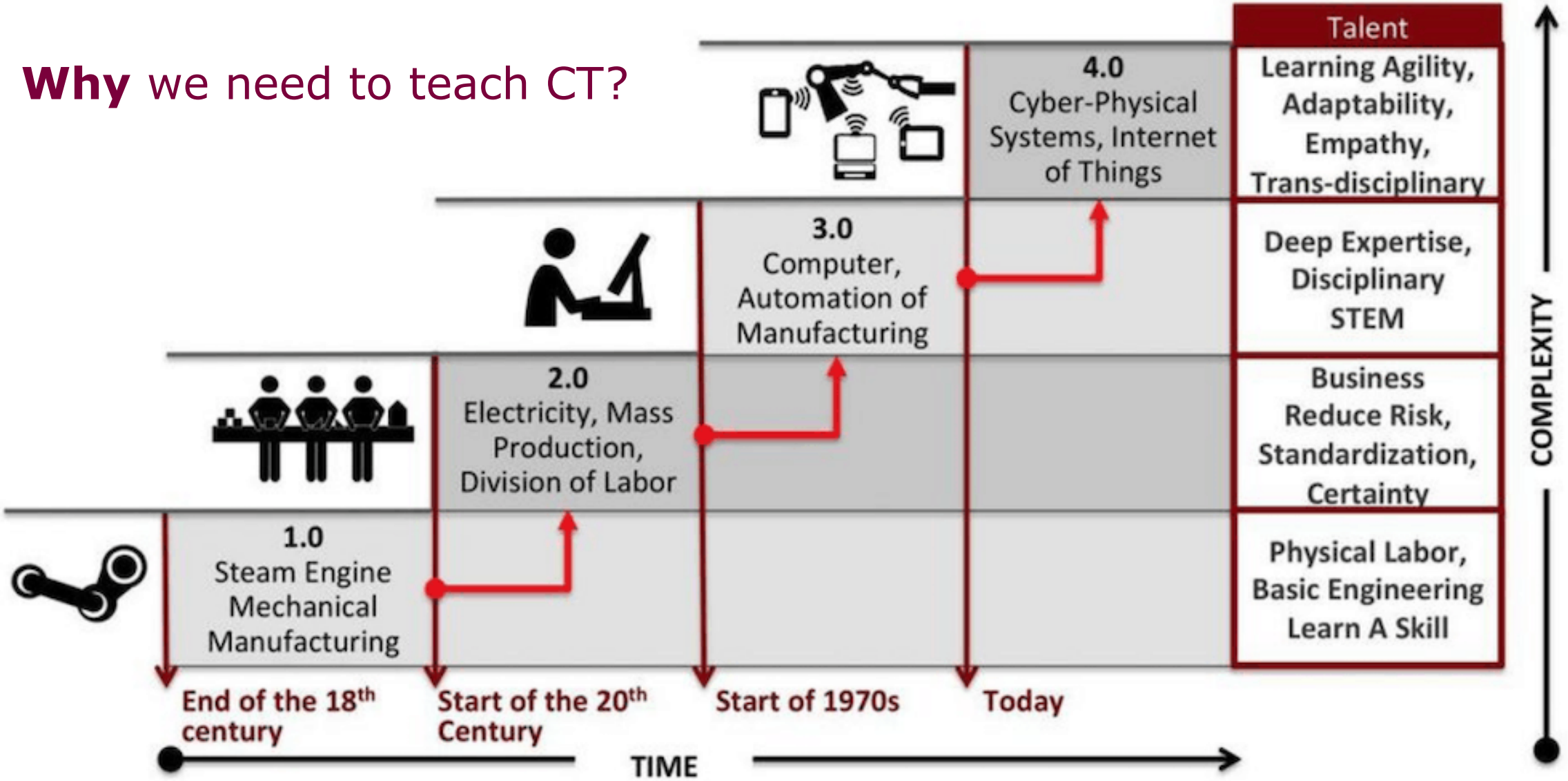
Vilnius University

Introducing Informatics in Primary Education: Curriculum and Teachers' Perspectives

