Co-funded by the European Union

Creating a set of interactive tasks and a pilot

The results are based on the work within the project "Computational Thinking and Mathematical Problem Solving, an Analytics Based Learning Environment" (CT&MathABLE). Coordination: Prof. Valentina Dagienė, Vilnius University (Lithuania). Partners: Ankara University (Türkiye), Eötvös Loránd University (Hungary), Gedminų Progymnasium (Lithuania), KTH Royal Institute of Technology (Sweden), Özkent Akbilek Middle School (Türkiye), University of Basque Country (Spain), University of Turku (Finland),. The project has received co-funding by the Erasmus+.

These results are developed by Daumilas Ardickas, Alvida Lozdienė, and Valentina Dagienė, under WP 4.

Reviewer: Marika Parviainen, University of Turku; Viktoras Dagys, Vilnius University.

1. Introduction

Work Package 4 (WP4) focuses on advancing Computational Thinking (CT) and Algebraic Thinking (AT) education by integrating interactive and gamified learning approaches into the curriculum. At the core of WP4 activities is the development and implementation of an interactive task framework. This framework aligns with the project's emphasis on gamification and interactivity, which are proven to significantly enhance student motivation. Research and practice indicate that motivated students achieve better learning outcomes, making game-based learning an essential element of the project.

The 100 interactive tasks created based on Bebras-like tasks incorporate visually appealing elements, minimal text, and interactive features, mirroring the simplicity and engagement of computer games. These tasks are familiar to many students worldwide, as the Bebras Challenge on Informatics and Computational Thinking has become a widely recognised initiative, establishing a strong connection between the Bebras brand and gamified educational content.

Specific Objectives of SO4.4

To develop and pilot a set of interactive tasks leveraging the developed tool, thereby enhancing the quality and engagement of Computational Thinking (CT) and Algebraic Thinking (AT) education.

Deliverables:

- **R4.4:** A comprehensive set of interactive tasks designed for implementation through the developed tool will be created. These tasks will undergo pilot testing in partner schools and associated schools, with feedback collected to refine and improve the framework.
- The integration of these tasks into an analytics-based learning ecosystem will be tested in two partner schools and associated schools. This process will include aligning the tasks with an assessment framework to ensure their effectiveness and relevance in diverse educational contexts.

Key Outputs:

1. **A Set of Interactive Tasks:** A detailed description of each task together with guide for designing interactive tasks aimed at developing skills in Computer Science, CT, and AT.
2. **Data Privacy and Protection Compliance:** All processes for task implementation will adhere to strict data privacy and protection regulations, ensuring a secure environment for both students and educators.

Through these activities, we foster the creation of a dynamic, engaging, and student-centered learning experience that bridges the gap between traditional and gamified education. The feedback from pilot schools informs further development, ensuring the scalability and adaptability of the framework across diverse educational settings.

2. Task Creation

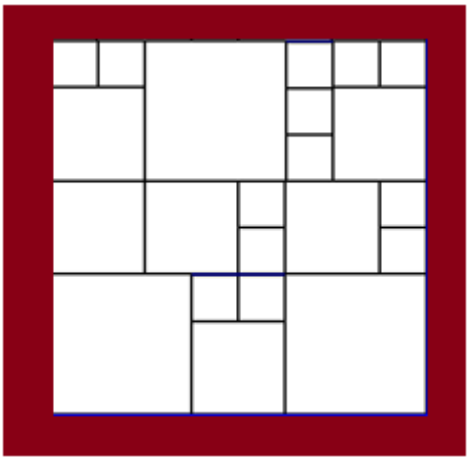
2.1. Example 1: Colouring

Data representation. Graph colouring

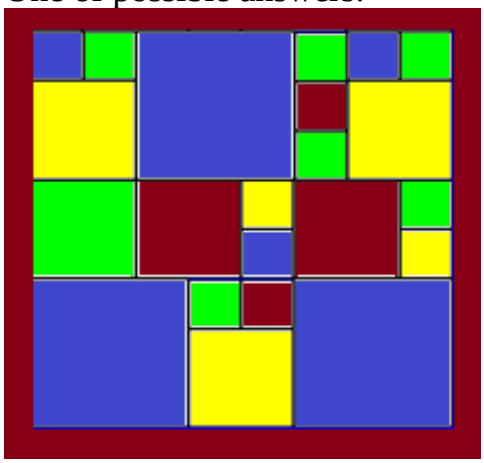
Colouring the picture using only 4 colours (white is not allowed). It doesn't matter what colours you choose, but two squares with a common border must be coloured differently.

Each click on a square will change its colour.

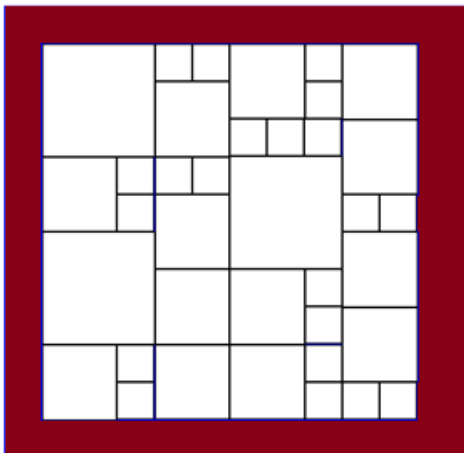
Case A



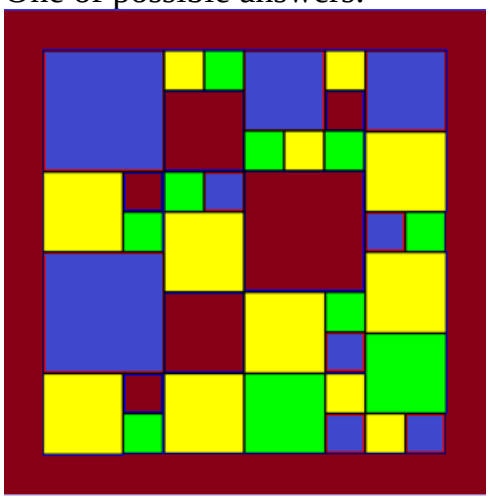
One of possible answers:



Case B



One of possible answers:



