



Situated
learning with
Bebras tasklets

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The project

Process and
products

Situated learning with Bebras tasklets

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The Bebras Challenge



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- International Challenge on Informatics and Computational Thinking (<https://www.bebbras.org/>)
- A non competitive contest
- Every year, almost 3 million students (56 countries in 2019)
- Each country customizes the contest to match local school constraints
- In Italy (<https://bebras.it/>): team based (≤ 4), 36.018 teams in 2016-2018, 5 categories, from 4th to 13th grade.

- **Informatics not taught, as subject**, in (non-vocational) Italian schools (at least not as a science).
- Bebras focuses on the part of Informatics that could be useful/fascinating for everyone: **computational thinking**.
- **Bebras** a **valuable resource** to
 - build / strengthen the association Informatics - scientific discipline
 - promote CT skills
 - foster soft skills



Premise



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- **Observations:**

- **During** the Bebras challenge, **pupils are engaged** in solving tasks, thus developing CT and soft skills
- **After** the challenge, curiosity for knowing **whether their solution was right or wrong** prevails over further investigation through the explanations and “It’informatics”

- **Goal:** engage pupils in **further exploring** the tasks’ informatics and CT concepts.
How?

- **Proposal: Situated learning** — turn tasks into unplugged games to **train younger pupils**

Isole e ponti (2 punti)

Nell'arcipelago di Kastoria c'è una regola molto semplice: si costruisce un ponte tra due isole solo se la somma delle loro popolazioni è maggiore di un numero prefissato scelto dalla Regina di Kastoria.

I numeri nella figura indicano le popolazioni di ogni isola.

Che numero ha scelto la Regina?

Staff - quality - Punteggio: 2 / 2

The context

A **6th grade class** (age 11 years) of a publicly-funded school:

- 22 pupils
- Bebras challenge in the first term
- some work in groups to check their answers and study the explanations
- two-hour weekly session for mildly structured activities devoted to the development of cross competencies
- their math and science teacher (author Martina Palazzolo)
- second term (January-May) of s.y. 2018/19



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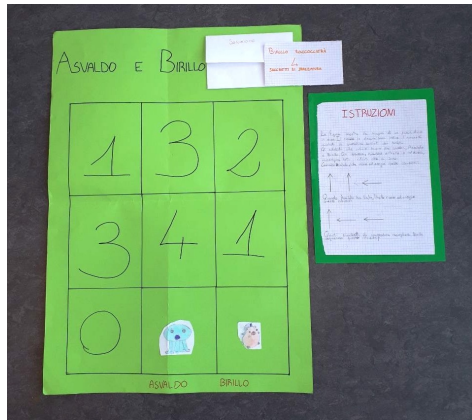
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Two phases:

- **Transposition of tasks into unplugged games**
- **Training sessions**

The activities - Preparation of the games

- in pairs
- choose a Bebras task
- design its transposition into a tangible game
- build the game (with cardboard, etc.)



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The activities - Preparation of the games

Requirements:

- training of younger **without the platform**
- with a Bebras task that had posed **difficulties**
- variations allowed, but the tasks' **original goals must be preserved**
- the **title, text, and question** should be clearly readable
- the game should be **self-explanatory** and have all the elements necessary to solve it
- equipped with an envelope containing **the correct answer**
- autonomously usable by peers
- **accessible** for the younger pupils

Some help or further explanation by the trainers was **allowed**

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The activities - Training sessions



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- Trainees: a **3rd grade** class
- two training sessions,
- all games offered in both
- report after each training: how did it go? adjustments needed?

The activities - An external observer



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Mentor and supervisor:

- computing education expert (author Violetta Lonati)
- member of the Italian Bebras Committee
- supported the teacher in relation to the computational thinking aspects
- helped her monitor the critical aspects

The learning goals - computational thinking skills



Goal: improve in the **computational thinking skills** (CT) implied by Bebras tasks (by the chosen one).

