



PISA Innovative Assessments of Learning Skills

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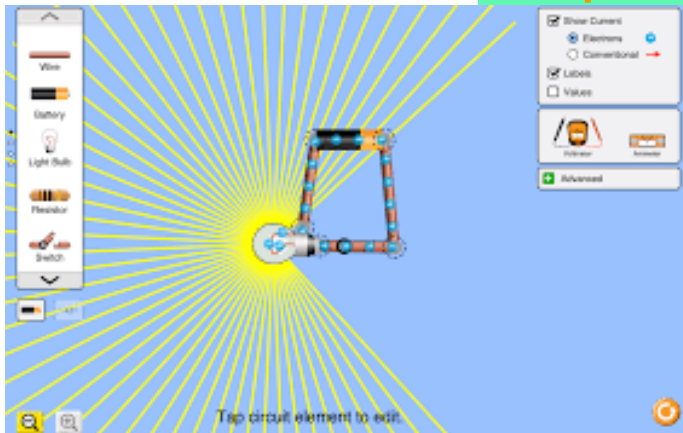
*Research Forum on Assessment and Education for the Future
Hong Kong, 17 November 2022*

The rise of digital learning

C O
D E

60 million students

PHET
INTERACTIVE SIMULATIONS™

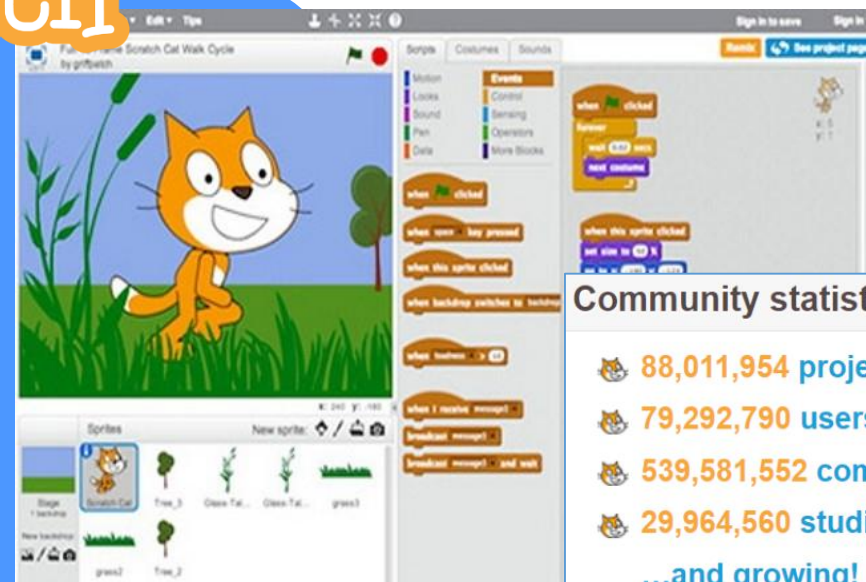


1 billion+
