Lesson Plan on Modeling Propagation Phenomena

Roberto Araya
CIAE, Universidad de Chile y Ministerio de Educación

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Emergency Preparedness Education: Flood & Typhoon

Faculty of Education, Khon Kaen University

roberto.araya.schulz@gmail.com

Lesson Study

Title: Modeling Propagation Phenomena

Theme: modeling the domino effect

Objective: develop math model of domino effect

Strategy: USAB & Concrete→Pictorial→ Symbolic

Please name some propagation phenomena

5th graders & 8th graders

Examples

waves, heat, wind, shocks in chain reactions, earthquakes, avalanche, flood
concentrations, tea, pollution
contagion, genes, neuronal activity
inmigration, rumor, imitation, culture

Now classify

Physics
Chemistry
Biology
Social Sciences

Example

Domino effect in landslides, plate movement, floods

Modeling

Concrete Model → Pictorial Model → Math Model

USAB: Use – Select – Adjust - Build

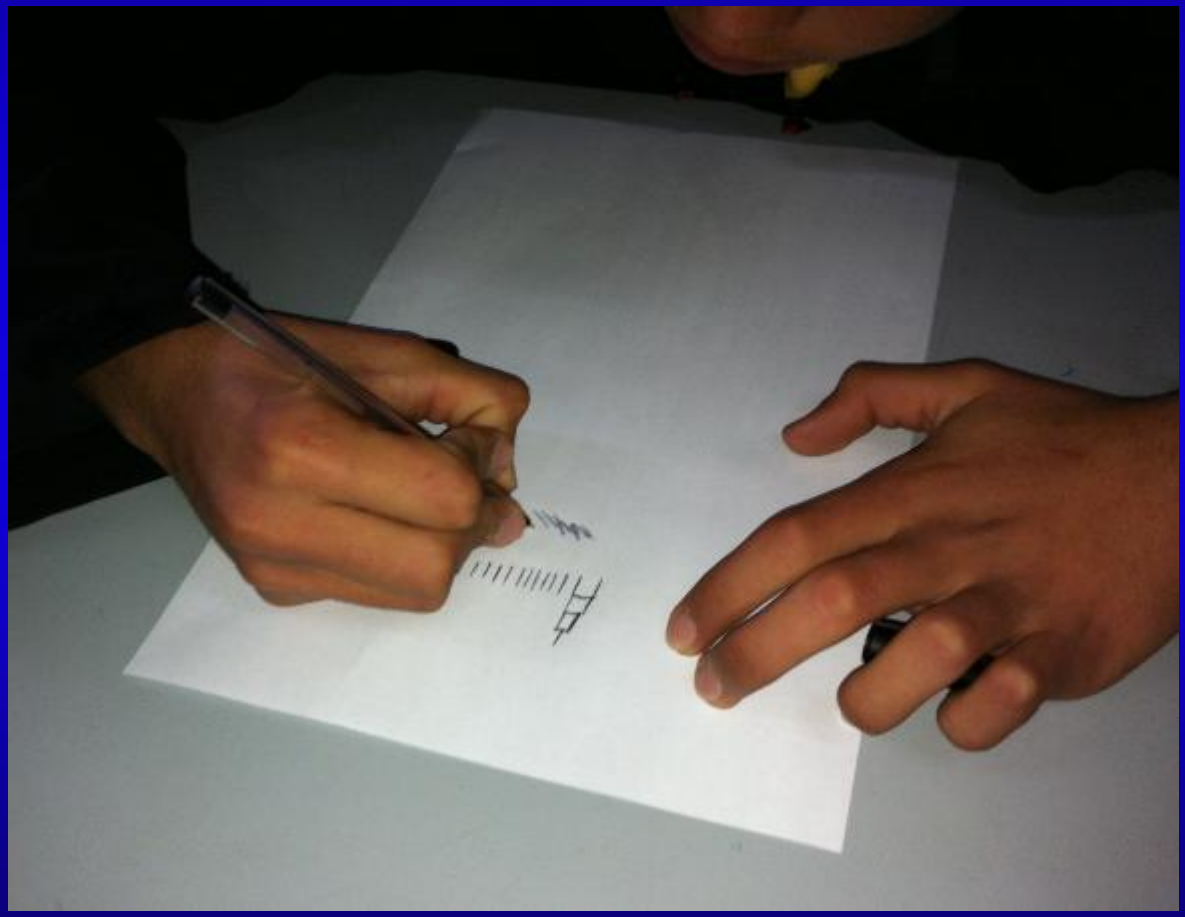
Concrete Model

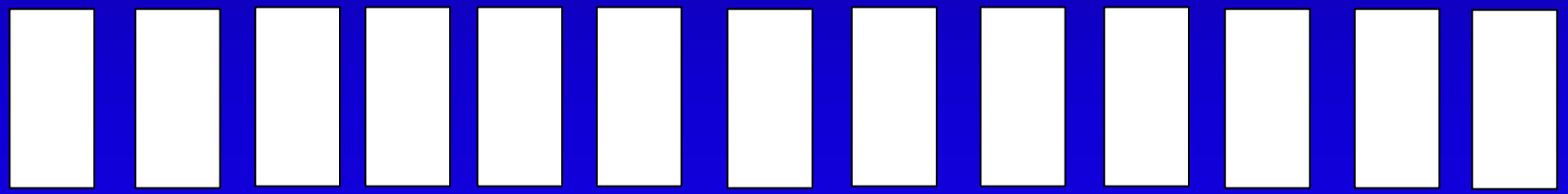
Concrete Model

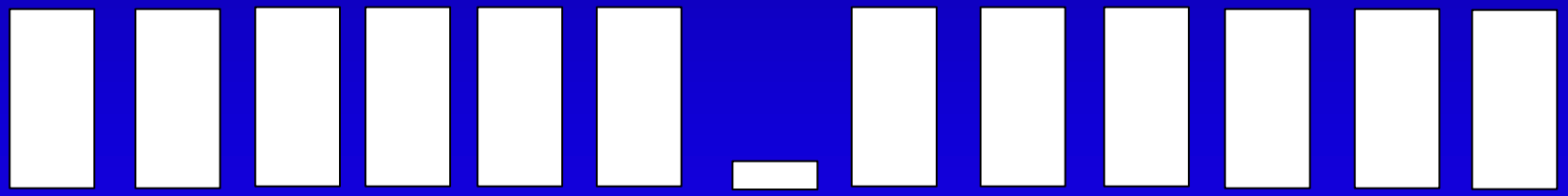
5th graders & 8th graders

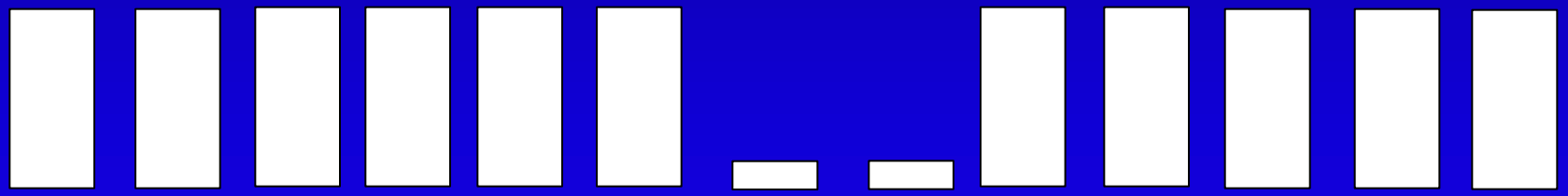
Simulations

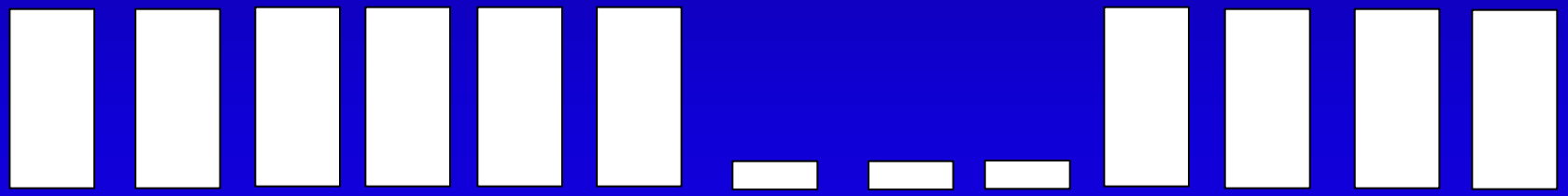
Pictorial representation