In particular the focus was on:

- **Represent** — representing information through abstraction such as models, diagrams, symbolic encodings and understanding such representations;
- **Algo_think** — automating tasks through algorithmic thinking (i.e., series of ordered steps);
- **Implement** — implementing algorithmic solutions complying with some predefined syntax (*i.e.*, *coding*);
- **Organize** — logically organizing data;
- **Reason** — analytically reasoning about data, objects, situations to check properties and draw logical conclusions.

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The learning goals - soft skills



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The project also aimed at promoting **soft skills** like:

- **learning to learn**;
- **collaborating** with peers towards a common goal;
- **adapting** language and communicative style to engage with younger mates;
- devising and **designing** a tangible object, and planning its creation;
- practically **producing** a tangible object by identifying, getting and using the proper materials and techniques



During the whole project:

- **Costructivist learning**: teacher as facilitator
- Importance of interaction, use of language, feedback (**socio-constructivism**)
- **Constraints** to promote the expected learning outcomes
- **Randomly drawn pairs**

The methodology



The Teacher designed the activities in a **CSSC learning environment**

- **Constructive**: the first phase required a mindful and effortful involvement by pupils in the exploration of the tasklets and allowed them to individually construct knowledge and meaning
- **Self-regulated**: pupils were let free to decide how to use their time and how to plan their activities, while the teacher monitored their work
- **Situated**: during the training sessions pupils acted in a social and cultural context, where learning was further enacted in the interaction with the younger pupils
- **Collaborative**: pupils worked in pairs, exchanging ideas and mediating different points of view

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The methodology

During the training sessions:

- classroom organized with **table islands**
- **one trainer** (member of the pair) for each game
- **logging** on cards
- **help / interaction** allowed



For the assessment: mainly **products and interaction**

In the observation: expert as non participant observer;
anecdotal records methodology; incidents interpreted and used to make adjustments

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Birthday party



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Birthday Party (4 points)

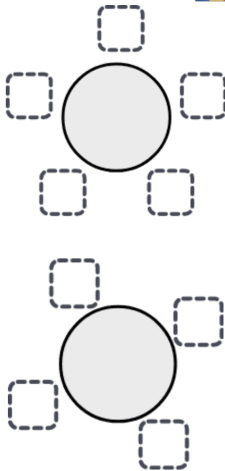


Mister Beaver is friends with all the animals.
Unfortunately, some of them quarrel with each other.

The Rabbit quarrels with the Fox, but he is friends with the Bear. The Dog quarrels with the Bear, but he is friends with the Fox. The Elephant is friends with the Giraffe, but quarrels with the Lion. The Mouse quarrels with the Giraffe and the Cat. Finally the Cat is friends with the Rabbit, but quarrels with the Fox.

Mister Beaver wants to celebrate his birthday and arranges two tables so that the animals sitting at each table do not quarrel, and friends sit at the same table.

Place the animals around the two tables by dragging them into the correct position.



Birthday party



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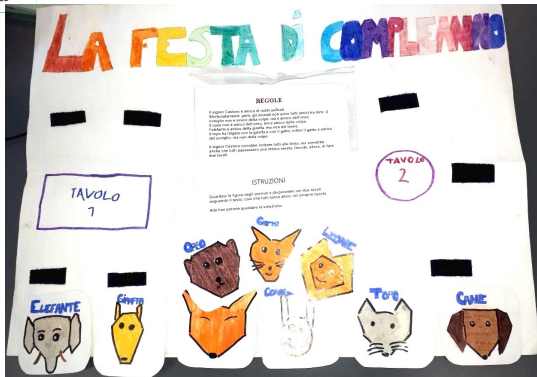
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Place the animals around the two tables by dragging them into the correct position.