simulations
since 2002



170 million+
projects created

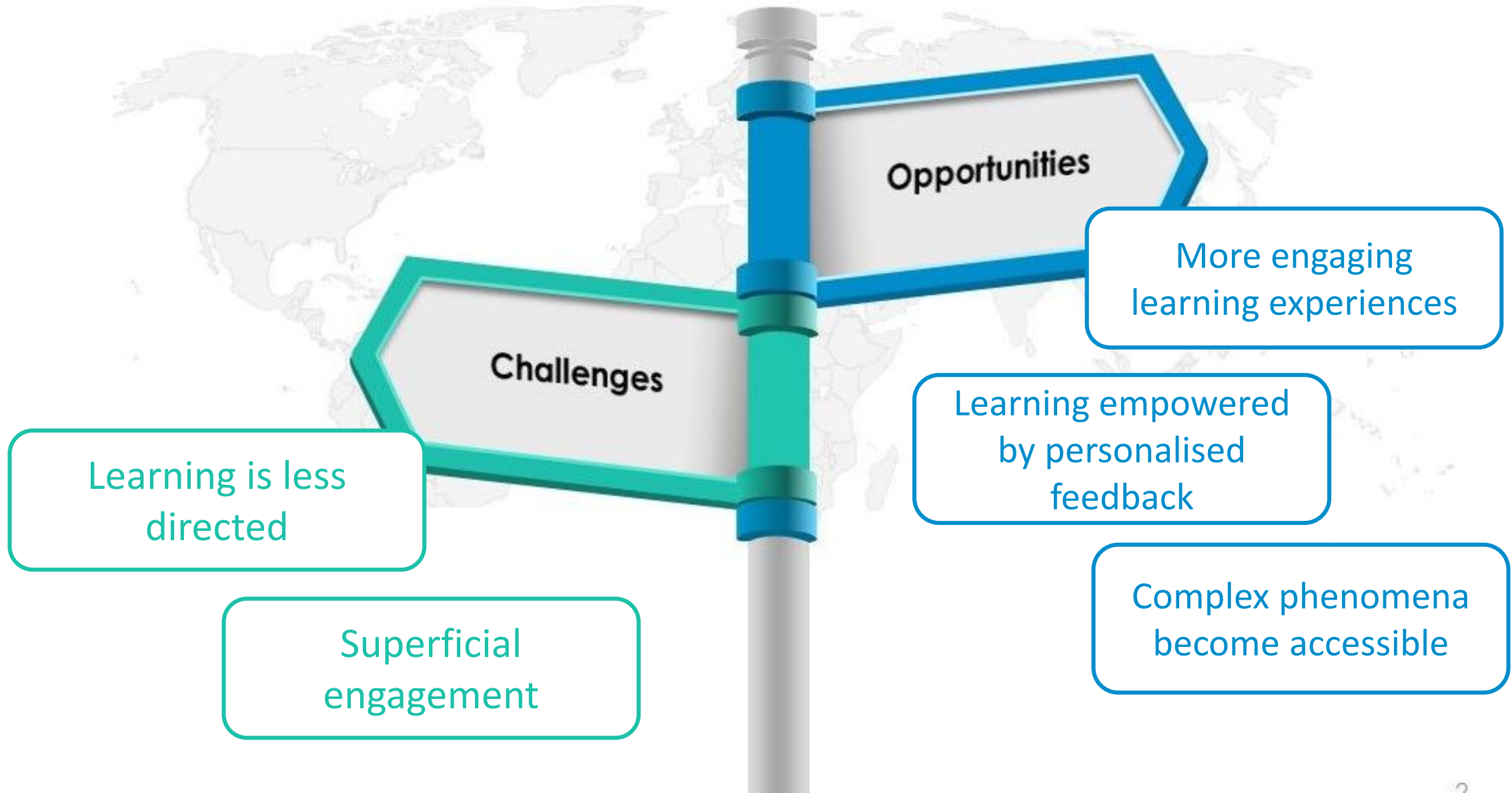
SCRATCH



Community statistics at a glance

- 88,011,954 projects shared,
 - 79,292,790 users registered,
 - 539,581,552 comments posted,
 - 29,964,560 studios created
- ...and growing!

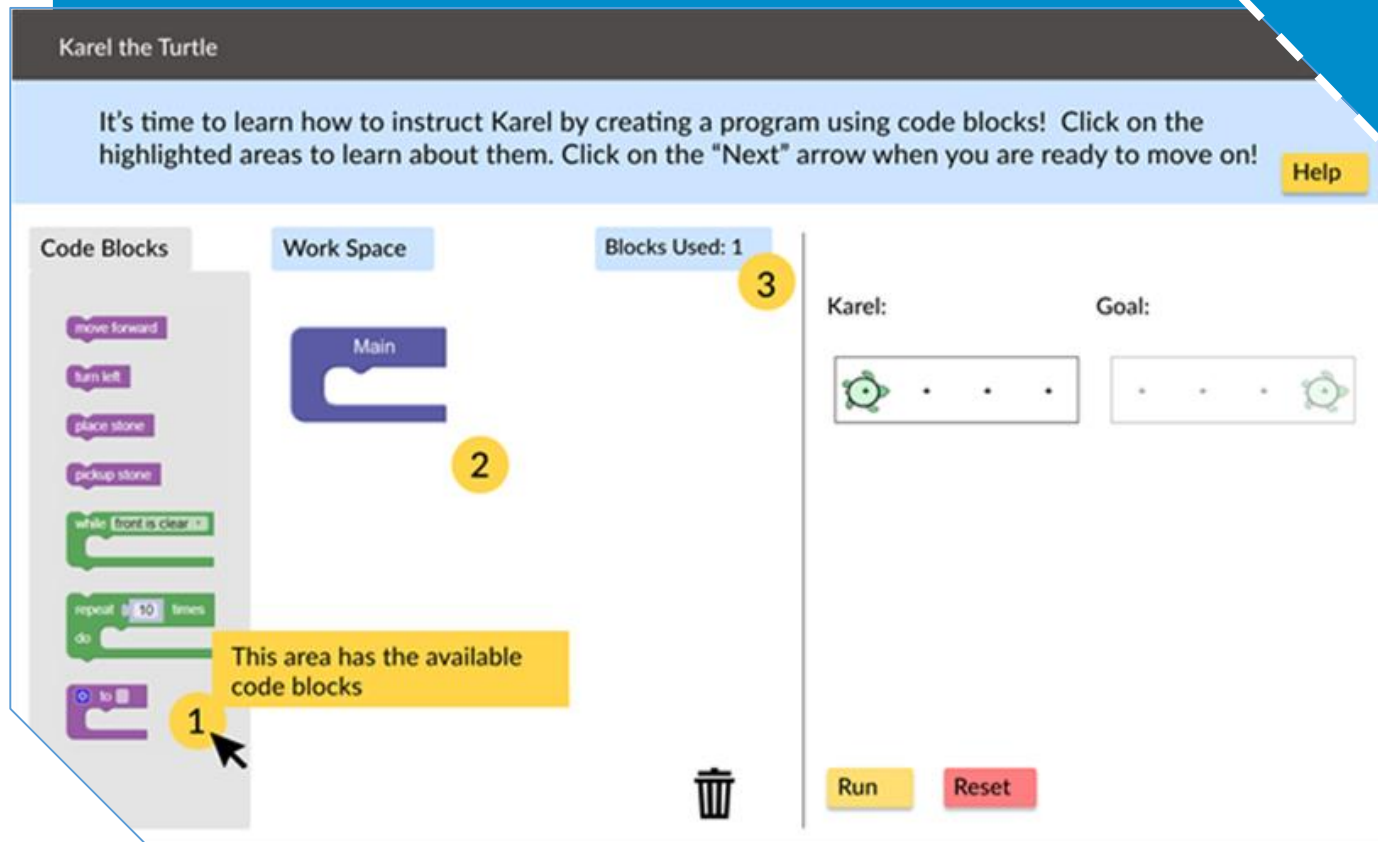
Challenges and opportunities of digital learning