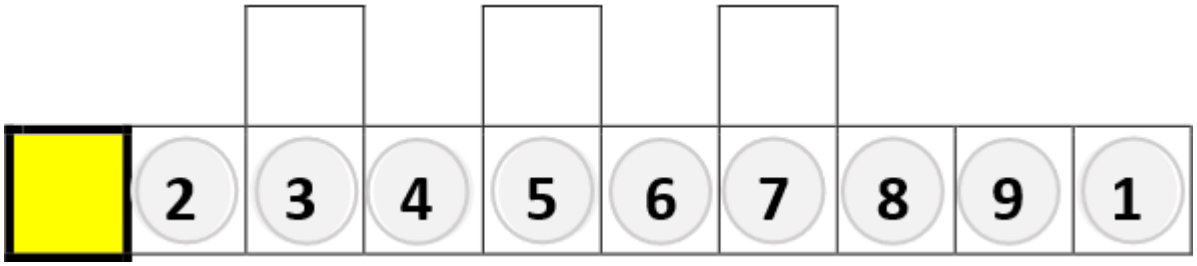
2.2. Example 2: Checkers Puzzles

This task requires dragging images.

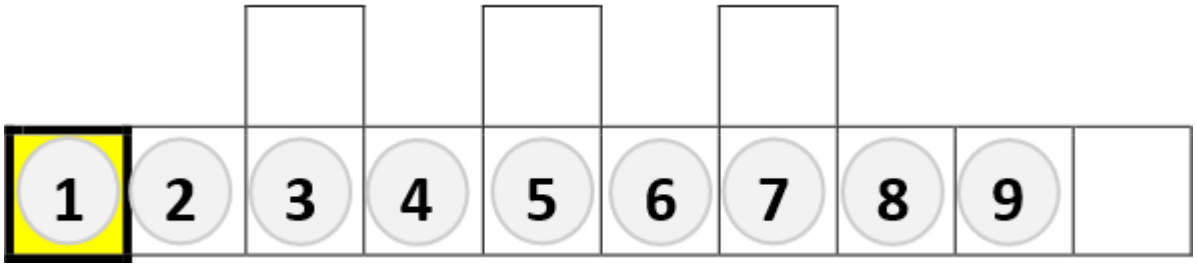
Logical reasoning

Case A

There are 9 numbered checkers. To slide the checkers into the free boxes, move the checker numbered 1 into the yellow box and get all 9 checkers numbered consecutively in a row.

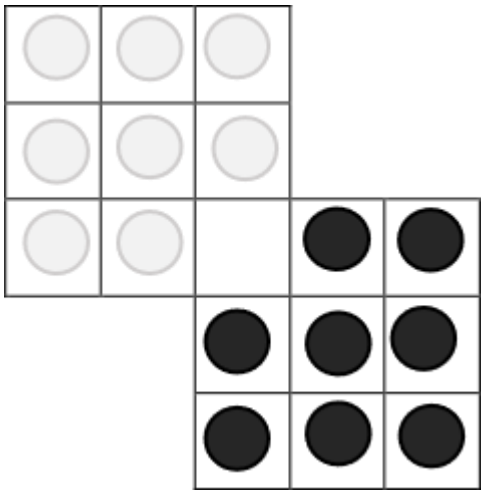


Answer



Case B

You need to swap the white checkers with the black checkers in their places, according to the following rules. In one move, a checker can be moved up, down, left, or right in a free box. It is also possible to jump over a single checker in these directions, no matter what colour it is. It is not necessary to move the checkers in order, but it is possible to move checkers of the same colour several times if necessary.



The best answer is 46 moves

1.	one step to the right	11.	one jump to the left	21.	one step down	31.	one jump up	41.	one jump to the left
2.	one jump to the left	12.	one step up	22.	one step to the left	32.	one step to the right	42.	one step to the right
3.	one step to the left	13.	one step to the right	23.	one jump up	33.	one jump to the left	43.	one jump up
4.	one jump to the right	14.	one jump to the left	24.	one jump up	34.	one jump up	44.	one step down
5.	one step up	15.	one step down	25.	one step down	35.	one step to the right	45.	one jump down
6.	one step down	16.	one jump to the right	26.	one step down	36.	one jump to the left	46.	one step up
7.	one step down	17.	one step up	27.	one jump to the right	37.	one step down		
8.	one jump up	18.	one step down	28.	one step up	38.	one jump to the right		
9.	one jump to the right	19.	one step to the right	29.	one step down	39.	one jump to the right		
10.	one step to the left	20.	one step up	30.	one jump to the left	40.	one step to the left		

Can be changed from up to down (down to up), left to right (right to left)

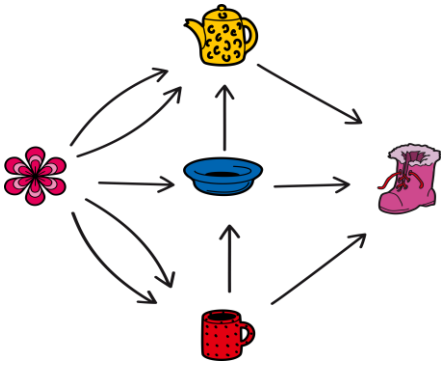
2.3. Example 3: Magician

Data representation. Graph.

Case A

A magician can transform one object into another. During the transformation, some objects disappear and new ones appear. A magician can transform:

- Two flower blossoms into a cup.
- A cup and one flower blossom into a plate.
- Two flower blossoms and a plate into a teapot.
- One cup, one plate and one teapot into a shoe.



How many flower blossoms does a magician need to create 2 shoes?

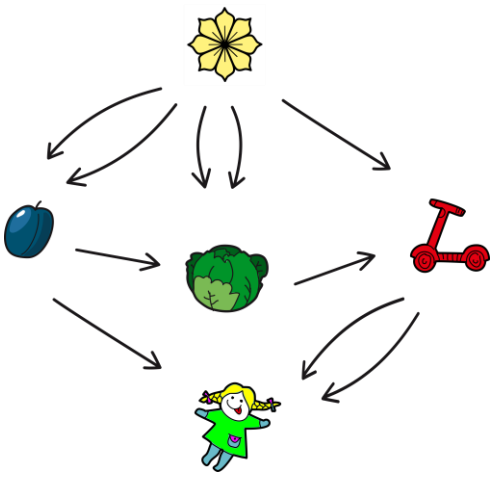
Write the number in the box

Answer: 20
2 flower blossoms are needed to make the cup
For a plate, you need a cup and 1 flower blossom, which means 2 + 1 = 3
A teapot uses 2 flower blossoms and 1 plate, which means 2 + 3 = 5
For 1 shoe, it takes a cup, a plate and a teapot, which means 2 + 3 + 5 = 10 flower blossoms.
For 2 shoes, 20 flower blossoms are needed.

