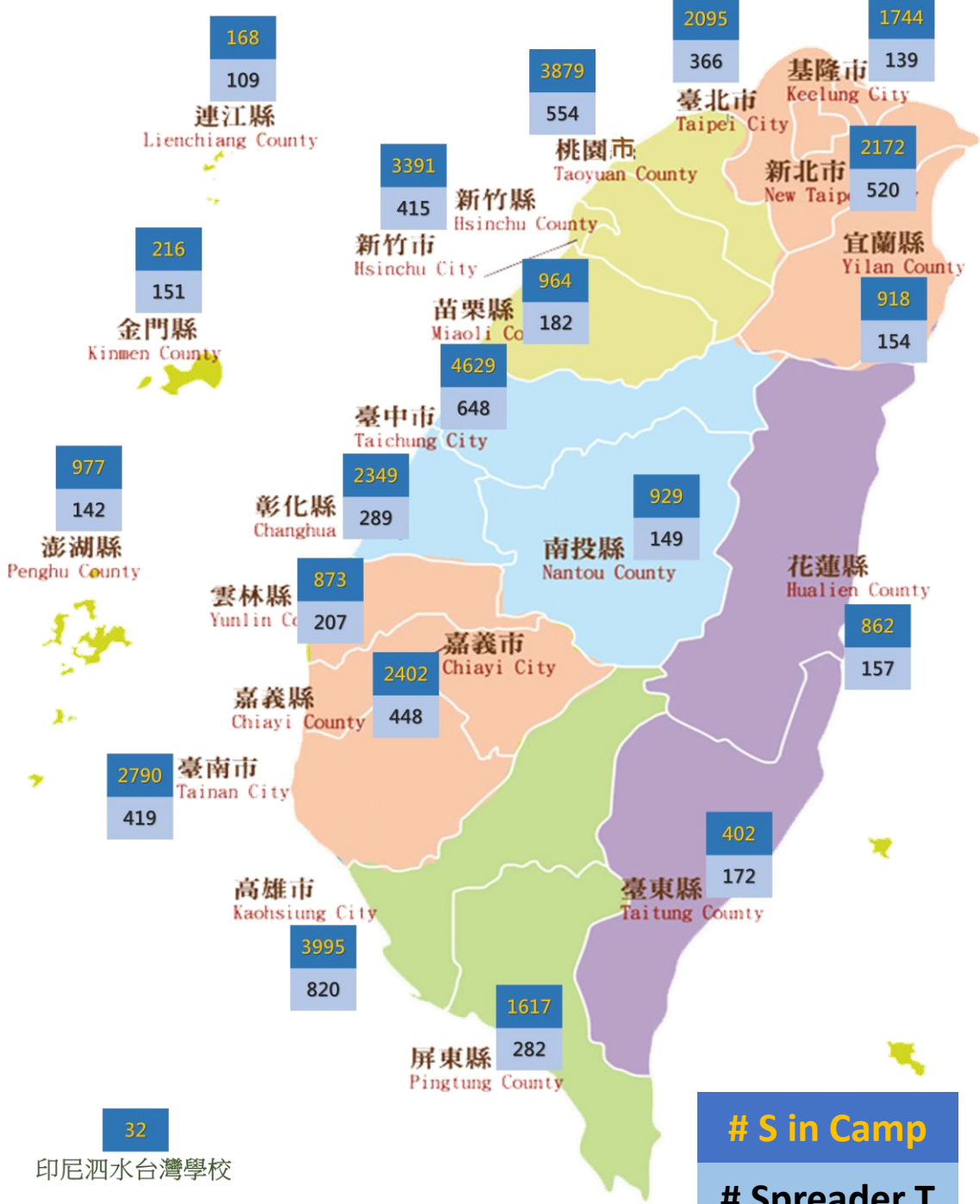
	2014	2015	2016
Qualified Spreader Teachers (1st Stage Modules)	746	3,117	815
Qualified Spreader Teachers (2nd Stage Modules)			1,755
Total	746	3,117	2,570
	6,433		

	2014	2015	2016
Summer Camp	1,105	9,626	10,320
Weekend Camp	185	1,445	960
Winter Camp	7,060	1,288	6,465
Total	8,530	12,360	17,745
	38,635		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連江縣
Lienchiang County
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臺北市
Taipei City
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基隆市
Keelung City
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Taoyuan County
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S in Camp
Spreader T