What we aim to achieve in the PISA LDW assessment

Build realistic digital learning experiences with:

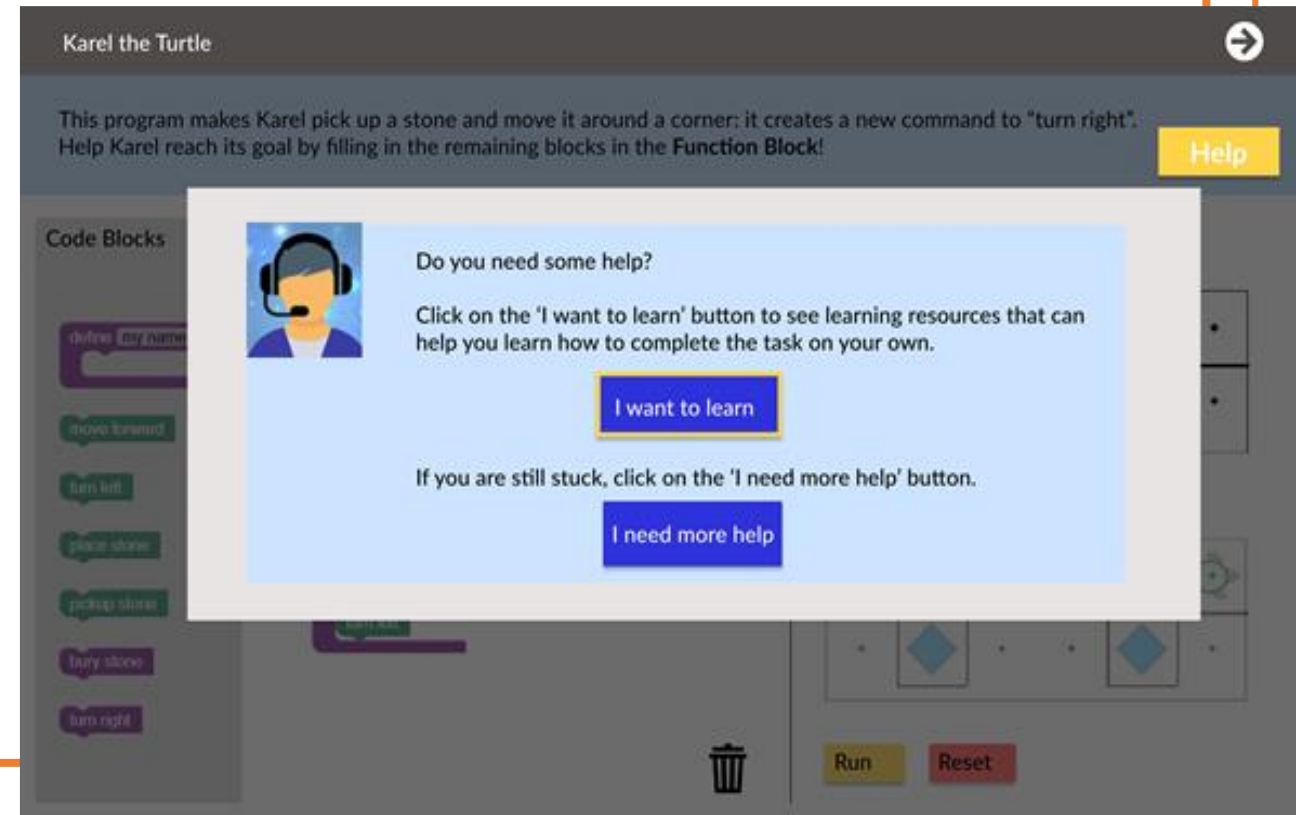
- An **engaging challenge** to solve
- Opportunities to learn** how to do it
- Intelligent feedback** on progress



What we aim to achieve in the PISA LDW assessment

Track students' work on the learning platform to assess:

- ❑ What **progress** students make on the learning challenge
- ❑ How well they use **learning resources** (worked examples, hints, and feedback)




Definition of Learning in the Digital World

“The capacity to engage in an iterative process of knowledge building and problem solving using computational tools. This capacity is demonstrated by effective self-regulated learning while applying computational and scientific inquiry practices”

COMPUTATIONAL and SCIENTIFIC INQUIRY PRACTICES

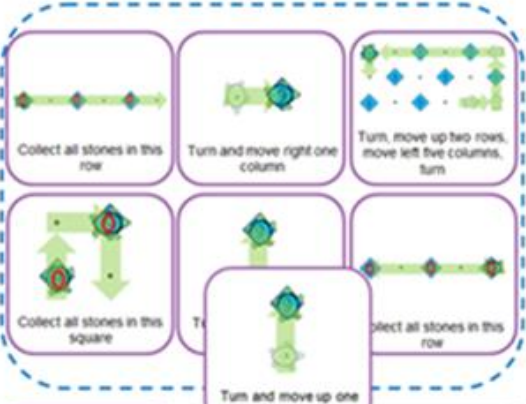
- Decompose problems and recognize patterns

METACOGNITIVE MONITORING and COGNITIVE REGULATION PROCESSES


Karel the Turtle 


Define the first SIX (6) steps you plan to follow when building your solution to the big challenge task. Select a solution step and drag and drop the steps into the order in which you will complete them. Any solution step can be used multiple times.


Solution Steps



Step 2 Step 3

Step 4 Step 5 Step 6 

Karel: 

Goal: 

Run Reset

COMPUTATIONAL and SCIENTIFIC INQUIRY PRACTICES

- Decompose problems and recognize patterns
- Conduct experiments and analyse data

METACOGNITIVE MONITORING and COGNITIVE REGULATION PROCESSES

I like that!

