A Teacher Workshop for Introducing Computational Thinking in Rural and Vulnerable Environments

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Comp. Thinking (CT) in Chile

- Population 17M, with 2M in K-8
- Since 2010, several initiatives to introduce kids to CT
  - National Informatics Olympiad
  - Informal workshops taught by universities, NGOs, etc.
- Challenges
  - Almost no training programs for school teachers
  - CT initiatives concentrated in urban areas
  - Growing digital divide, especially in vulnerable and rural populations

Our Workshop

- 12 hour workshop promoting computational thinking as a **tool to support student learning and improve engagement**
- Train all teachers and admin personnel at a K-8 rural and vulnerable school, with **no prior experience in programming**
- Workshop carried out after morning classes, using school's equipment (provided by a government agency)

Barriers to overcome

- Manage teacher expectations
  - CT does not automatically lead to greater student achievements
- Change teacher mindset/preconceptions
  - Enhance learning using CT and project-based learning (PBL)
  - Guide students in discovering tech, not become programmers

Workshop Goal

Explore whether teacher are able to plan and develop pedagogical projects that incorporate CT in their classrooms, using Scratch

Workshop sessions (total 12 hrs)

Day 1	Day 2	Day 3
Present concepts like CT and algorithms. Discuss strategies to achieve PBL.	Discuss sample projects. Ask groups to brainstorm project ideas.	Groups continue working on their projects.
Present Scratch: actors, basic events, variables and control structures.	Groups work on their projects in Scratch. We develop/show code snippets as needed.	Groups demo their projects, explain expected learning outcomes.

Research Questions

(**RQ1**) Was our workshop able to **change** teacher attitudes about using CT to develop pedagogical projects?

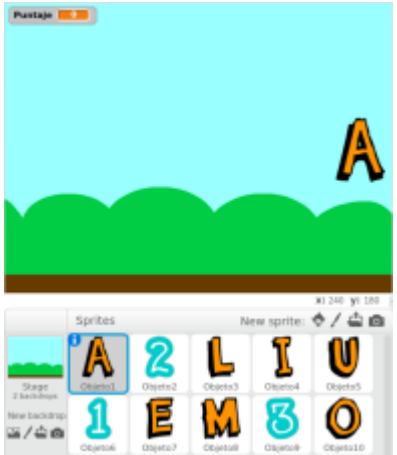
(**RQ2**) How do teachers envision using CT in **rural** and **vulnerable** classrooms?