Structure of the JDM Project (nationwide project)

Mathematics-Grounding Activity (MGA)

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Context (for PD & Practice)

Workshop	Quality Control	**Workshop**	Quality Control	Workshop	Quality Control
Math Camp					
Terminal Report					

video

Structure of the JDM Project (nationwide project)

Mathematics-Grounding Activity (MGA)

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Context (for PD & Practice)

Workshop	Quality Control	Quality Control
Math Camp	Workshop	Workshop
Terminal Report		

Quality Control


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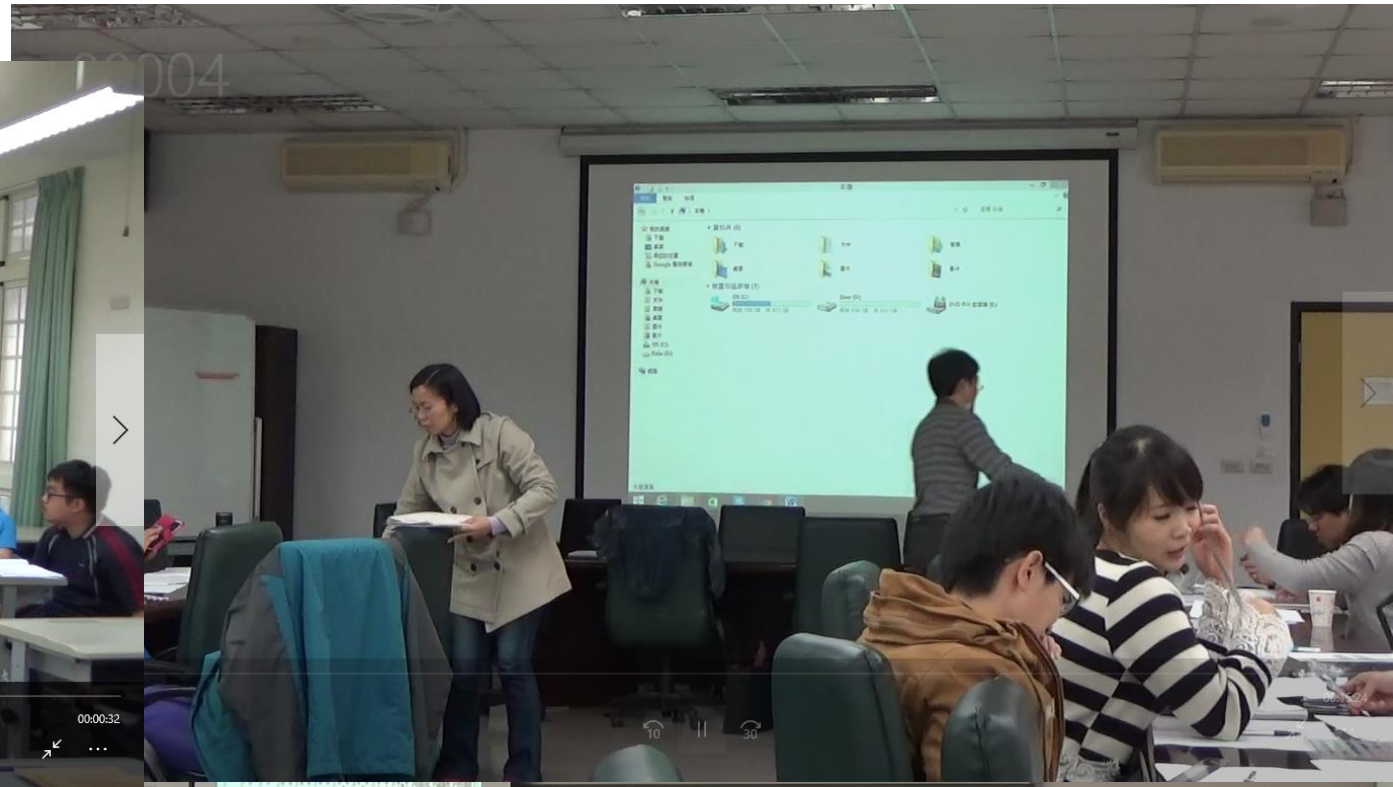