What is the relationship between a movie's release date and Mark's rating? Complete the sentence with the correct option: Alex's rating _____ if the movie has been released _____

Help

YouCompare

SHOW NEXT 6 CARDS

1

2

3

4

Rank: 2 4 1 3

Test

YouModel

Link

Characteristics:

- Movie length
- Reviews
- Price to rent

Release date

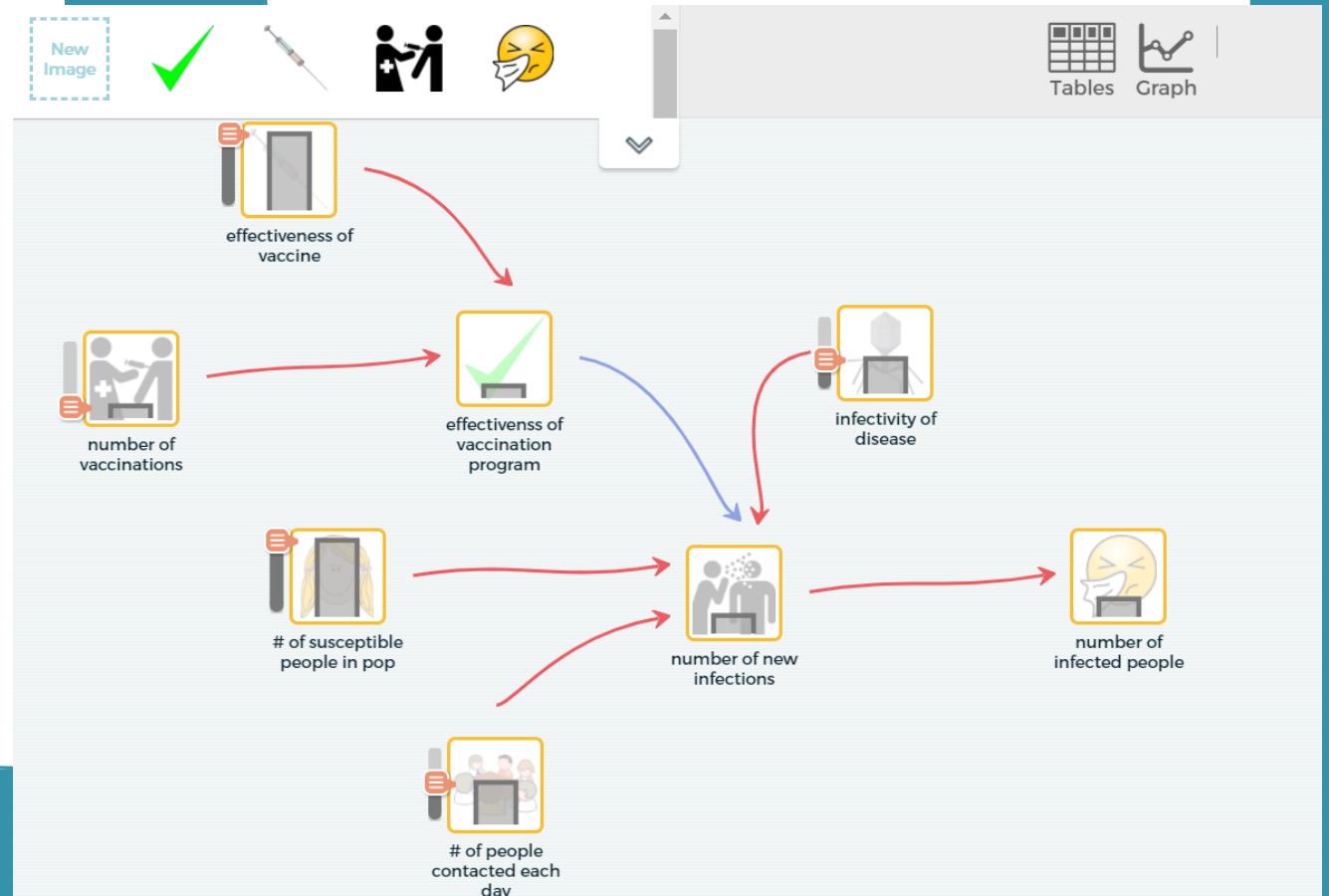
Rating

Check Model

COMPUTATIONAL and SCIENTIFIC INQUIRY PRACTICES

- Decompose problems and recognize patterns
- Conduct experiments and analyse data
- Build and debug computational artefact

METACOGNITIVE MONITORING and COGNITIVE REGULATION PROCESSES



COMPUTATIONAL and SCIENTIFIC INQUIRY PRACTICES

- Decompose problems and recognize patterns
- Conduct experiments and analyse data
- Build and debug computational artefact

METACOGNITIVE MONITORING and COGNITIVE REGULATION PROCESSES

- Monitor progress and adapt

Fitness app - Learning task 1 of 3 12:00

✓ Quiz ✓ Tutorial ● Learning tasks ☆ Big Challenge [Help](#) [Next](#)

Let's begin! The model shown has activities Weight lifting and Jumping but is not complete.
We need to find the relationship between **Weight lifting** and **Fitness**.
Conduct some experiments with the submarine...

Experiment lab

Plan	Weight lifting (hours per week)	Jumping (hours per week)	Fitness (points)
1	Amount	Amount	

[+ Add plans](#)

Conducting experiments

The table shows an experiment to find the relationship between skipping and Fitness.