Case B

A magician can transform one object into another. During the transformation, some objects disappear and new ones appear. A magician can transform:

- Two flower blossoms into a plum.
- A plum and two flower blossoms into a cabbage.
- A flower blossom and a cabbage into a scooter.
- A plum and two scooters into a doll.



How many flower blossoms does a magician need to create 3 dolls?
Write the number in the box

Answer: 36
Plum needs 2 flower blossoms
A cabbage needs 1 plum and 2 flower blossoms, which means 2 + 2 = 4
A scooter takes 1 cabbage and 1 scooter, which means 4 + 1 = 5
For 1 doll, it takes 1 plum and 2 scooters, 2 + 10 = 12 flower blossoms.
3 dolls need 36 flower blossoms.

3. List of a Set of interactive tasks

Algorithms (26)

1. Cells transformations. Algorithms. Spatial thinking
2. Drawing robot. Algorithm. Introduction to function
3. Drawing robot1. Algorithm. IF conditions
4. Drawing robot2. Algorithm. IF conditions
5. Flower blossom ornament. Algorithm. Sequences of commands
6. Flower blossoms.-Algorithm. Loop
7. Line of dots. Algorithm. Loop FOR
8. Maze1-Algorithm.-Sequence.-Rules
9. Robot meeting. Algorithm. Execution
10. Symbol sequences. Algorithm. Sequences
11. Toy Collection. Algorithm. Loop While
12. Treasure. Algorithm. Sequences of commands
13. Water lily. Algorithm. Backtracking

Data analysis and representation (40)

1. Colouring. Data representation. Graph
2. Cube. Data analysis. Logics. Spatial thinking
3. Cycling to a friend. Data representation. Graph. Shortest path
4. Decision Tree. Data representation
5. Encoding of images. Data representation. Coding
6. Famous name. Text encryption. Data analyzis and representation. Coding
7. Game of Stars. Data analysis. Logic
8. Graph1-Data representation. GRAPH
9. Hidden aphorism. Data analyzis. Coding
10. International MORSE code. Data representation.
11. Journey by bike. Data analysis
12. Magician. Data representation. Graph
13. Missing arrows. Data analyzis and representation
14. Numbered cells. Data analysis and representation
15. Numbered strips. Data analysis and representation
16. Picture creation. Data representation
17. Shape-creation.-Data analysis. (Structure or decomposition)

18. Square code. Data representation
19. SUDOKU-Data analysis. (Structure or decomposition)
20. Word encryption. Data representation. Coding.

Generalization (8)

1. Black and White cells. Generalization
2. Logical number sequence. Generalization
3. Regularities. Generalisation. Logical reasoning
4. Share the chocolates. Generalization

Logical reasoning (20)

1. CARS. Logic. IF conditions
2. Checkers puzzles. Logical reasoning
3. Equation. Logic. IF conditions. Data analysis and representation
4. Football. Logical reasoning
5. Logical change of drawing. Logical reasoning. Spatial thinking
6. Pyramid. Box. Logical reasoning. Spatial thinking
7. Time. Only logic
8. VENN1-Logical reasoning
9. VENN2-Logical reasoning
10. VENN3-Logical reasoning

New (6)

1. Climate-Data analysis and representation
2. Uni-Museum-Data analysis and representation
3. Japanese Calendar. Algorithm

4. **Detailed task list** with links to the "live" tasks

Category	**Task title** (with variants)	**No**	**Link in Bebras Lodge (interactive task)**	**Type of interactivity**
Algorithms	Cells transformations. Algorithms. Spatial thinking	alg-01	https://bebras-lodge.sp.fsf.vu.lt/public/8c7f1c2154ef47babc62	Sorting
		alg-02	https://bebras-lodge.sp.fsf.vu.lt/public/233852d4e82d4276a0eb	Sorting
Algorithms	Drawing robot. Algorithm. Introduction to function	alg-03	https://bebras-lodge.sp.fsf.vu.lt/public/254194cff5384fa89c91	Multiple open integers
		alg-04	https://bebras-lodge.sp.fsf.vu.lt/public/69c6752ca73c43469adc	Drag&drop
Algorithms	Drawing robot1. Algorithm. IF conditions	alg-05	https://bebras-lodge.sp.fsf.vu.lt/public/dfa6a95608354188ac53	Multiple 3-state switches or drag&drop
		alg-06	https://bebras-lodge.sp.fsf.vu.lt/public/cef2841b5224421babb4	Rect of 3-state switches
Algorithms	Drawing robot. Algorithm. IF conditions	alg-07	https://bebras-lodge.sp.fsf.vu.lt/public/2881838f3a4042388543	Rect of switches
		alg-08	https://bebras-lodge.sp.fsf.vu.lt/public/4b066989e91e44edb53e	Rect of switches
Algorithms	Flower blossom ornament. Algorithm. Sequences of commands	alg-09	https://bebras-lodge.sp.fsf.vu.lt/public/026778e906db420291fe	Drag&drop