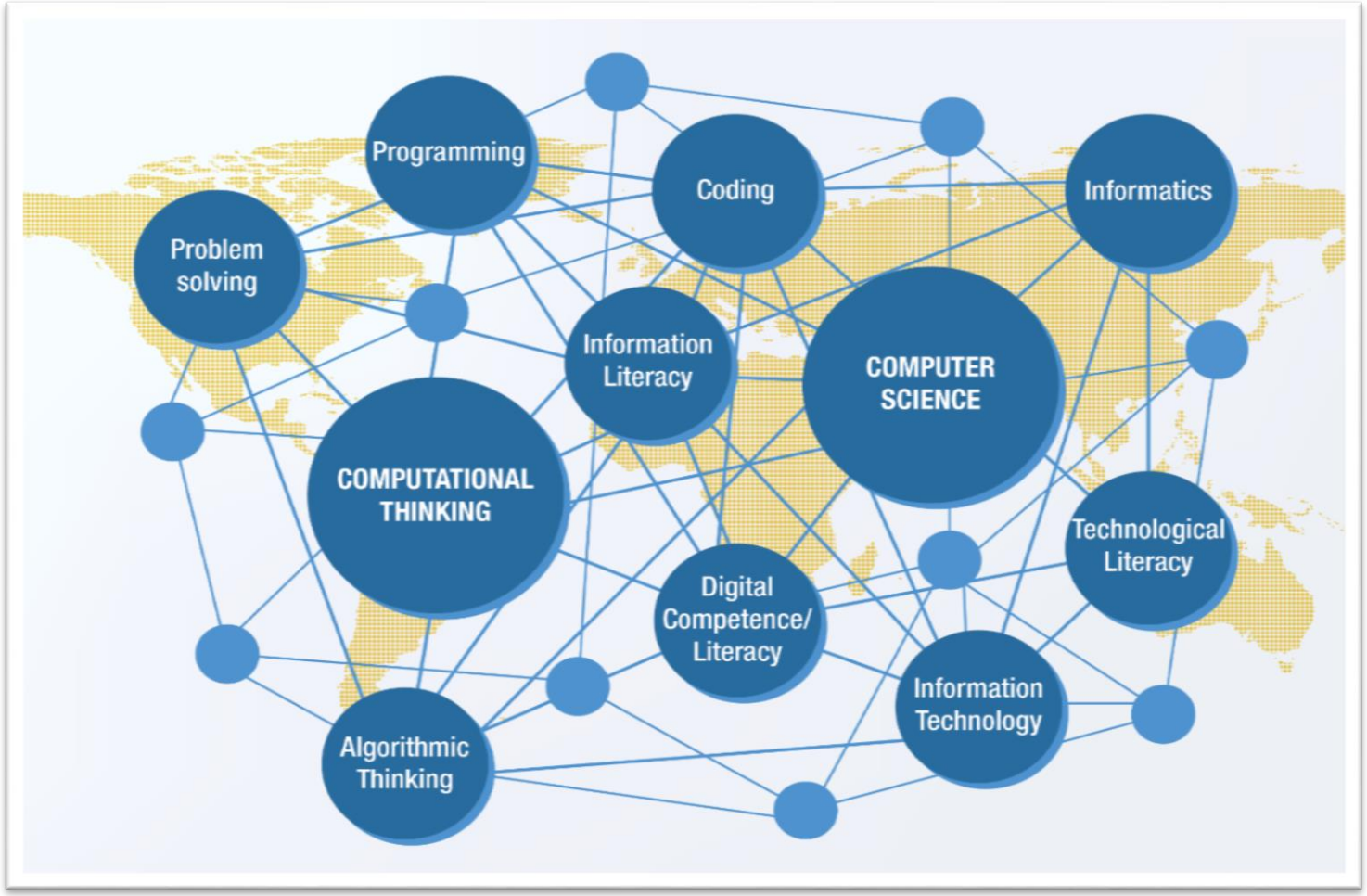
Valentina Dagienė, valentina.dagiene@mif.vu.lt
Tatjana Jevsikova, tatjana.jevsikova@mif.vu.lt
Gabrielė Stupurienė, gabriele.stupuriene@mif.vu.lt

Future of Work: 4th Industrial Revolution (World Economic Forum)

Why we need to teach CT?