補預測圖


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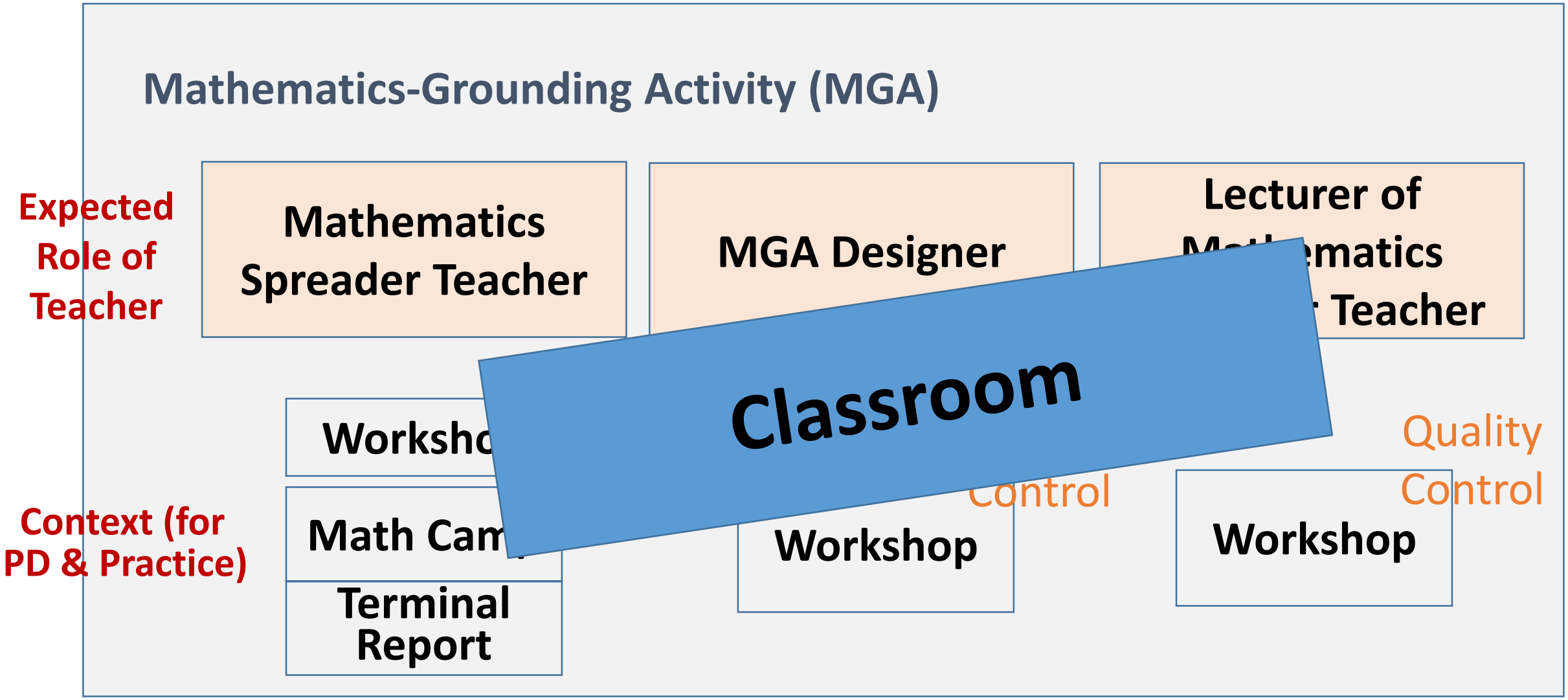
Structure of the JDM Project (nationwide project)



Teaching Mathematical Concepts with One MGA

An example of **GAME** as the Approach

- The promoter of **game-based learning**, **Keith Devlin**, contends that "***games are the best way to teach math***" (Shapiro, 2014).