	Activity 1 (hours per week)	Activity 2 (hours per week)	Fitness (points)
	1	2	20
+1 hour	2	2	30
+1 hour	3	2	40

We see that as the number of hours of skipping increases, the impact on Fitness increases.
because Jogging is unchanged (always 2) we conclude that the increase in Skipping has causes the increase in Fitness.

COMPUTATIONAL and SCIENTIFIC INQUIRY PRACTICES

- Decompose problems and recognize patterns
- Conduct experiments and analyse data

METACOGNITIVE MONITORING and COGNITIVE REGULATION PROCESSES

- Monitor progress and adapt
- Evaluate knowledge and performance

To what extent did you do the following in the Big Challenge? Complete the sentences below:

I submitted _____ (an optimal solution/a correct, but not optimal solution/an incorrect solution/ no solution)

I successfully used the tools and resources in the Big Challenge to help me make progress _____ (None of the time/Rarely/Several times/Every time)

COMPUTATIONAL and SCIENTIFIC INQUIRY PRACTICES

- Decompose problems and recognize patterns



You are about to start the Big Challenge at the science fair! I would like to know how you are feeling, before you start.

Select an emotion to show how you are feeling right now.

- Enjoyment 😊
- Anxious 😟
- Hopeful 😊
- Bored 😞
- Relaxed 😌
- Frustrated 😡
- Hopeless 😞

METACOGNITIVE MONITORING and COGNITIVE REGULATION PROCESSES

- Monitor progress and adapt
- Evaluate knowledge and performance

NON-COGNITIVE REGULATION PROCESSES

- Maintain task engagement
- Manage affective states

Task Sequence

30 minutes

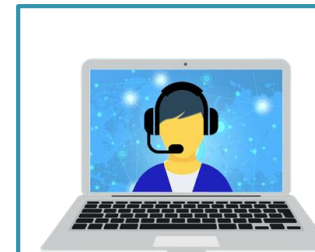
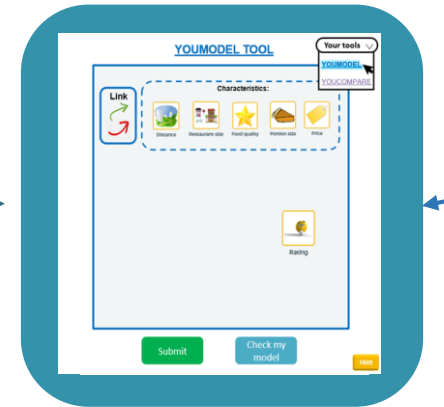
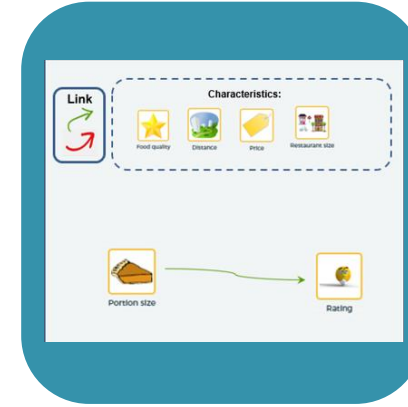
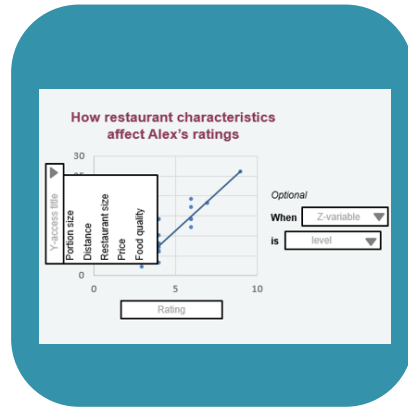
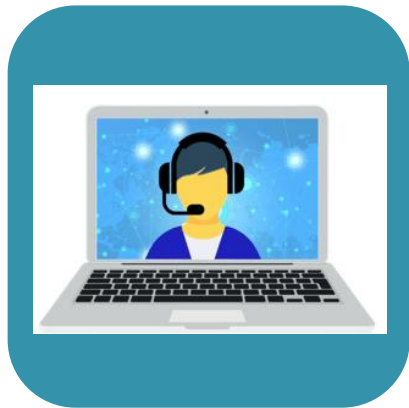
Introduction of overall learning goal

Evaluation of prior knowledge

Tutorial

Learning activities

Challenge



Hello again!

How confident do you feel in creating a new command to turn right [please select one]?

- Very confident
- Confident
- Moderately confident
- Slightly confident
- Not at all confident