CT and related terminology



- **Emphasis on a particular aspect of CT** (e.g. "Algorithmic thinking" captures the spirit of computing, the art of computing)
- **Stakeholders' acceptance and preference** for other well-established terms e.g. problem solving, algorithmic thinking and critical thinking
- The **context of use** (academia versus policy documents)
- **Soundness** in national languages

https://publications.jrc.ec.europa.eu/repository/bitstream/JRC104188/jrc104188_computhinkreport.pdf

Informatics in primary education

Vilnius University

The main Challenges:

- Curriculum
- Integration
- Teacher education & support
- Content development
- Research
- ...

Vilnius University

Aim of research

- to study the tendencies of Informatics education in primary school,
- to analyze and share Lithuanian experience on introducing a primary school Informatics curriculum and teacher preparation.

Research questions

Vilnius University

1. What is the up-to-date picture of introduction of Informatics in primary education in various countries?
2. What are the general differences in big topics (areas) of primary Informatics education curriculum?
3. How Lithuanian teachers are prepared for introduction of the new Informatics curriculum on the national level?

Vilnius University

Research methodology

- Study of expert answers during spring-summer period in 2019:
  - **52 experts** representing different **countries.**
  - High competence requirements in the topic.
  - General confidence level is evaluated as high (median: 5; mean: 4.6).

Participating countries

Vilnius University

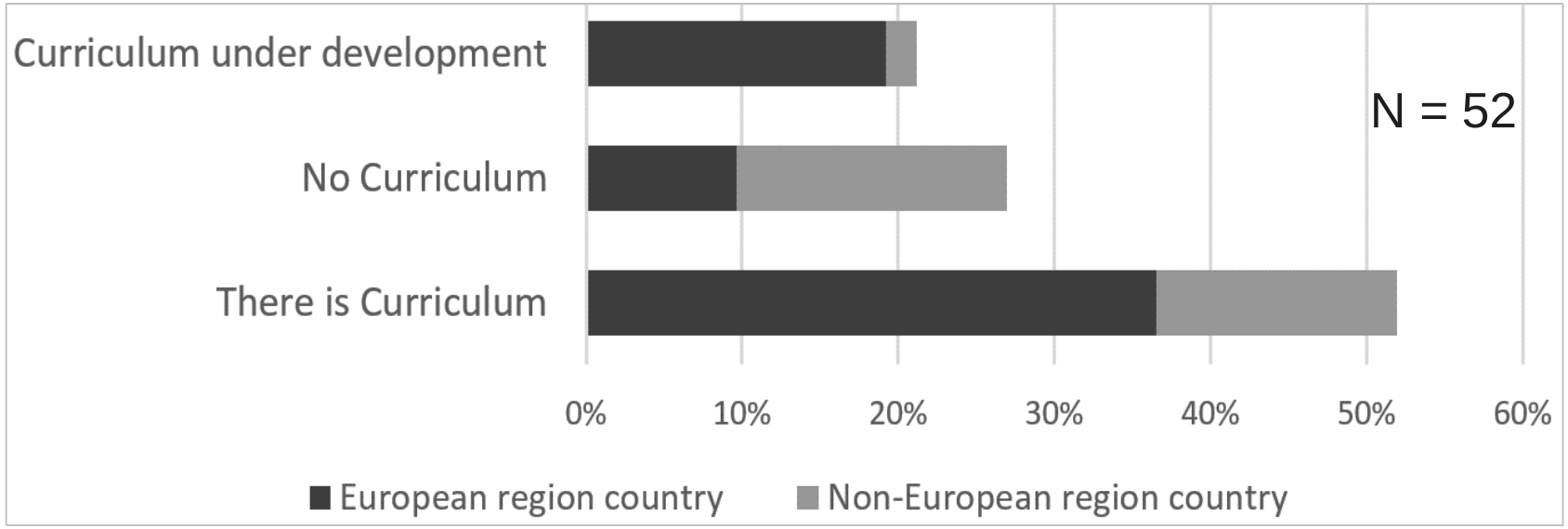
- **European region – 34 countries**:
  - Austria, Belarus, Belgium, Bosnia and Herzegovina, Bulgaria, Croatia, Czechia, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Macedonia, Malta, Netherlands, Norway, Poland, Portugal, Romania, Russia, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, United Kingdom, Ukraine.
- **Non-European region – 18 countries**:
  - Algeria, Australia, Cyprus, Cuba, India, Indonesia, Iran, Japan, Malaysia, Palestine, Philippines, Singapore, South Africa, South Korea, Thailand, Tunisia, Turkey, Uzbekistan.