		alg-10	https://bebras-lodge.sp.fsf.vu.lt/public/720b6dc85e73417ea622	Rect of open integer/text
Algorithms	Flower blossoms.-Algorithm. Loop	alg-11	https://bebras-lodge.sp.fsf.vu.lt/public/8bece844d4154157b7fd	Drag&drop
		alg-12	https://bebras-lodge.sp.fsf.vu.lt/public/4270edd1885a43b5b6fc	Multiple open integers, drag&drop
Algorithms	Line of dots. Algorithm. Loop FOR	alg-13	https://bebras-lodge.sp.fsf.vu.lt/public/68eda9520c154c85ab5a	Drag&drop
		alg-14	https://bebras-lodge.sp.fsf.vu.lt/public/35a593d4ea0c443fb2d2	Multiple open integers
Algorithms	Maze-Algorithm-Sequence-Rules	alg-15	https://bebras-lodge.sp.fsf.vu.lt/public/89fc81ae5ab24884b8c0	Game
		alg-16	https://bebras-lodge.sp.fsf.vu.lt/public/4d78df56b9c74604aff7	Game
Algorithms	Robot meeting. Algorithm. Execution	alg-17	https://bebras-lodge.sp.fsf.vu.lt/public/b7cf3f33363a499ebb18	Multiple choice + open integer
		alg-18	https://bebras-lodge.sp.fsf.vu.lt/public/49082b59e9b14359bcac	Multiple choice + open integer
Algorithms	Symbol sequences. Algorithm. Sequences	alg-19	https://bebras-lodge.sp.fsf.vu.lt/public/7e83726224704babbc7e	Drag&drop
		alg-20	https://bebras-lodge.sp.fsf.vu.lt/public/a1a4a529651148c8810c	Drag&drop
Algorithms	Toy Collection. Algorithm. Loop While	alg-21	https://bebras-lodge.sp.fsf.vu.lt/public/13f1b4d062fb405eab5e	Drag&drop
		alg-22	https://bebras-lodge.sp.fsf.vu.lt/public/25789057952248c89197	Drag&drop

Algorithms	Treasure. Meeting of friends. Algorithm. Sequences of commands	alg-23	https://bebras-lodge.sp.fsf.vu.lt/public/3150193691344107a6e9	Select one
		alg-24	https://bebras-lodge.sp.fsf.vu.lt/public/91db485eaec84e409497	Select multiple
Algorithms	Water lily. Algorithm. Backtracking	alg-25	https://bebras-lodge.sp.fsf.vu.lt/public/9fa1eed7ed62458ca846	Select one + open text + open integer
		alg-26	https://bebras-lodge.sp.fsf.vu.lt/public/efec70aca8ce4a168b63	Open integer
Algorithms	Japanese Calendar1	alg-27	https://bebras-lodge.sp.fsf.vu.lt/public/650181e01cba4003bd1d	Drag&drop
	Japanese Calendar2	alg-28	https://bebras-lodge.sp.fsf.vu.lt/public/69340bda75ff42198172	Open integer
Data analysis and representation	Colouring. Data representation. Graph	dat-01	https://bebras-lodge.sp.fsf.vu.lt/public/e6d06428a4894117a286	Colouring (many correct answers)
		dat-02	https://bebras-lodge.sp.fsf.vu.lt/public/33d6bdc2d8c94b9ca274	Colouring (many correct answers)
Data analysis and representation	Cube. Data analysis. Logics. Spatial thinking	dat-03	https://bebras-lodge.sp.fsf.vu.lt/public/9524e165cd2d4837b1e5	Drag&drop
		dat-04	https://bebras-lodge.sp.fsf.vu.lt/public/c326893623a64b2a9ead	Drag&drop
Data analysis and representation	Cycling to a friend. Data representation. Graph. Shortest path	dat-05	https://bebras-lodge.sp.fsf.vu.lt/public/200878c2745a4c25b8ca	Open integer

		dat-06	https://bebras-lodge.sp.fsf.vu.lt/public/31475442d6b14f93bed8	Open integer
Data analysis and representation	Decision Tree. Data representation	dat-07	https://bebras-lodge.sp.fsf.vu.lt/public/08f9ca1c2520485ea039	Drag&free drop
		dat-08	https://bebras-lodge.sp.fsf.vu.lt/public/8c1df362b9e343ee8627	Drag&drop
Data analysis and representation	Encoding of images. Data representation. Coding	dat-09	https://bebras-lodge.sp.fsf.vu.lt/public/a4ab9851dae44a0b8673	Open text
		dat-10	https://bebras-lodge.sp.fsf.vu.lt/public/0b602bd3d03d4e54ab81	Open text
Data analysis and representation	Famous name. Text encryption. Data analysis & representation. Coding	dat-11	https://bebras-lodge.sp.fsf.vu.lt/public/4dcf6c08ffb945278701	Open text
		dat-12	https://bebras-lodge.sp.fsf.vu.lt/public/3704f6afd71d45c4899e	Open text
Data analysis and representation	Game of Stars. Data analysis. Logic	dat-13	https://bebras-lodge.sp.fsf.vu.lt/public/449def1922cd4516bbe5	Select one
		dat-14	https://bebras-lodge.sp.fsf.vu.lt/public/2694b03aaf884fac8d36	Select multiple
Data analysis and representation	Graph. Data representation.	dat-15	https://bebras-lodge.sp.fsf.vu.lt/public/9d64dc2159704374978a	Drag&drop
		dat-16	https://bebras-lodge.sp.fsf.vu.lt/public/dea79b5c2c614b6fb043	Drag&drop (many correct answers
Data analysis and representation	Hidden aphorism. Data	dat-17	https://bebras-lodge.sp.fsf.vu.lt/public/7a72a5a06490436aa75c	Open text

	analysis. Coding			
		dat-18	https://bebras-lodge.sp.fsf.vu.lt/public/cd1ad08893da414e8cbc	Open text
Data analysis and representation	International MORSE code. Data representation.	dat-19	https://bebras-lodge.sp.fsf.vu.lt/public/ad131f8d6522402eb585	Drag&drop
		dat-20	https://bebras-lodge.sp.fsf.vu.lt/public/a57483551378480dae16	Drag&drop
Data analysis and representation	Journey by bike. Data analysis	dat-21	https://bebras-lodge.sp.fsf.vu.lt/public/9f0df31a432147bf95ca	Complex. Five parts
		dat-22	https://bebras-lodge.sp.fsf.vu.lt/public/e0b9bd73c2ac46e8a986	Complex. Three parts
Data analysis and representation	Magician. Data representation. Graph	dat-23	https://bebras-lodge.sp.fsf.vu.lt/public/5466c23aae024bf398e4	Open integer
		dat-24	https://bebras-lodge.sp.fsf.vu.lt/public/fc8cd1b68d2f4dffaf11	Open integer
Data analysis and representation	Missing arrows. Data analysis & representation	dat-25	https://bebras-lodge.sp.fsf.vu.lt/public/8ddb29f0d7ae486cb770	Drag&drop
		dat-26	https://bebras-lodge.sp.fsf.vu.lt/public/1347b02f89544ed68702	Drag&drop
Data analysis and representation	Numbered cells. Data analysis & representation	dat-27	https://bebras-lodge.sp.fsf.vu.lt/public/81ce41c3fb20444d86d8	Open integer
		dat-28	https://bebras-lodge.sp.fsf.vu.lt/public/8a750488688b457b9529	Open integer
Data analysis and representation	Numbered strips. Data analysis & representation	dat-29	https://bebras-lodge.sp.fsf.vu.lt/public/3a788ce5dd9740b58026	Drag&drop