Birthday party

- **CT skills:** **reason** (on constrains)
- two critical points
- trainers very directive:
- “start over with the other table”
- “check against the right solution”



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Drawing game



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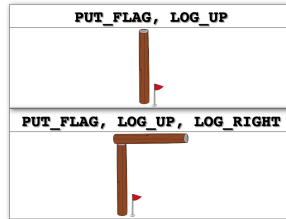
Drawing Game (6 points)



Beaver Joe plays a drawing game that uses logs to draw shapes. There are four commands that he can use:

- **PUT_FLAG** to mark the starting point and start painting,
- **LOG_UP** to draw a log pointing upward,
- **LOG_RIGHT** to draw a log lying horizontally to the right,
- **GOTO_FLAG** to go to flag and continue drawing from the flag.

For example:



What is the sequence of commands that Joe should type to draw a square?

PUT_FLAG, LOG_UP, LOG_RIGHT,
LOG_RIGHT, LOG_RIGHT

PUT_FLAG, LOG_UP, LOG_RIGHT,
LOG_UP, LOG_RIGHT

PUT_FLAG, LOG_UP, LOG_RIGHT,
GOTO_FLAG, LOG_UP, LOG_RIGHT

PUT_FLAG, LOG_UP, LOG_RIGHT,
GOTO_FLAG, LOG_RIGHT, LOG_UP



Drawing game

- CT skills: **from execute to algo-think + implement**
- white sheets (with numbered line 1–6)
- 4 logs + 1 flag
- one card for each command
- multiple copies of the commands

+ importance of reusing same command
vs rearranging tasks

+ program writing process:
select command
and trace effect

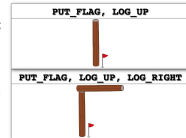
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GOTO_FLAG, LOG_UP, LOG_RIGHT

PUT_FLAG, LOG_UP, LOG_RIGHT,
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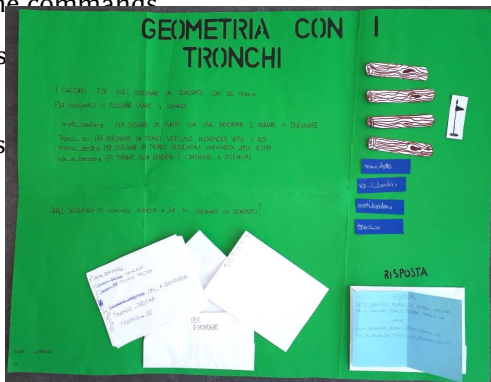
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Drawing game

- **CT skills: from execute to algo-think + implement**
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- 4 logs + 1 flag
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Waiter



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Waiter (2 points)



Mauro works as a waiter in a coffeehouse. When he takes orders, he tries to be as fast as possible and writes down only the pieces of information needed to the guy who will prepare the service.

Which one of the following notes will he write?

client 1 : coffee
 cake

client 2 : tea

client 3 : tea
 biscuits

client 4 : juice

client 5 : juice

client 6 : tea

client 7 : coffee

client 8 : tea

client 9 : cake
 tea

Food

coffee xx

tea xxxxxx

juice xx

Beverage

biscuits x

cake xx

coffee

tea

juice

biscuits

cake

| | | |
|---|--------|----------|
| 1 | coffee | cake |
| 2 | tea | |
| 3 | tea | biscuits |
| 4 | juice | |
| 5 | juice | |
| 6 | tea | |
| 7 | coffee | |
| 8 | tea | |
| 9 | tea | cake |

coffee x 2

tea x 5

juice x 2

biscuits x 1

cake x 2



Waiter (2 points)

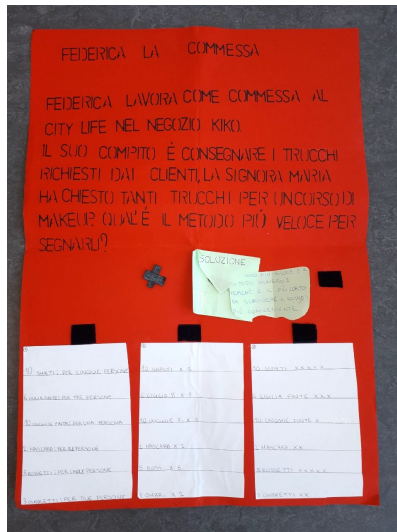


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Which one of the following notes will he write?