Results

Vilnius
University

Existence of Informatics curriculum in primary education

Vilnius University

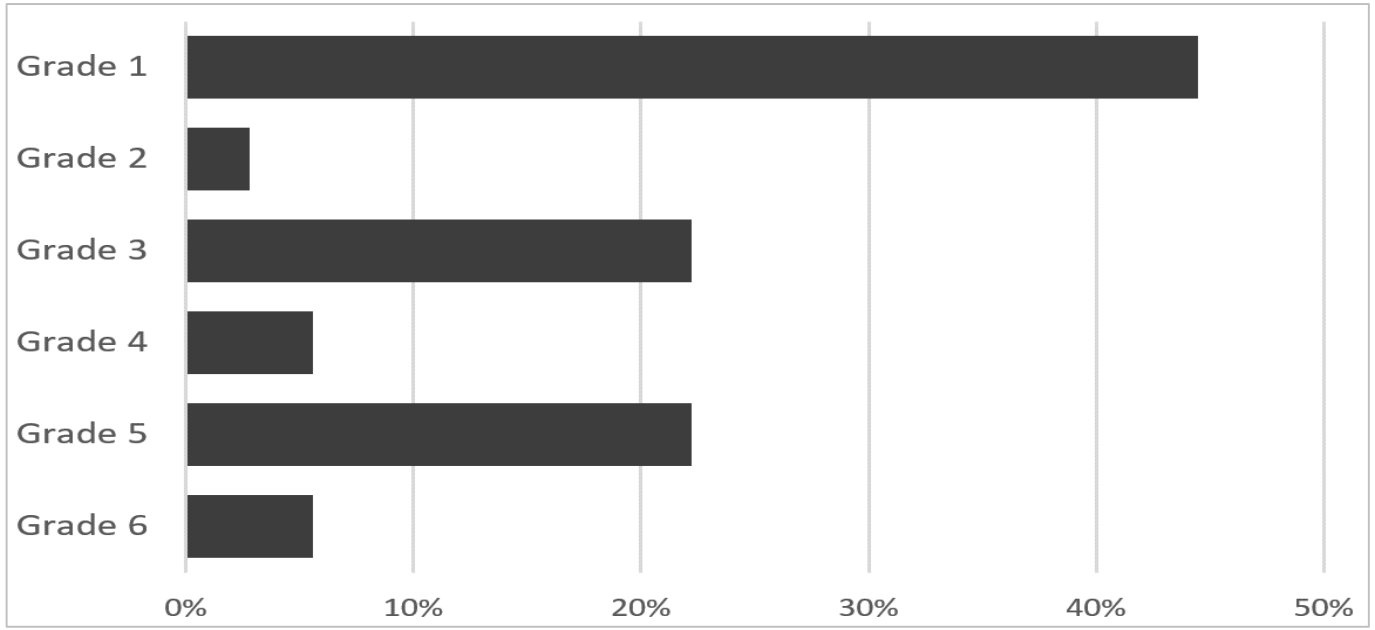


52% of surveyed countries (27 countries) have already **introduced** Informatics **curriculum** for primary education.