		dat-30	https://bebras-lodge.sp.fsf.vu.lt/public/1717f308850b4e37bbfb	Drag&drop
Data analysis and representation	Picture creation. Data representation	dat-31	https://bebras-lodge.sp.fsf.vu.lt/public/055b28a555f94e8a8b3f	Drag&drop
		dat-32	https://bebras-lodge.sp.fsf.vu.lt/public/638c5aae7ea14f63aa22	Drag&drop
Data analysis and representation	Shape-creation.- Data analysis. (Structure or decomposition)	dat-33	https://bebras-lodge.sp.fsf.vu.lt/public/65706d4df3b448d28dd1	Complex. Open integer, select one
		dat-34	https://bebras-lodge.sp.fsf.vu.lt/public/f4dc9bcc5b0e40e2822c	Complex. Open integer, select one
Data analysis and representation	Square code. Data representation	dat-35	https://bebras-lodge.sp.fsf.vu.lt/public/04b777157a47421c92f5	Open text
		dat-36	https://bebras-lodge.sp.fsf.vu.lt/public/3801601b8af94336bdaa	Open text
Data analysis and representation	SUDOKU- Data analysis. (Structure or decomposition)	dat-37	https://bebras-lodge.sp.fsf.vu.lt/public/784bbfc5354d4ec1a264	Drag&drop
		dat-38	https://bebras-lodge.sp.fsf.vu.lt/public/d28f46b9f6504d65bf6c	Drag&drop
Data analysis and representation	Word encryption. Data representation. Coding.	dat-39	https://bebras-lodge.sp.fsf.vu.lt/public/28e828deb4cd4d11a30e	Open text
		dat-40	https://bebras-lodge.sp.fsf.vu.lt/public/14d4bb5c03fb46c7a262	Open text

Data analysis and representation	Climate-Data analysis & representation-1-EN	dat-41	https://bebras-lodge.sp.fsf.vu.lt/public/d9205059c2db433daa14	Select one
	Climate-Data analysis & representation-2-EN	dat-42	https://bebras-lodge.sp.fsf.vu.lt/public/87b22f827aec4998b8bd	Select one
Data analysis and representation	Uni-Museum-Data analysis & representation-1	dat-43	https://bebras-lodge.sp.fsf.vu.lt/public/814557e4037e4968b30c	Open integer
	Uni-Museum-Data analysis & representation-2	dat-44	https://bebras-lodge.sp.fsf.vu.lt/public/015be84945f44a898d3f	Open integer
Generalization	Black and White cells. Generalization	gen-01	https://bebras-lodge.sp.fsf.vu.lt/public/526ec5bc45dc4a4e8ed8	Open integer
		gen-02	https://bebras-lodge.sp.fsf.vu.lt/public/52d87559ca9546eeb590	Open integer
Generalization	Logical number sequence. Generalization	gen-03	https://bebras-lodge.sp.fsf.vu.lt/public/4033e3c783ce46738184	Open integer
		gen-04	https://bebras-lodge.sp.fsf.vu.lt/public/bbb545c0defc4a4bb382	Open integer
Generalization	Regularities. Generalisation. Logical reasoning	gen-05	https://bebras-lodge.sp.fsf.vu.lt/public/d220250e8da7492196ad	Open integer
		gen-06	https://bebras-lodge.sp.fsf.vu.lt/public/432e7ba7c772464db7c5	Open integer
Generalization	Share the chocolates.	gen-07	https://bebras-lodge.sp.fsf.vu.lt/public/5b365d2bb1bf4114a146	Select one

	Generalization			
		gen-07a	https://bebras-lodge.sp.fsf.vu.lt/public/d130bf546f7141f18626	Select one
		gen-08	https://bebras-lodge.sp.fsf.vu.lt/public/91c4959382cc465c8fa2	Select one
		gen-08a	https://bebras-lodge.sp.fsf.vu.lt/public/fcdded4bdeae42409880	Select one
Logical reasoning	CARS. Logic. IF conditions	log-1	https://bebras-lodge.sp.fsf.vu.lt/public/9880d9c4d67f4036b825	Drag&drop
		log-2	https://bebras-lodge.sp.fsf.vu.lt/public/929b4bdb23754a9d81e1	Drag&drop
Logical reasoning	Checkers puzzles. Logical reasoning	log-3	https://bebras-lodge.sp.fsf.vu.lt/public/7d3e310dedcb45189cc6	Drag&drop
		log-4	https://bebras-lodge.sp.fsf.vu.lt/public/5ed38c59c60148c489be	Drag&drop
Logical reasoning	Equation. Logic. IF conditions.	log-5	https://bebras-lodge.sp.fsf.vu.lt/public/7e355999b473447c95c1	Drag&drop
		log-6	https://bebras-lodge.sp.fsf.vu.lt/public/306fa5be41094897965c	Drag&drop
Logical reasoning	Football. Logical reasoning	log-7	https://bebras-lodge.sp.fsf.vu.lt/public/ef76795485684356b451	Open integer
		log-8	https://bebras-lodge.sp.fsf.vu.lt/public/dae71fe0600d40f48ec3	Open integer
Logical reasoning	Logical change of drawing. Logical reasoning. Spatial thinking	log-9	https://bebras-lodge.sp.fsf.vu.lt/public/fcf7902e63284880a939	Select one
		log-10	https://bebras-lodge.sp.fsf.vu.lt/public/cdac60f50b0340a4b80c	Select one