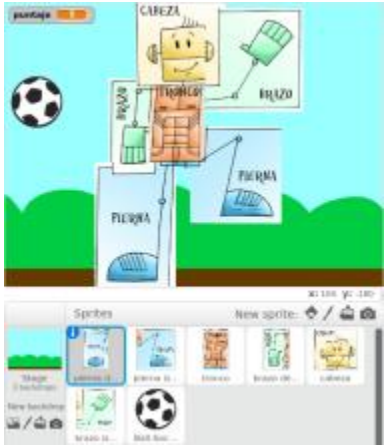
17 participants

- Male = 5, Female = 12
- Teachers = 14, Admin = 3

Teacher projects

5 simple games





2 stories

1) Differentiated educators
2) Spanish, English, Phys. Ed.
3) Math, Admin

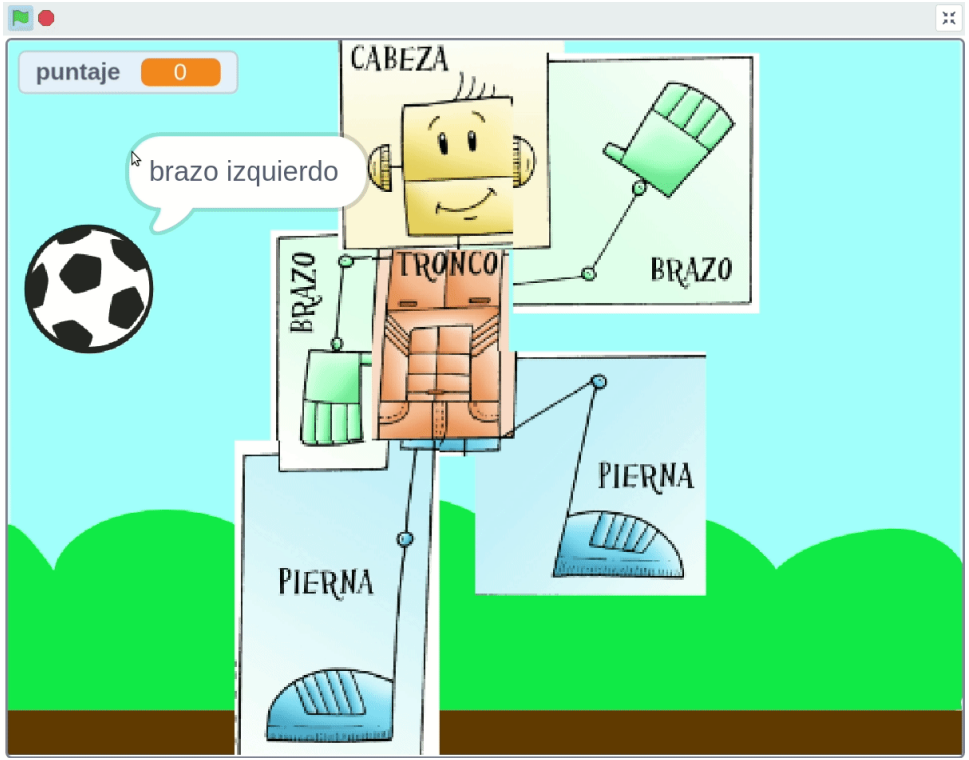
4) Spanish, Preschool
5) Math, Phys. Ed

6) Social Sciences
7) Preschool

Differentiated educators

Spanish + Preschool

Math + Phys. Ed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brazo izquierdo
CABEZA
BRAZO
TRONCO
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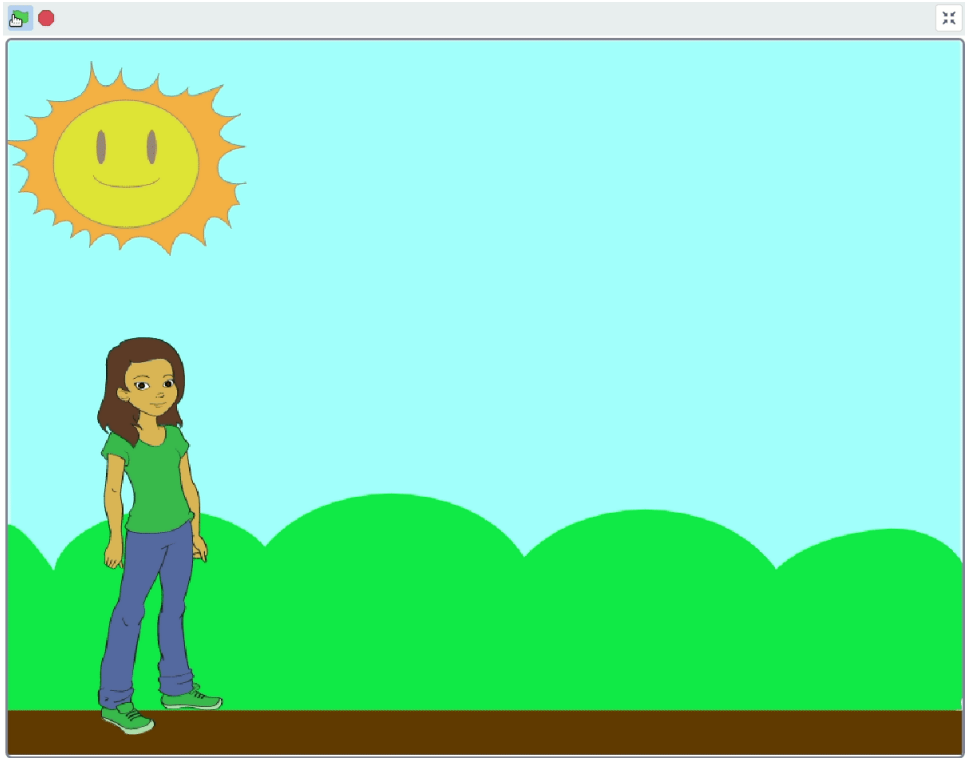
PIERNA
PIERNA

Preschool – plant cycle



Case Study Design [Yin 2013]

Data Sources

Information about participants

- Demographics
- Involvement, attitudes, and common errors during sessions
- Collected by workshop facilitators

Exit surveys [Choi 2013]

- Perceptions and reflections about technology and pedagogical aspects
- Prior exposure to computing classes

Workshop materials

- Slide decks
- Worksheets
- Sample projects

Projects created by teachers

- Source code (in Scratch)
- Oral presentation at the end of the workshop

Evaluation: Dr. Scratch

Automatic assessment tool, specifically tailored to measure computational thinking skills in Scratch project [Moreno et al. 2017]

- Flow control
- Data representation
- Abstraction and problem decomposition
- User interactivity
- Synchronization
- Parallelism
- Logical thinking

Evaluation Scores

Dimension	G1	G2	G3	G4	G5	G6	G7
Flow control	2	3	1	2	2	2	2
Data representation	2	2	1	1	2	3	1
Abstraction/decomposition	1	1	1	0	1	1	1
User interactivity	2	2	1	2	2	2	1
Synchronization	2	3	1	0	2	1	1
Parallelism	1	3	1	0	1	0	1
Logical thinking	0	3	0	2	2	3	0

Findings

RQ1: Changes in teacher attitudes?

Positive experience for teachers

Tech initially perceived as a “distraction”
- now believe that their students need to develop CT/programming skills

Also believe that they can transfer what they learned to their classrooms
- regardless of subject
- but with additional support

Some lingering feelings of insecurity/fear

RQ2: Envision using CT in rural and vulnerable classrooms?

Rural:
- close-knit community
- all teachers and admins participated
- we committed to travelling each day

Vulnerable:
- more differentiated educators
- no other discernable effect

Explain topics = animations
Explore topics = mini-games

Lessons Learned

1. Provide concrete examples of how CT can be incorporated into different subjects and levels
2. Provide follow-up sessions/material to introduce new concepts, project ideas, correct common errors, etc.
3. Unlikely subject and level pairings had positive results, as CT provides a common ground
4. Admin participation is key for community buy-in
5. Update teacher training programs so as to teach CT to all teachers

Take Away

1. Avoid too many guided programming exercises
2. Explain/show commands and code snippets as needed
3. Clear up common misconceptions/stereotypes about computing
4. Promote experimentation as a way of figuring out new commands, features

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Downloadable materials: http://bit.ly/scratch-profesores-dcc