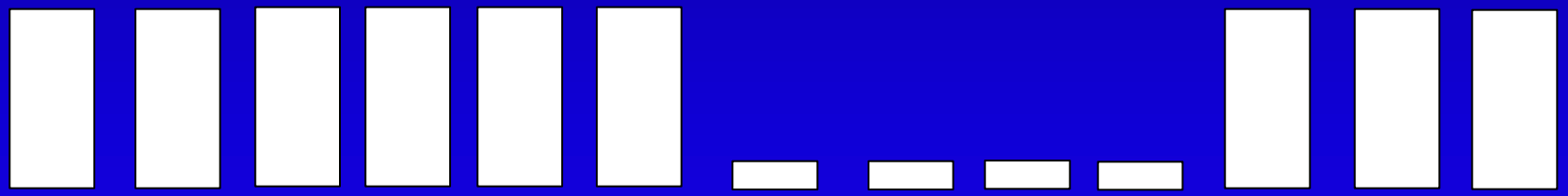


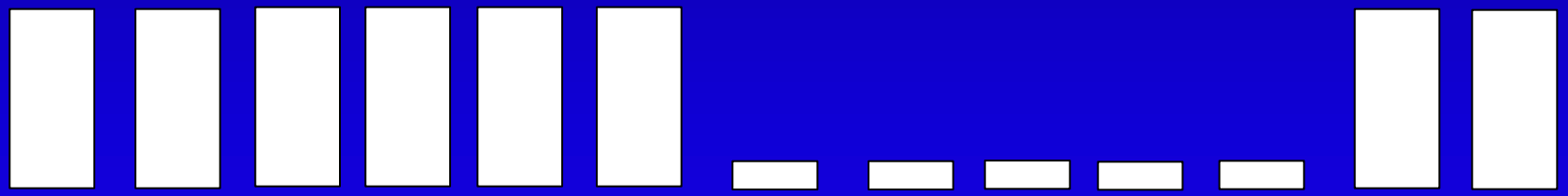


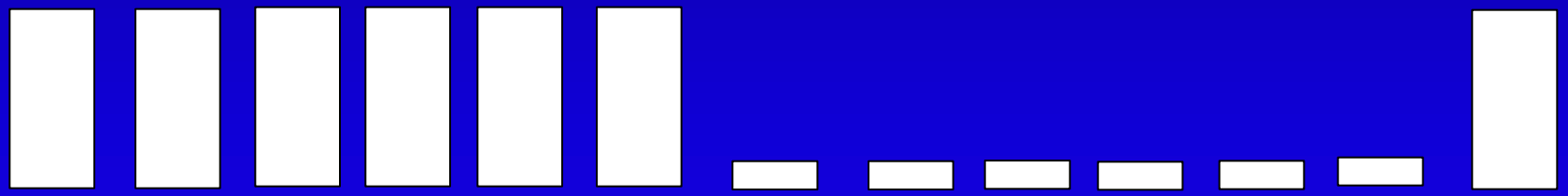


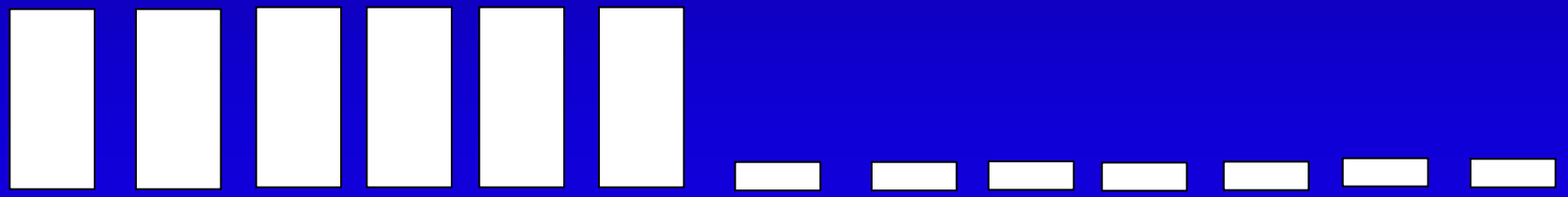




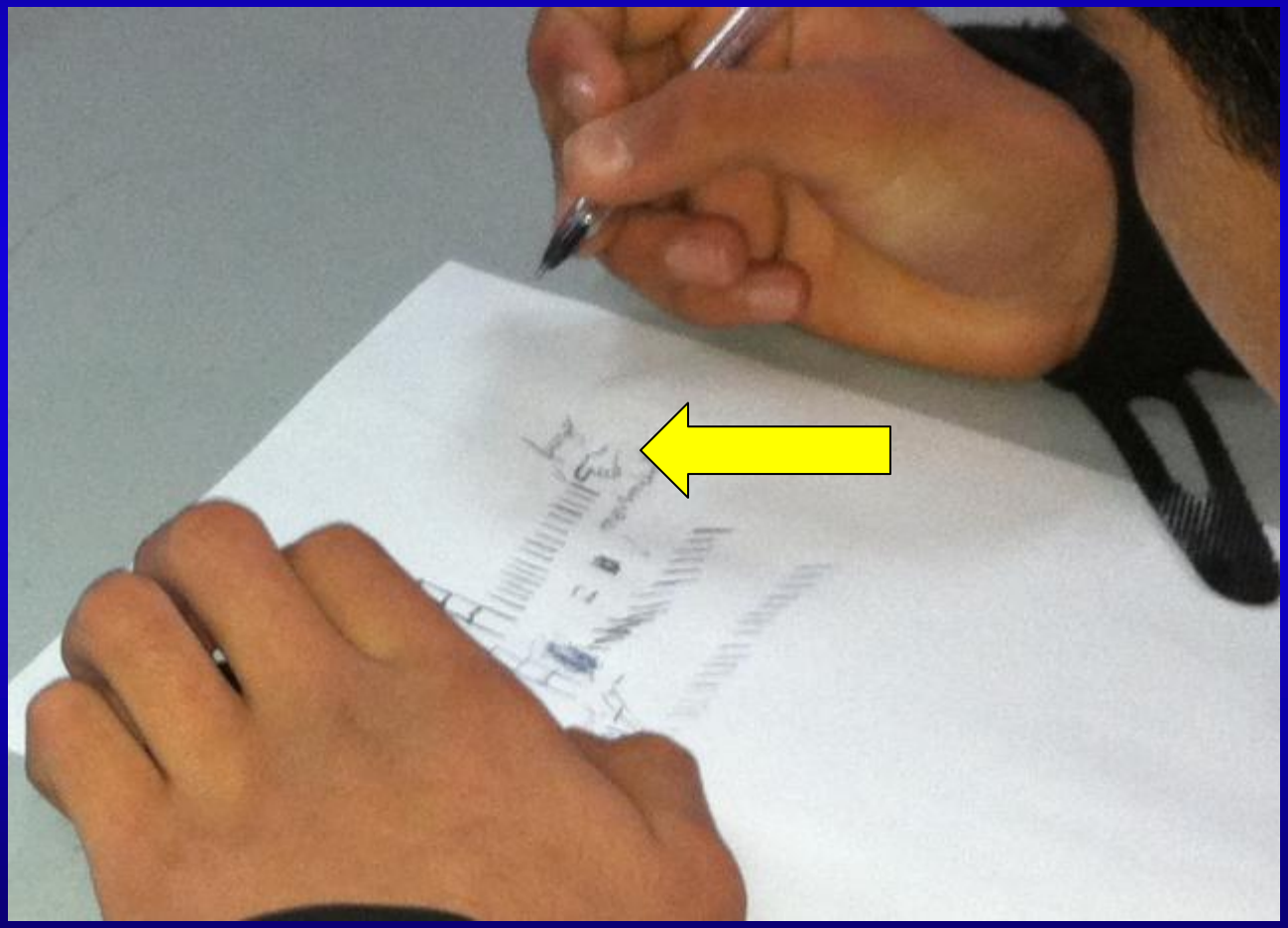








Concrete → Pictorial



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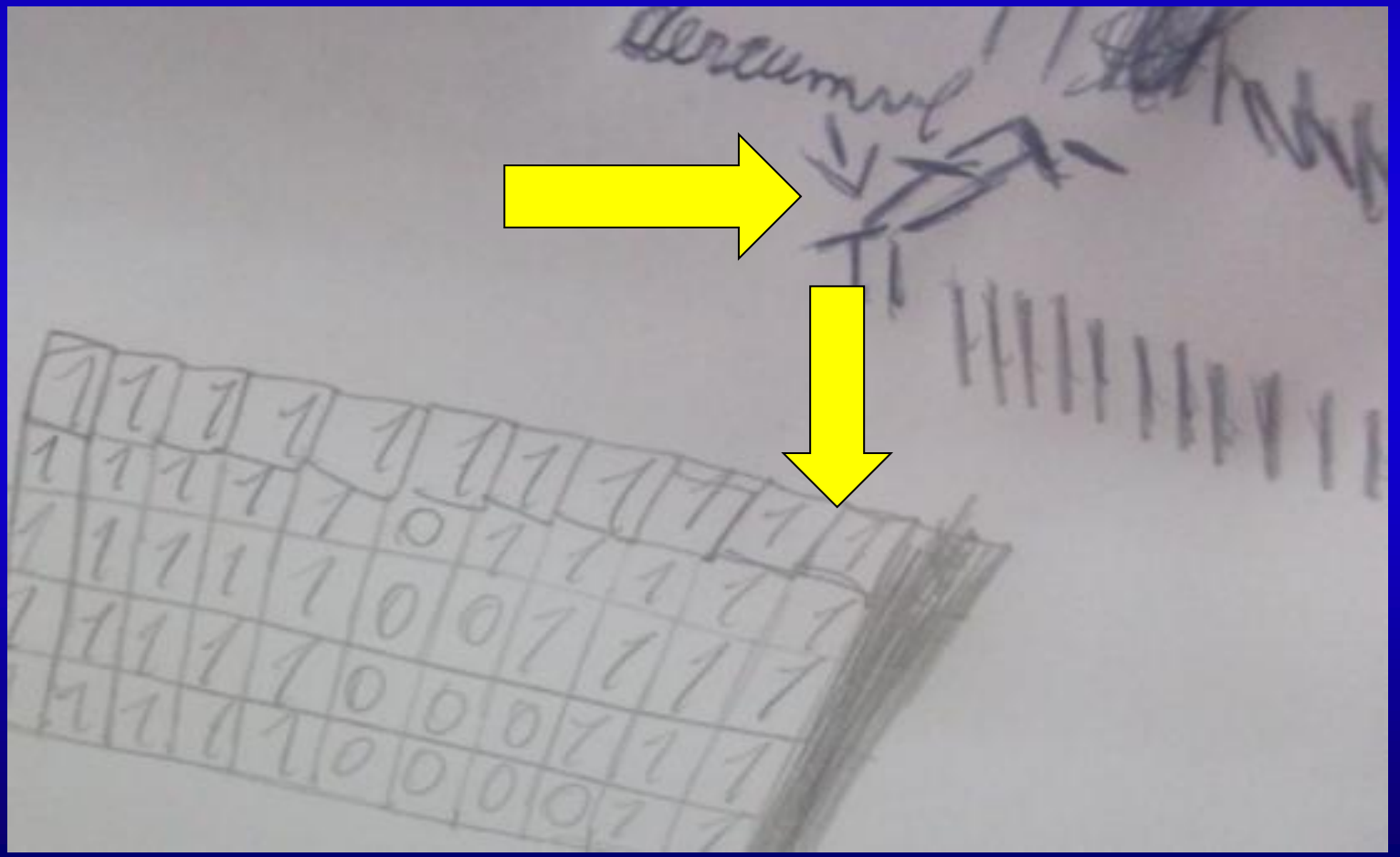
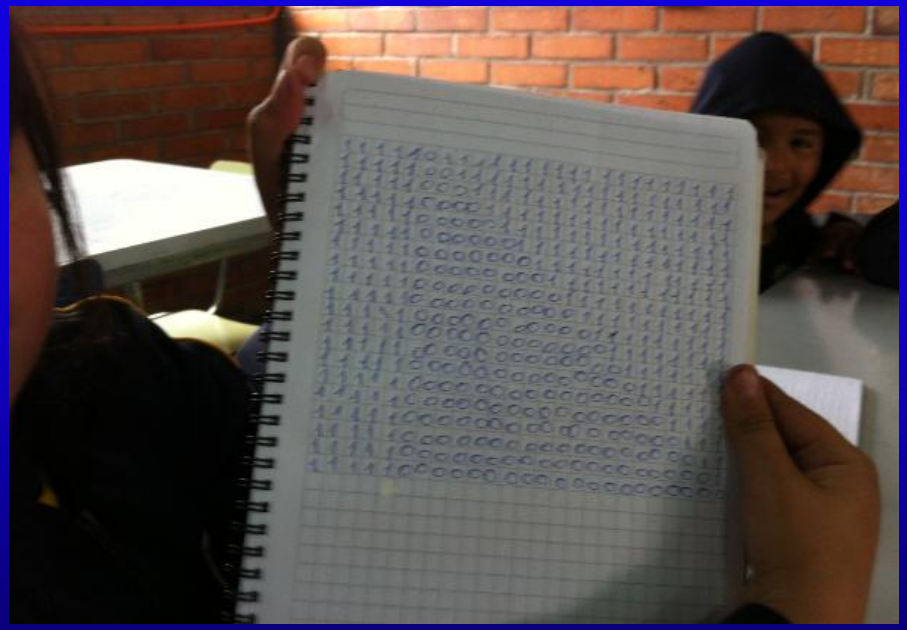
Concrete → Pictorial → Symbolic