Logical reasoning	Pyramid. Box. Logical reasoning. Spatial thinking	log-11	https://bebras-lodge.sp.fsf.vu.lt/public/4eeba541d29645a7bb67	Open integer
		log-12	https://bebras-lodge.sp.fsf.vu.lt/public/01f5834cdec545e0af79	Open integer
Logical reasoning	Time. Only logic	log-13	https://bebras-lodge.sp.fsf.vu.lt/public/42a9bfb55487415898a6	Open integer
		log-14	https://bebras-lodge.sp.fsf.vu.lt/public/ddab7cc71e1f483a8e7a	Open integer
Logical reasoning	VENN1-Logical reasoning	log-15	https://bebras-lodge.sp.fsf.vu.lt/public/eeaaeb026b1f40ea98dc	Select one
		log-16	https://bebras-lodge.sp.fsf.vu.lt/public/0ac49c5cc3aa42c9bdbb	Open integer
Logical reasoning	VENN2-Logical reasoning	log-17	https://bebras-lodge.sp.fsf.vu.lt/public/06d2bd83415d40f58e16	Drag&drop
		log-18	https://bebras-lodge.sp.fsf.vu.lt/public/ba6de9e1d36e4224806c	Drag&drop
Logical reasoning	VENN3-Logical reasoning	log-19	https://bebras-lodge.sp.fsf.vu.lt/public/57c57b44462248fcb32d	Drag&drop
		log-20	https://bebras-lodge.sp.fsf.vu.lt/public/03043fa1e36947e4ae2b	Open integer
Logical reasoning	Venn	log21	https://bebras-lodge.sp.fsf.vu.lt/public/4d2aac149e0140af95bf	Drag&drop

5. Piloting Interactive Tasks

One of the most impressive outcomes of the CT&MathABLE project so far has been the creation of 100 interactive tasks related to various informatics concepts, now fully integrated into the ViLLE platform. These tasks were piloted with students at Klaipėda Gedminai Progymnasium, providing a valuable opportunity to observe their impact in a real classroom setting. More than 900 students participated in the pilots (the target was 500 students).

Project partners observed lessons with primary and secondary school students during the piloting. The pupils' enthusiasm was striking: they eagerly engaged with various challenges, showing particular interest in tasks such as Venn diagrams, logical puzzles, and problems requiring strategic planning. These activities captured their attention and encouraged them to think critically and apply computational and algebraic thinking in hands-on, meaningful ways.

It was especially impressive to see how even first-graders—students who had only recently started school—were deeply engaged and able to solve many problems independently. Their success reflected the accessibility and intuitive design of the ViLLE platform. Meanwhile, older students took on more advanced tasks that provided stimulating challenges, sparking curiosity and strengthening higher-level problem-solving skills.

This direct piloting experience offered the project team valuable insights into how students interact with the tasks in real time. Feedback gathered during the sessions is being used to refine the problem sets further, ensuring they remain user-friendly while offering the right level of challenge to support the development of computational thinking skills effectively. The iterative cycle of piloting, reflection, and improvement lies at the heart of the project's approach, ensuring that the tools created can be widely and meaningfully adopted in classrooms.

The observations and follow-up discussions with teachers were significant for fine-tuning the tasks, making them practical and effective for everyday school use. The ultimate goal is to help teachers accurately assess their students' computational and algebraic thinking skills and provide more substantial support for their learning journeys.

The excitement surrounding the CT&MathABLE project was evident in Gedminai school: students enthusiastically solved problems in the ViLLE environment, interacted with guests, and proudly showcased their learning. For the partners, witnessing this engagement firsthand reinforced the project's value and impact—designing diverse learning activities, measuring students' progress, and directly benefiting schools by enhancing how computational thinking is taught and assessed.

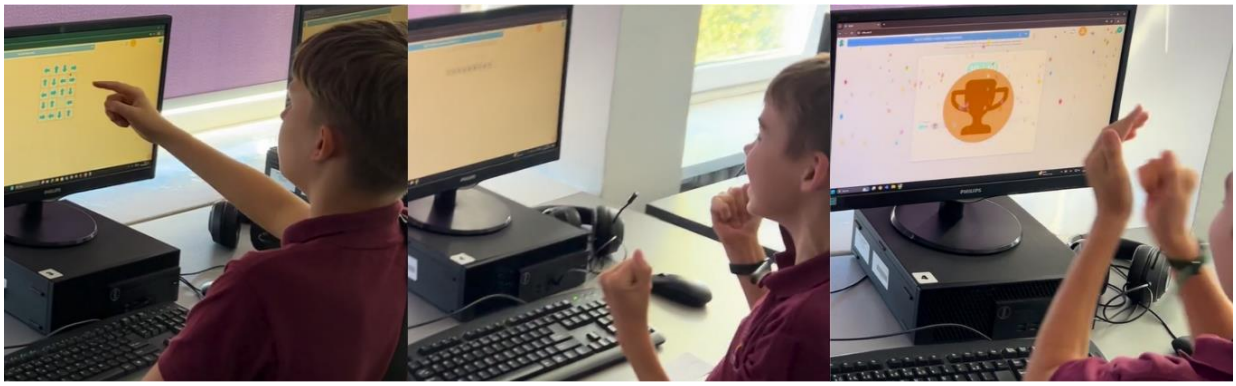
Snapshots from the piloting of interactive tasks at Gedminai School

Videos from the piloting in Klaipėda Gedminai school:

https://www.canva.com/design/DAGUHvIQZWE/34bopXeo-KENBOKuggLFQg/watch?utm_content=DAGUHvIQZWE&utm_campaign=designshare&utm_medium=link&utm_source=editor

https://www.canva.com/design/DAGUILtLfaQ/DmfBjLORLgWxW7bPTU278w/watch?utm_content=DAGUILtLfaQ&utm_campaign=designshare&utm_medium=link&utm_source=editor

https://www.canva.com/design/DAGTeNAq6Ps/0lSCT4DV6EzksuinlImYuQ/watch?utm_content=DAGTeNAq6Ps&utm_campaign=designshare&utm_medium=link&utm_source=editor



Excerpts from one of the videos on the piloting

6. ViLLE and parametrization of tasks

Visual learning environment ViLLE's real-time learning analytics provide teachers and researchers with invaluable information about the suitability of tasks and the progress of student groups. The analytics offer detailed data and also visually represent it, allowing teachers to quickly see, for example, if a student is falling behind. For researchers, one of the most interesting visualizations compares tasks with student performance, showing accuracy and time spent on each task. Combined with in-person observation, this data helps researchers optimize individual tasks, the overall task set, and the sequence in which they're presented.