Curriculum is **being developed** at the moment in **21%** of all surveyed countries.

Start of Informatics introduction

Vilnius University



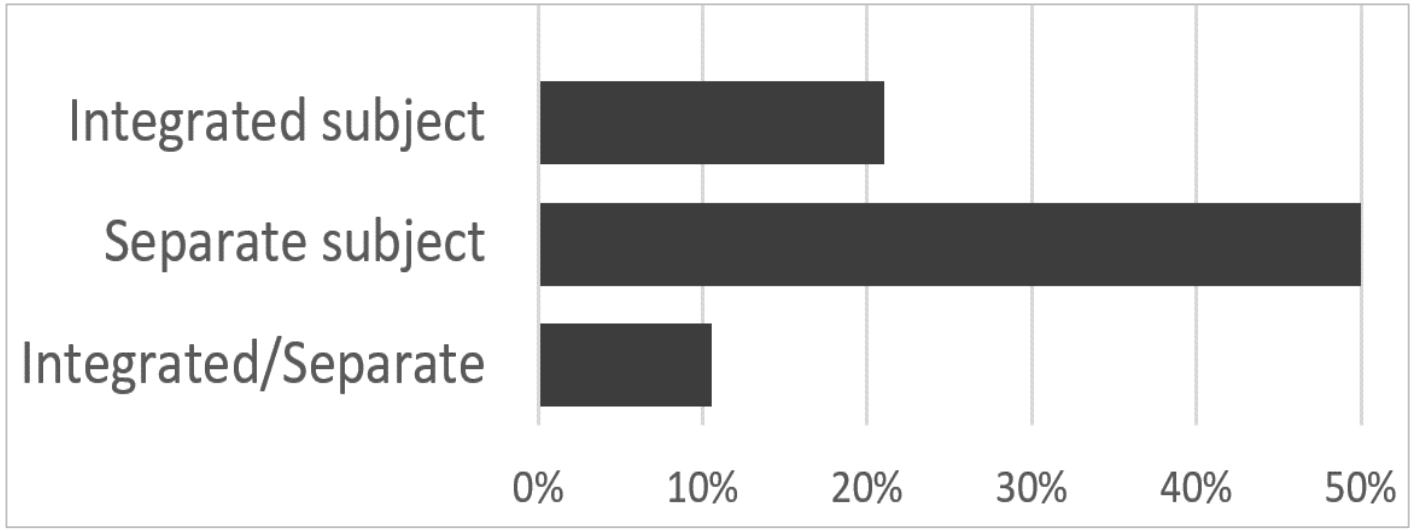
N = 37

Countries that introduce informatics in primary school

- Only 33% out of all surveyed countries, or 46% out of countries with Informatics in primary education introduce Informatics in grades 1 or 2:
- Australia, Belarus, Bosnia and Herzegovina, Cuba, Denmark, Estonia, Greece, Indonesia, Norway, Poland, Romania, Russia, Sweden, Switzerland, Thailand, UK, Ukraine.