Evidence-centered design in LDW

Evidence Rules



**Unit structure, tasks,
affordances & UI design**



Scoring and analysis

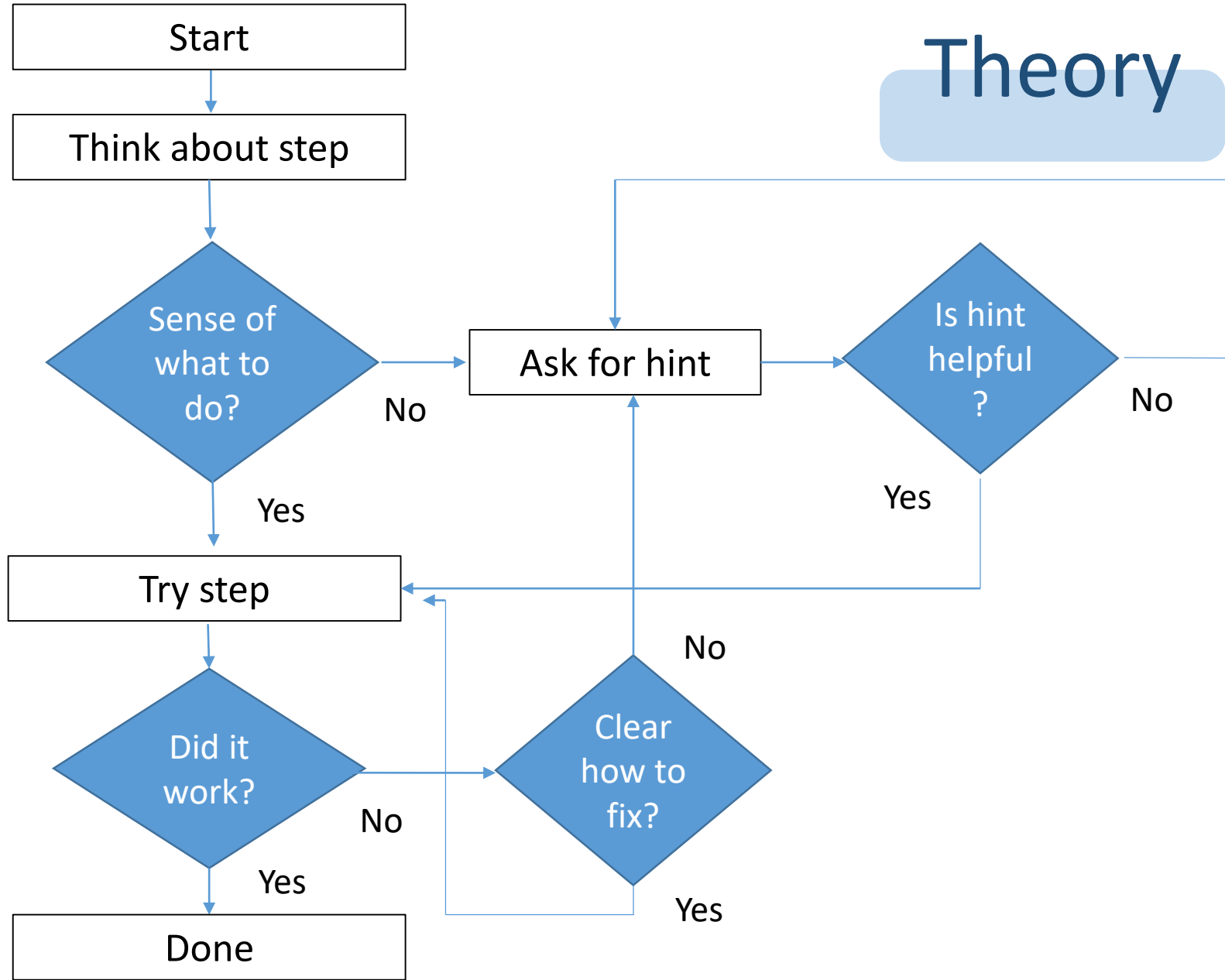
What kinds of behaviour are associated to different levels of mastery of each facet of the construct?

What task design and affordances do we use to elicit the desired behaviour and collect the necessary (process) data?

How do we convert observed actions into scores?

How do we aggregate data into reporting scales?

An example:
Identifying
effective help-
seeking



An example: Identifying effective help-seeking

Task & UI design

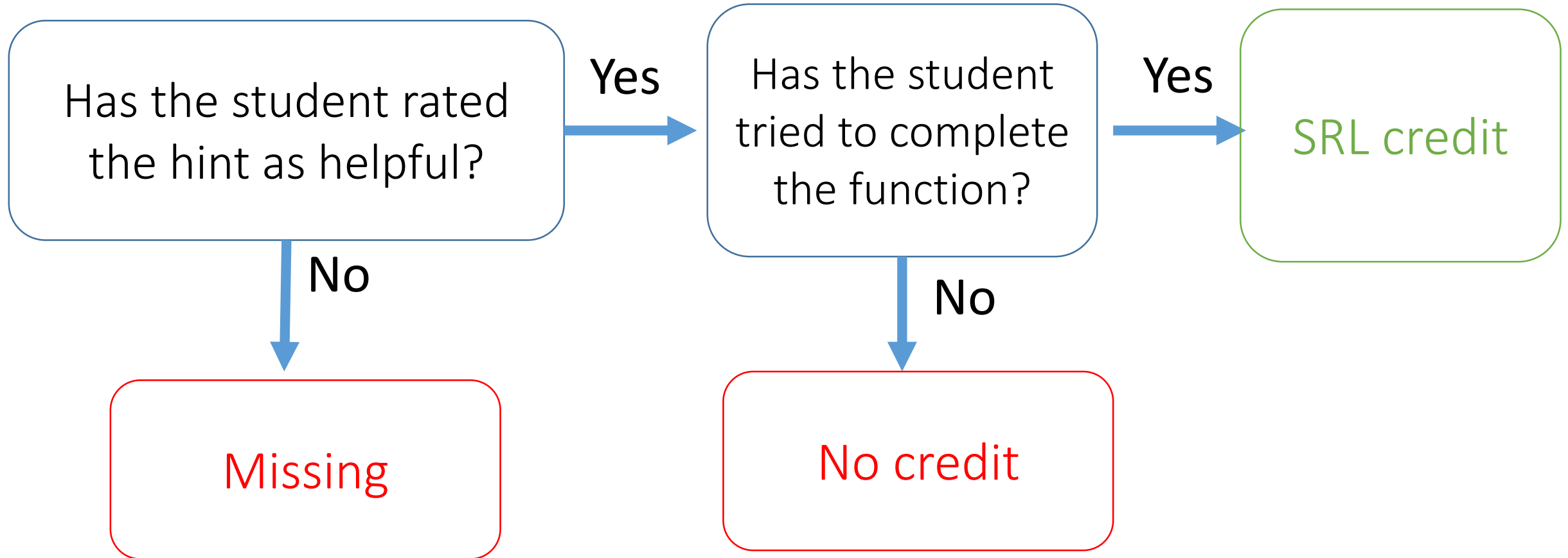
The image shows a programming environment interface. At the top left is a home icon. Below it are tabs for 'Challenge' (selected), 'Example' (checked), and 'Example' (crossed). A timer shows '02 : 21'. The main area is divided into three sections:

- Challenge:** A text box containing: "Challenge: This program has karel pick up a stone and creates a new command to "turn right". Fill in the missing BLOCK:"
- World:** A visual representation of a grid with a Karel character (a green robot) at the top left, a blue diamond (stone) at the top middle, and several holes (represented by '+' signs) in the grid.
- Code Editor:** A block-based code editor with three functions:
 - `define my name` (empty)
 - `define main` containing: `bury stone`, `move forward`, `bury stone`
 - `define turn right` containing: `turn left`, `turn left`, `turn left`
 - `define bury stone` (empty)

A white hint overlay is centered on the screen, featuring an information icon (i in a circle), the text "Hint 2 of 2", and the following text: "You only need to complete the function "bury stone" so Karel picks up each stone on top and buries it in the succeeding hole. Find the right sequence of blocks by testing the code often." At the bottom of the hint are two buttons: "This is useful!" (blue) and "That's not useful" (red).

An example:
Identifying effective help-seeking

Scoring
rules



Multi-dimensional reporting

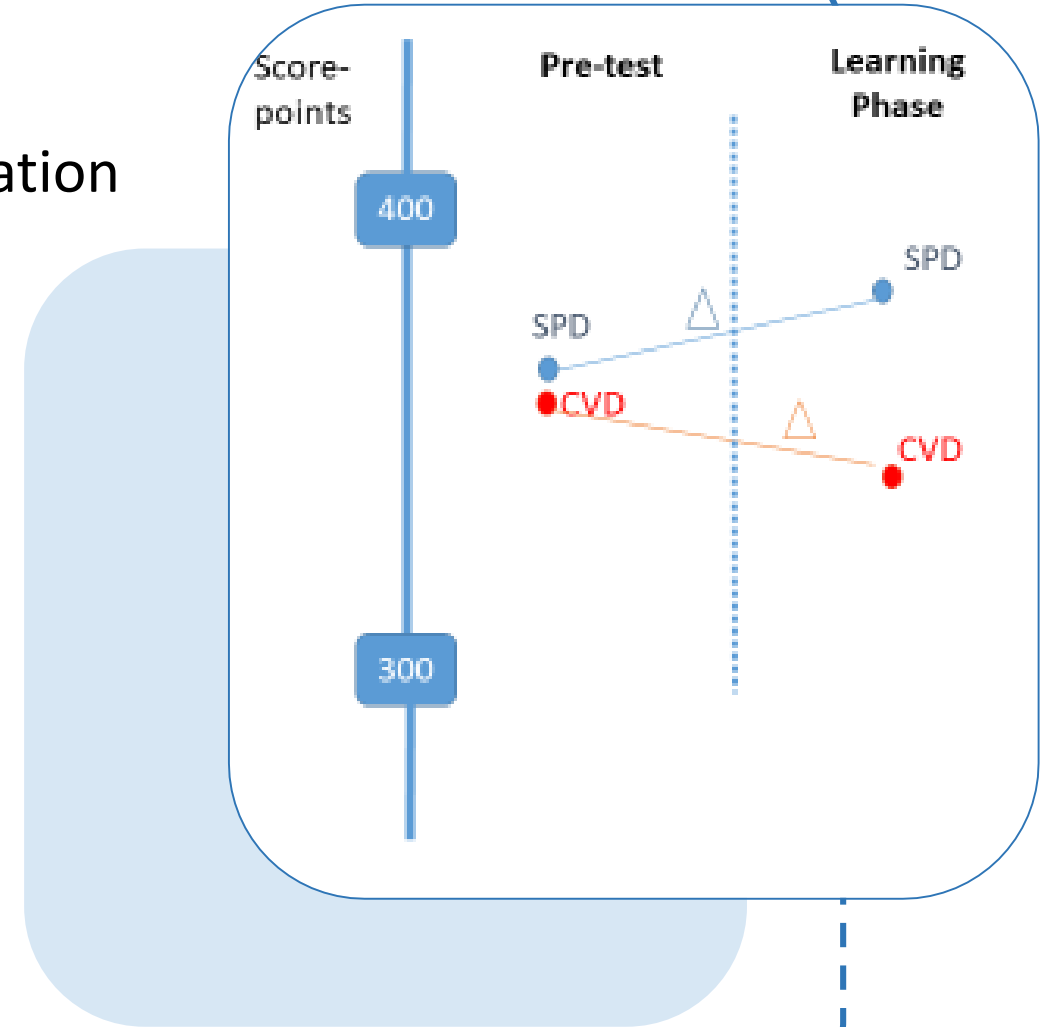
□ Two reporting scales

- Computational & Scientific Inquiry
- Metacognitive monitoring and cognitive regulation