Symbolic Model



Missing a mathematical mechanism that causes "1" to change to "0"

The

Mechanic Spreadsheet

The Mechanic Spreadsheet

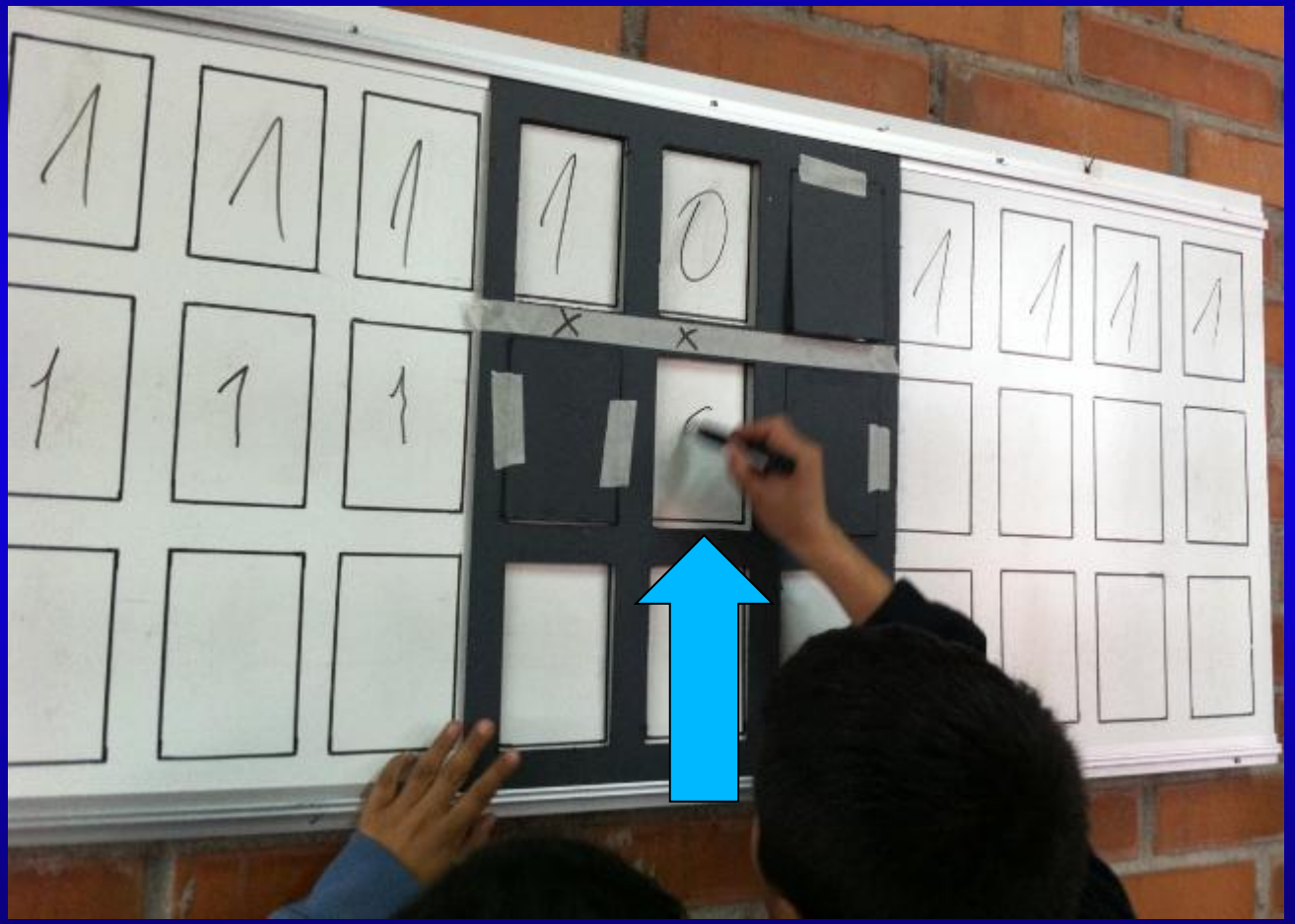
Modeling

USAB: Use – Select – Adjust – Build

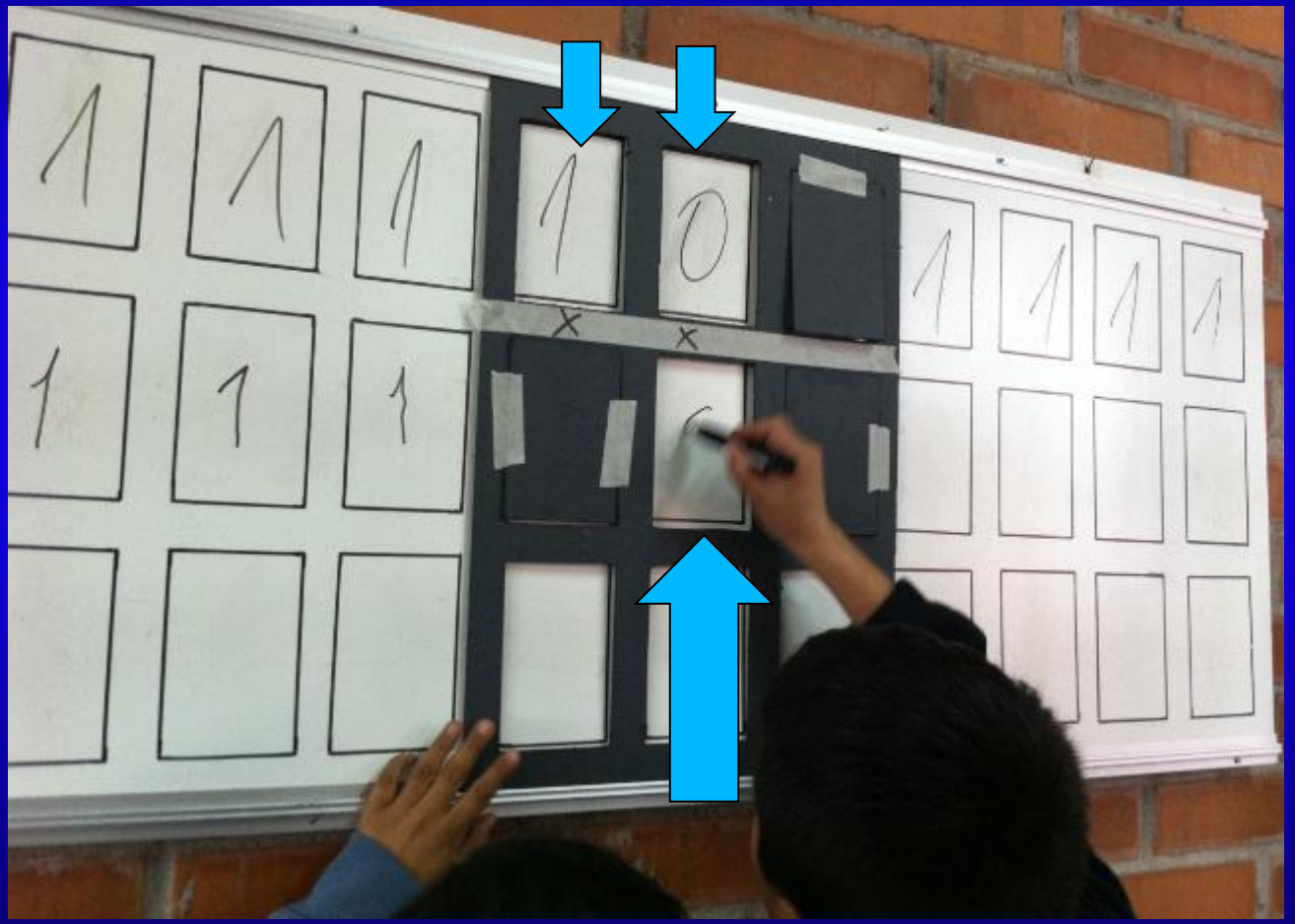
The Mechanic Spreadsheet

The Mechanic Spreadsheet

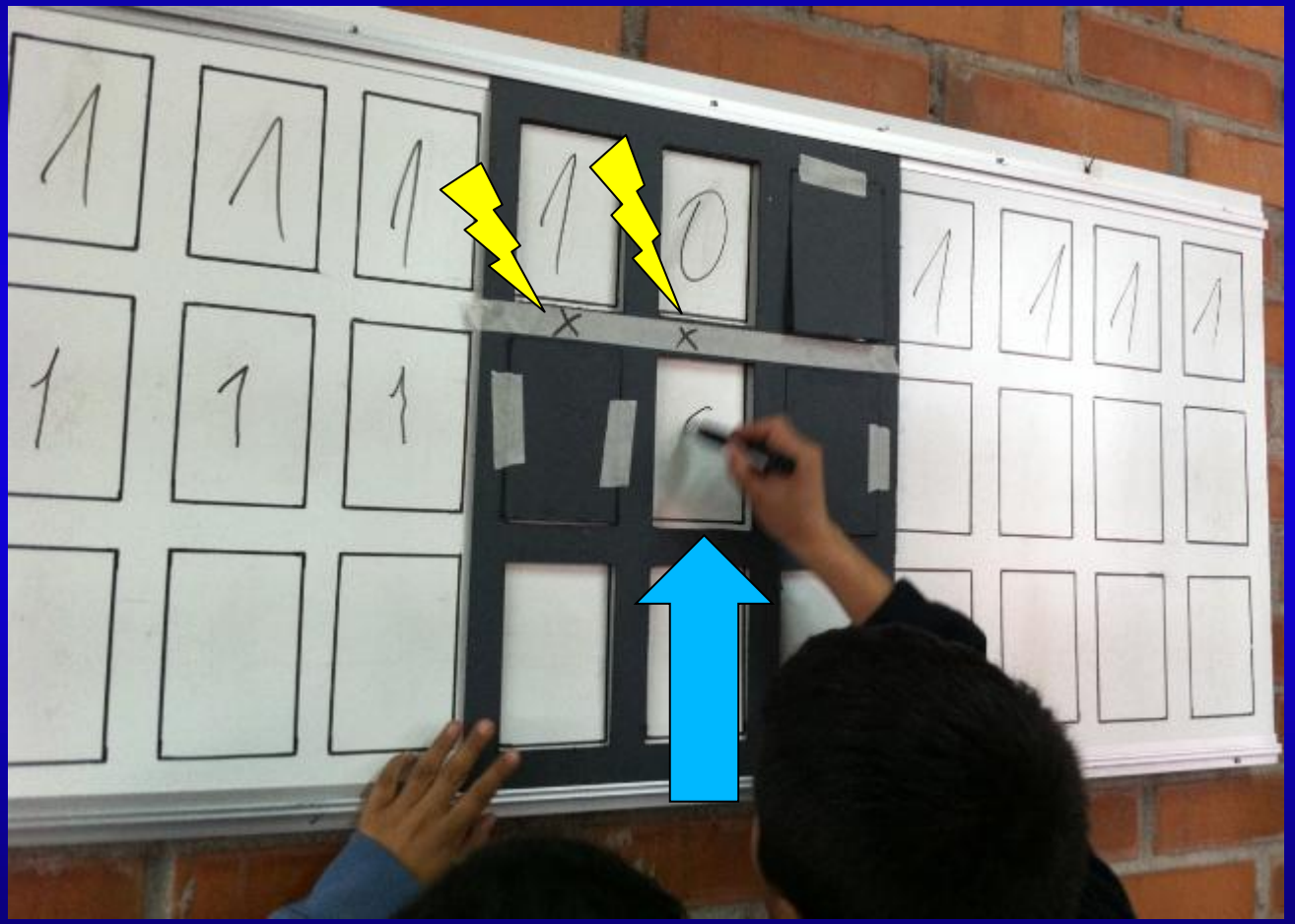
The Mechanic Spreadsheet



The Mechanic Spreadsheet