Based on a literature review and classroom observations, our goal is to create a set of tasks that the average student can complete within about 40 minutes during class and 10-30 minutes at home (depending on grade level) to achieve 50% of the points, earning a bronze trophy in the ViLLE system. This system motivates students by encouraging active learning and allowing them to choose the tasks that interest them most. In an ideal lesson, motivation is sparked by initial tasks that grab students' attention, helping them reach a flow state in their learning. Learning is most effective when it occurs within the student's zone of proximal development and when students engage in collective knowledge-building with their peers. This leaves the teacher with the challenge of balancing personalization.

A novel aspect of this project is the use of two levels of task parametrization. Most tasks have built-in parameters that allow each student to complete a slightly different version of the task. The second level involves adjusting the core concept of the task, for example, by modifying the encoding to suit different grade levels. This approach is beneficial when the same idea is revisited across multiple years of the curriculum.

Example 1. Parametrized tasks: encoding (in Lithuanian, as presented for students at Gedminai Progymnasium)

Paveikslėlis užkoduotas anglų kalbos raidėmis. Įrašykite trečią eilutę.

Paveikslėlis užkoduotas anglų kalbos raidėmis. Įrašykite ketvirtąją eilutę.

2	2	1	2	2	2	2	2	221152
1	1	2	2	2	2	2	2	2162
2	1	1	1	2	2	2	2	123142
1	1	1	1	2	2	2	1	
2	2	2	1	1	2	2	2	322132

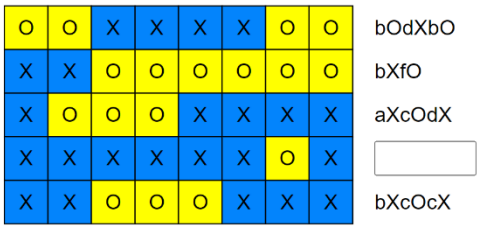
Paveikslėlis užkoduotas anglų kalbos raidėmis. Įrašykite ketvirtąją eilutę.

2	1	1	1	2	2	1	1	12312221
1	1	2	2	2	2	2	2	2162
2	2	2	2	2	2	2	1	7211
2	2	2	2	1	1	1	2	
1	1	2	1	1	1	1	1	211251

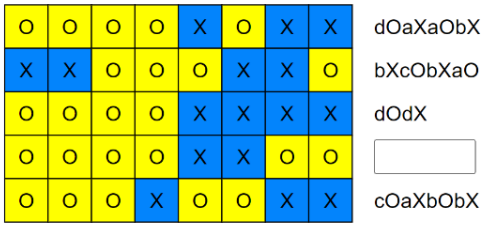
Paveikslėlis užkoduotas anglų kalbos raidėmis. Įrašykite trečią eilutę.

A	B	B	A	A	B	B	1A2B2A2B
A	C	C	C	A	A	A	1A3C3A
A	C	C	C	C	C	B	
C	C	C	B	B	B	A	3C3B1A
A	A	A	A	A	B	C	5A1B1C

Paveikslėlis užkoduotas anglų kalbos raidėmis. Įrašykite ketvirtąją eilutę.
English alphabet: abcdefghijklmnopqrstuvwxyz

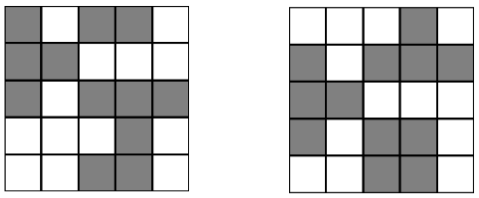


Paveikslėlis užkoduotas anglų kalbos raidėmis. Įrašykite ketvirtąją eilutę.
English alphabet: abcdefghijklmnopqrstuvwxyz

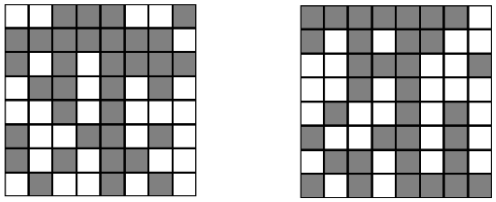


Example 2. Parametrized tasks: shifting rows

Duotas ornamentas. Keisdami poromis **tik** eilutes gaukite tokį raštą:

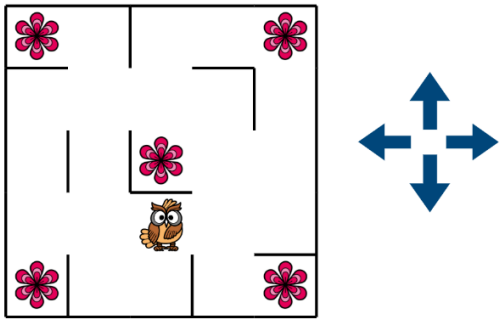


Duotas ornamentas. Keisdami poromis **tik** eilutes gaukite tokį raštą:



Example 3. Parametrized tasks: movement in the maze

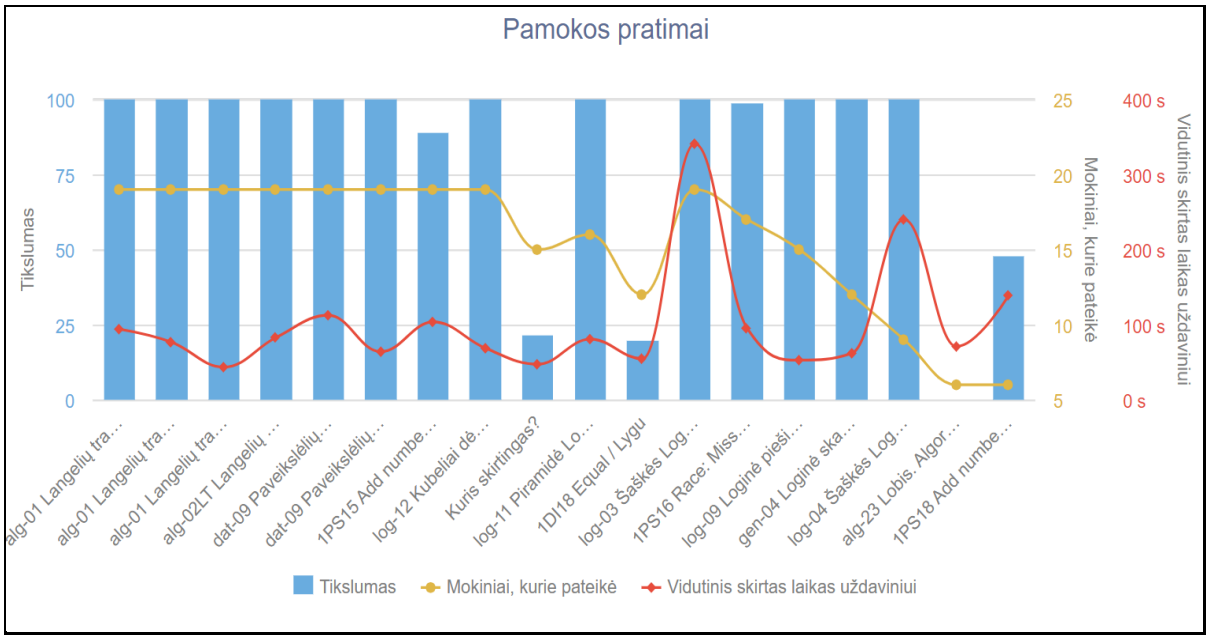
Padėk pelėdai surinkti visus gėlių žiedus. Paspausk rodyklę (arba klavišą su rodykle), kad perkeltum pelėdą prie artimiausios sienos ar kliūties.



7. Discussion and Reflection

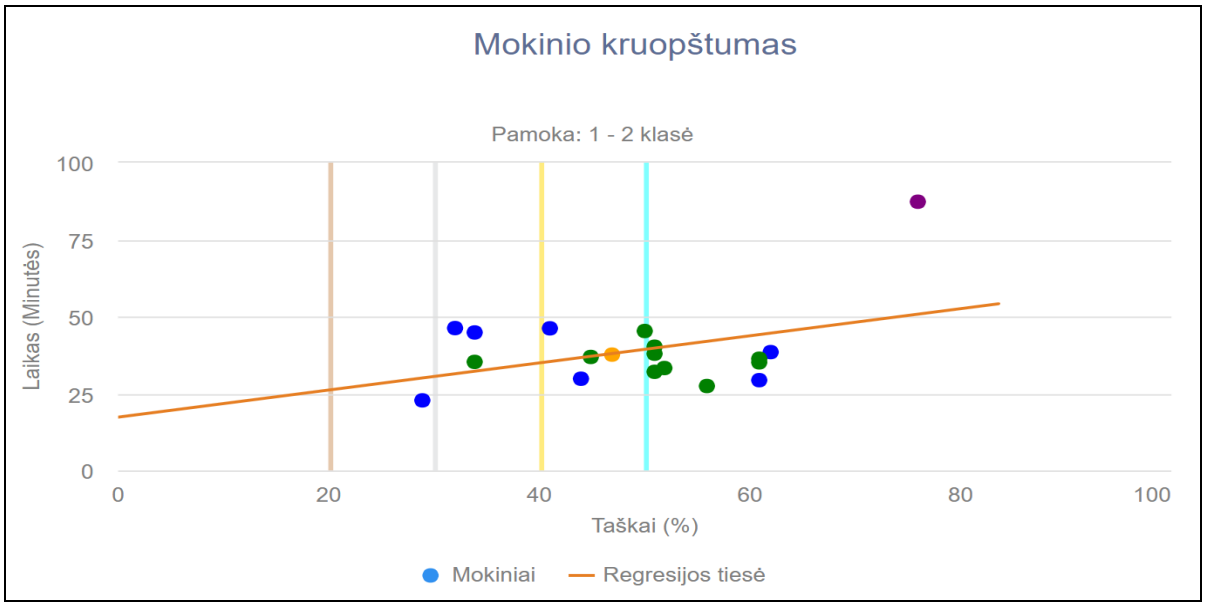
The partners and visiting teachers from other Klaipėda schools observed different classes (1st, 2nd, 4th, 5th, 6th, and 8th) using the ViLLE platform and interactive tasks. Below is an example of a 2nd-grade lesson from the Learning Analytics view.

This chart visualizes student progress during the lesson. The yellow line shows that, on average, all students completed about 12 out of 18 tasks (see Diagram below). Two tasks, 9 and 11, resulted in lower marks for most students (as indicated by the short blue bars in Figure 1). Tasks 12 and 16 took longer than the others (highlighted by the taller red line in the Diagram). These observations were also noted during in-class monitoring, and the task design team will improve these specific tasks.



Student progress during the lesson

The "student diligence" view in Diagram 2 (for grades 1-2) shows each student as a dot, placed according to their total points and time spent. Vertical lines mark the thresholds for different awards, such as trophies. As an anecdote, one student continued working at home immediately after the lesson, which is reflected in the extra time captured here. The general trend is clear: students who spent more time tended to score higher. This pattern would have been disrupted if any tasks had been poorly designed. This view also acts as an alert system for teachers—if students put in significant effort but consistently score lower than their peers, it would be immediately visible. However, in this case, no such issues were observed.



Student diligence view (in Lithuanian *Mokinio kruopštumas*)

Learning analytics, while powerful, should always be complemented by the teacher's knowledge of the class and ideally used over a more extended period. These visualizations offer just one perspective on the broader picture of student learning.

Following the piloting at Klaipėda Gedminai Progymnasium, a structured discussion was held with 18 teachers from the school who had participated in the process. The feedback was highly positive: teachers appreciated the interactive tasks, highlighting their clarity, accessibility, and ability to engage students across different age groups.

Teachers emphasized that the activities supported the development of computational and algebraic thinking skills and fostered motivation and curiosity among learners. Many noted that even younger pupils could approach the tasks independently, while older students benefitted from the more advanced challenges that encouraged deeper problem-solving.

The teachers valued the ViLLE platform's intuitive design and its potential to provide meaningful learning analytics for monitoring student progress. Several participants remarked that the tasks could easily be integrated into their regular teaching practice and serve as a valuable tool for both enrichment and assessment.

Overall, the reflection confirmed that the piloting was very well received. The positive evaluation from teachers validated the project's approach. It provided the consortium with constructive suggestions for further refinement, ensuring that the tasks will continue to be relevant, user-friendly, and impactful in real classrooms.