□ Measure of learning gains

□ Profiling of learners

- Level of engagement
- Affective states during learning
- Strategies and coherence in challenge tasks



Validation activities

Cognitive Laboratories

2021/22

7 countries

(AUS, BUL, CHL, COL, SPN, NOR, US)

- Small scale
- Qualitative orientation
- Used to refine the units (problem formulation and UI) in preparation for pilot studies

Eye-tracking study

2022

Germany

- Small-scale
- Qualitative orientation
- Used to refine the units, validate quality and appropriateness of SRL resources and evidence rules, and identify disengaged behaviours

Pilot Studies

2022/23

5 countries (AUS, BUL, CHL, NOR, COL)

National add-on study (Germany)

- Quantitative evaluation of unit quality
- Investigate:
 - Structure and dimensionality of construct
 - Relationship between item scores and different kinds of process data



From PISA to the Classroom: The Platform for Innovative Learning Assessment (PILA)

• What is PILA?

The **Platform for Innovative Learning Assessments** is a **free digital formative** tool that provides **engaging tasks** to support students' development of 21st Century skills

PILA is growing and improving through **co-design** with international group of teachers and students

PILA is and will remain **open-source**, to empower collaborative EdTech development and assessment research



Here is a sneak-peek: Learning & Assessment applications



Karel the Turtle

Functions 1 Task

Challenge Good Example Bad Example

Challenge: This program teaches Karel a new command by defining a new function called "turn around."

Start:

Goal:

```
define main
  move forward
  place stone
  turn around
  move forward
  turn around

to turn around
  turn left
  turn left
```

Play Speed: (slow) (fast)

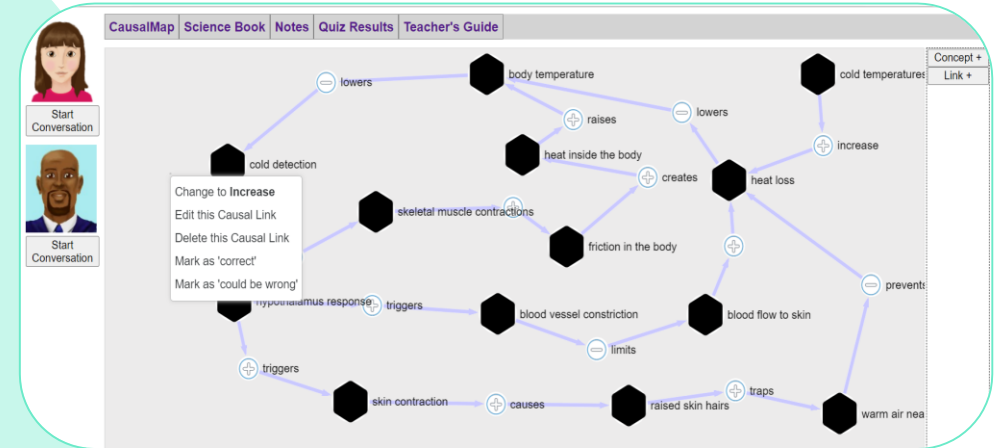
play

Karel the Turtle:

Help Karel navigate the world by building programs with block-based coding

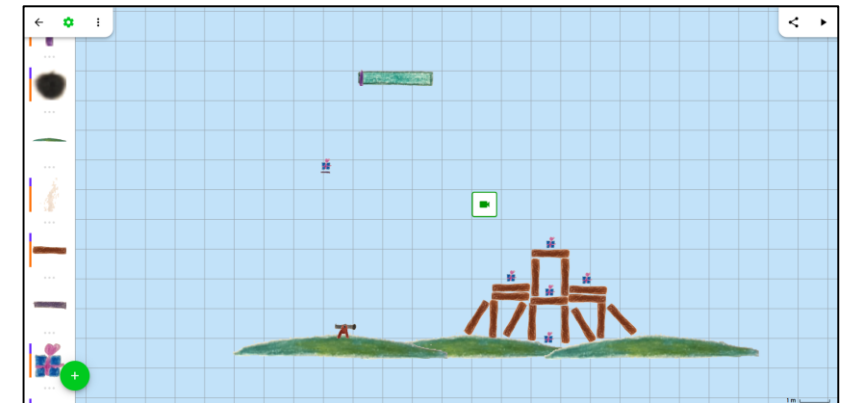


Betty's Brain



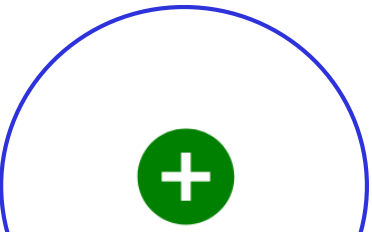
Betty's Brain

Teach Betty about complex phenomena by building a conceptual map



Cand.li:

Use your imagination and create your own videogames!



New Task

Karel the Turtle

Start: Goal:

Parson's Problem
Basic Toolbox

Karel Cleans Up

Start: Goal:

Karel Turns Left

Start: Goal:

Here is a sneak-peek: Customization tools

Start World: Goal World:

Basic | Toolbox | Tags

Task Name:

Instructions:
Karel is a turtle. Press the "play" button and watch Karel spin around

Rows: Cols:

Hint: (optional)
Hint goes here...

Basic | Toolbox | Tags

Available Blocks:

- Move Forward Limit
- Turn Left Limit
- Place Stone Limit
- Pickup Stone Limit

Other Settings:

- Limit Total
- Hide Toolbox
- Disable Workspace



Questions?

Contact us to participate

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pilaproject.org