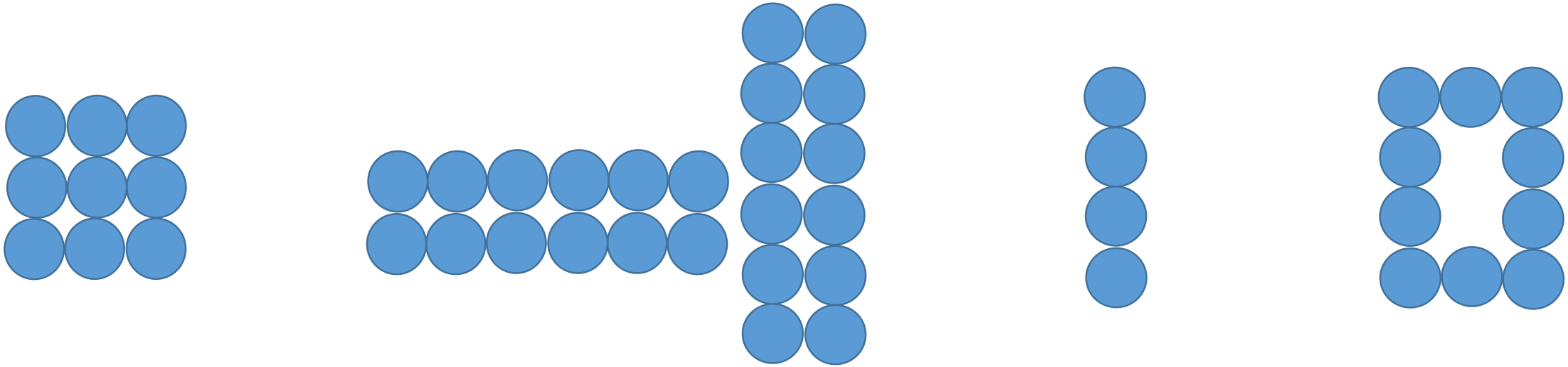
Example of RECTANGULAR NUMBERS

- Three sub-activities
- Exploring with the prerequisite of ***multiplication*** to develop students' further concepts of
  - *prime number*,
  - *composite number*, and
  - *factorization*

  through exploring the areas of rectangles

Sub-Activity 1

- Explore various kinds of rectangular number (e.g. one rectangle with 12 coins) with the coins
- Communicate and discuss with your partner(s), whether the following shapes belong to the set of rectangular number



Sub-Activity 2

- Practice with teachers' assistance
- Construct as many **rectangular numbers** as possible with **50 coins**, following the rules made in sub-activity 1.

Sub-Activity 3

- Competition game:
- A group of 2-3 people: take turns to pose any rectangular number within 50 and the opponent has to decode the width and length of the rectangles as much as possible, and make a record of those numbers
- Scoring with the following table

Points of the Denoted Number	List of the Numbers
0 point (no set of width and length)	e.g. 1, 2, 3, 5, …
1 point (1 set of width and length)	e.g. 4, 6, 8, 9, …
2 points (2 sets of width and length)	e.g. 12, 16, …
3 points (3 sets of width and length)	e.g. 24, 30, …
4 points (4 sets of width and length)	e.g. 36, 48

- Categorizing and Naming the numbers

Networking Theories (1)

- **Three Cognitive Representations of Learning** (Bruner, 1966)
  1. Enactive representation: forming the rectangular number(s)
  2. Iconic representation: e.g. sets of width and length
  3. Symbolic representation: e.g. categorizing & naming

Networking Theories (2)

- **The Progressive Functions of Mathematics Games** (e.g., Dienes, 1970)
  1. **Free Play**: Noticing the mathematics attributes embedded in
  2. **Rule of the Game**: Exploration of the rules by students themselves
  3. **Searching for Commonality**: Searching the mathematical structure from the activity
  4. **Representations**: Constructing ways of representation for the preparation of further abstract communication with peers (e.g. no-scored number)
  5. **Symbolization**: Building symbols as the language to examine and describe the representation
  6. **Formalization**: Proving the rules of the mathematical game, incl. the description of axioms, deductive reasoning of a theorem, proof from an axiom to a theory, etc.

Networking Theories (3)

- **Three Modes of Schema Construction (Skemp, 1986)**

Building		Testing
Experience from our own encounters with the physical world	**Mode 1**	***Experiment*** against expectations of events in the physical world
Communication from the schema of others	**Mode 2**	***Discussion*** comparison with the schemas of others
Creativity from within by formation of higher-order concepts (by extrapolation, imagination, intuition)	**Mode 3**	***Internal Consistency*** comparison with one's own existing knowledge and beliefs

Mode 1: the importance of *structured practical activities*
Mode 2: the value of *co-operative learning*
Mode 3: *creativity* in the learning of mathematics

Networking Theories (4)

- **<u>Model of Mathematics Understand</u>** (Pirie & Kieren, 1989)

- ‘don’t need’ boundaries
- ‘folding back’
- The complementaries of ‘acting and ‘experiencing’ that occur at each level of understanding