The diagram illustrates five separate data stores, each representing a different table. Each table has its own schema and data. The tables are:

- coffee**: columns: coffee, cake, tea, juice, biscuits
- food**: columns: food, coffee, tea, juice, biscuits
- coffee**: columns: coffee, cake, tea, juice, biscuits
- coffee x 5**: columns: coffee, cake, tea, juice, biscuits
- coffee x 5**: columns: coffee, cake, tea, juice, biscuits



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Waiter



Waiter (2 points)



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Which one of the following notes will he write?

| | |
|-------|-----------|
| count | 1. coffee |
| count | 2. tea |
| count | 3. tea |
| count | 4. juice |
| count | 5. juice |
| count | 6. juice |
| count | 7. coffee |
| count | 8. tea |
| count | 9. coffee |
| count | 10. tea |

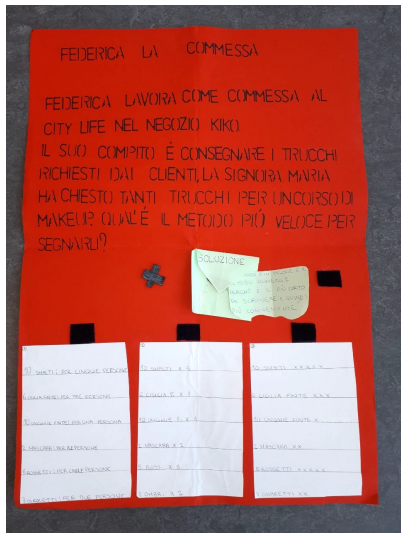
| | | |
|-------|--------|----|
| Email | coffee | x5 |
| | tea | x5 |
| | tea | x5 |
| | juice | x5 |
| | juice | x5 |
| | juice | x5 |
| | juice | x5 |
| | juice | x5 |
| | juice | x5 |
| | juice | x5 |

| | |
|--------|----|
| coffee | x5 |
| tea | x5 |
| tea | x5 |
| juice | x5 |
| juice | x5 |
| juice | x5 |
| juice | x5 |
| juice | x5 |
| juice | x5 |
| juice | x5 |

| | | |
|------------|------------|------------|
| 1. coffee | 2. tea | 3. coffee |
| 4. tea | 5. juice | 6. juice |
| 7. juice | 8. juice | 9. coffee |
| 10. tea | 11. coffee | 12. tea |
| 13. coffee | 14. tea | 15. coffee |

| | |
|--------|----|
| coffee | x5 |
| tea | x5 |
| tea | x5 |
| juice | x5 |
| juice | x5 |
| juice | x5 |
| juice | x5 |
| juice | x5 |
| juice | x5 |
| juice | x5 |

- **CT skills: organize + represent**
- setting changes
- correct answer correctly transposed
- some aspects were lost
- this emerged when asked to check the correspondences



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Conclusions and future work



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Bebras proved to be a good inspiration and **social and cultural context** for situated learning of CT and soft skills

- in most cases the trainers had examined **in depth** the tasks and correctly understood and transposed their core CT ideas
- **all but one pair succeeded** in finalizing the game
- the **interaction** with peers, trainees and the teacher further fostered learning
- **feedback** from the younger often helped improve the understanding of tasks

Conclusions and future work



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- A **new edition** of the project has just started with a new class this term.
- The teacher is better prepared at **monitoring** the different aspects that emerged (CT aspects grasped and preserved, difficulty level)
- We plan to **measure and evaluate** more analytically the actual impact on CT skills
- And develop **further activities** that allow to fully explore and exploit the richness of the tasks, sometimes overlooked during the time of the contest

Thank you!



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Any questions?



*ALaDDIn: **L**aboratorio di **D**ivulgazione e **D**idattica dell'**IN**formatica
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- Popularization of informatics as a **science**
- Teaching of **informatics** (not computer skills) in K-12