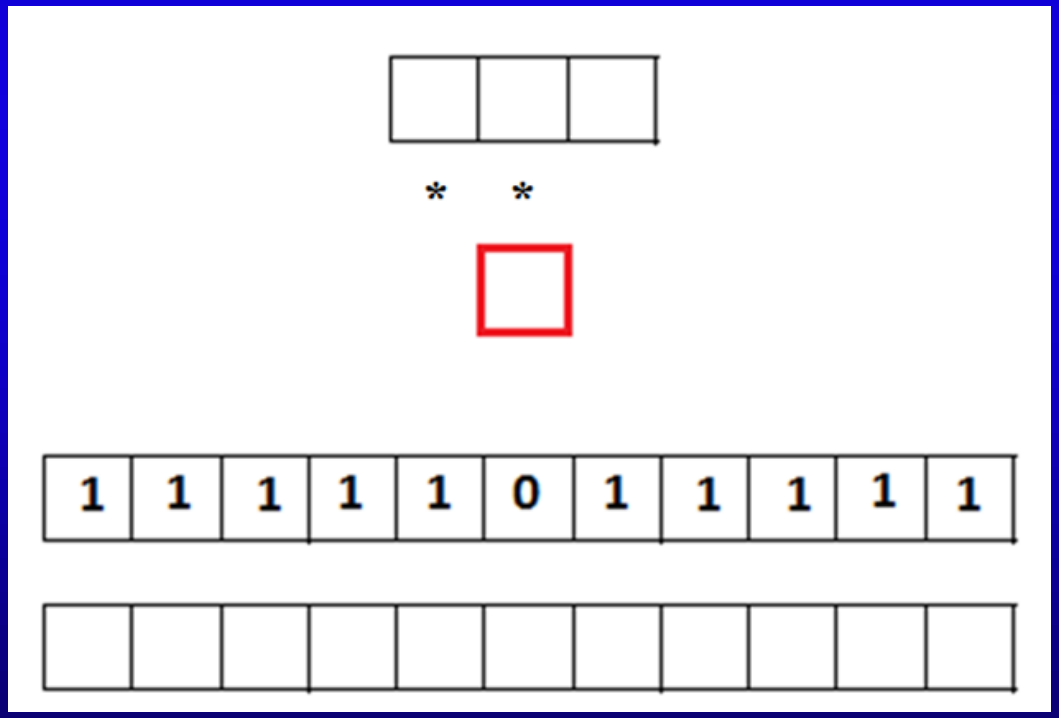
The Mechanic Spreadsheet



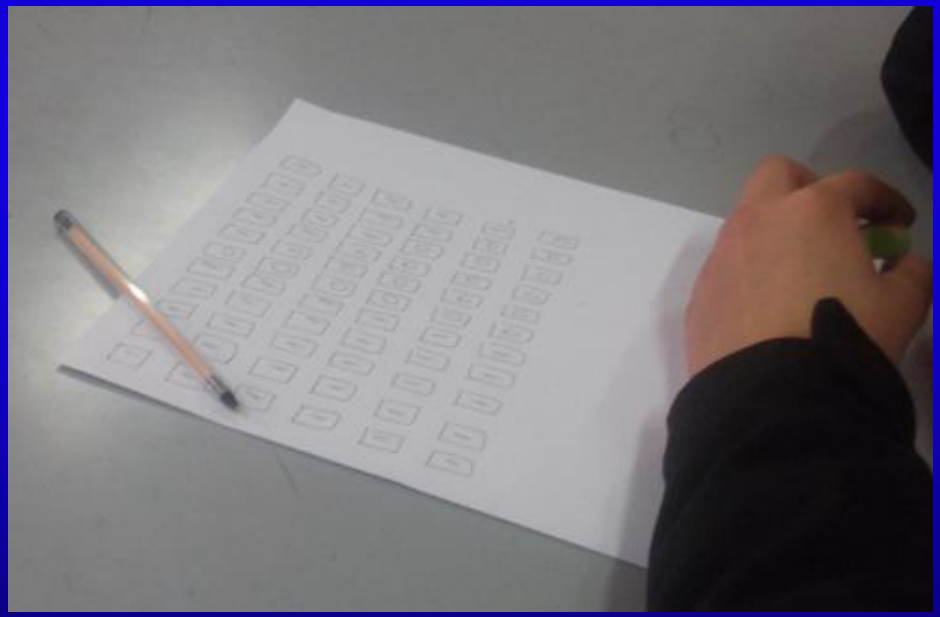
The Mechanic Spreadsheet

Math Model

Rule: *the value of any cell is the multiplication of its value in the previous instant with the value of its left neighbor cell in the previous instant.*



The Mechanic Spreadsheet



¡ Wow !

A local rule generates a global phenomenon

Modeling

USAB: Use – Select – Adjust – Build

How to generate propagation to the left?

1) Do it with the concrete model

2) Do it with the math model (What rule should you write in the mechanic spreadsheet?)

¡ Wow !

Different local rule generates different global phenomena

Modeling

USAB: Use – Select – Adjust – Build

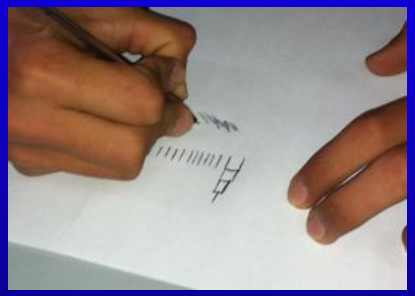
How to generate a propagation to the left and right simultaneously?

1) Do it with the concrete model

2) Do it with the math model (What rule should you write in the mechanic spreadsheet?)

Modeling

Concrete → Pictorial → Mathematical



1 1 1 1 0 1 1 1

Mechanic

Spreadsheet


+3


+3


+3

Climbing?

Continue climbing indefinitely?

… How about the other propagation phenomena?

Modeling

USAB: Use – Select – Adjust – Build

Next Lessons

Difussions

Oscilatory waves

Thank you

roberto.araya.schulz@gmail.com