Integrated or separated subject

Vilnius University



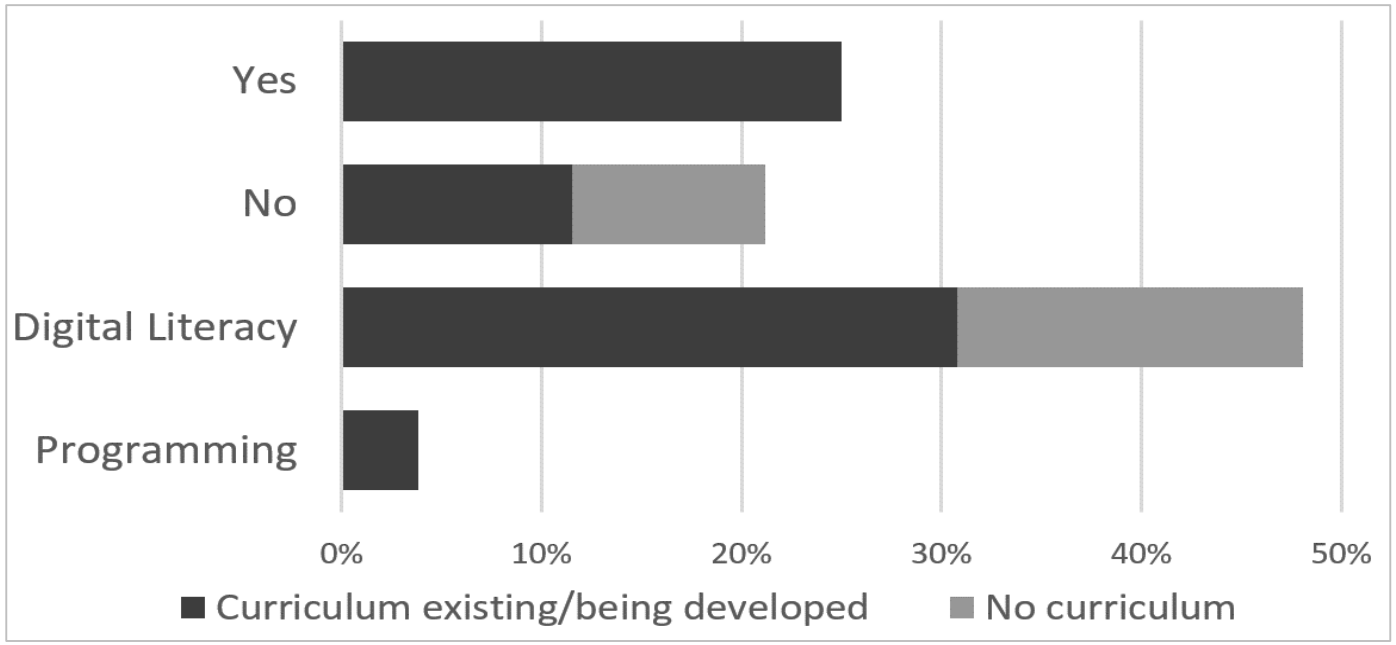
N = 38

Has curriculum/being developed

- **50%** of countries introduce Informatics as a **separate** subject in primary education
- **21%** of countries include basics of Informatics in primary education in an **integrated** way.
- Both: differences in integration in grades, selection on a school level, etc.

Pre-service teacher training

Vilnius University



N = 52

- **77%** of surveyed countries have **included elements of Informatics** into **primary teacher education programs.**
- However, almost in half of surveyed countries (**46%**) teacher training is mostly **limited to digital literacy**.

Topics (competence areas) of Informatics in primary edcuation

Vilnius University

- Lithuania is undergoing Informatics curriculum development process for primary education since 2016.
  - More than 30-year way of teaching Informatics in schools: Informatics in Lithuanian schools has been introduced as a compulsory subject since 1986
  - Since 1995, a national exam in informatics has been installed.

- In order to compare topics introduced in different countries, we used 6 topics of recently developed Lithuanian curriculum.
- Start of Informatics from Grade 1.

Topics (competence areas) in curriculum of Lithuania

Vilnius University

1. Digital content
2. Algorithms and programming
3. Problem solving
4. Data and information
5. Virtual communication
6. Safety and copyright

Inside the competence areas...

Vilnius University

Digital content	Algorithms and programming
1. Familiarize with digital content diversity. 2. Use digital content to learn in various subjects. 3. Create digital content, using various technologies. 4. Evaluate and improve digital content.	1. Understand an importance of algorithm and program for problem solving. 2. Perform actions of algorithm / program. 3. Identify sequencing, branching, loop actions and express them by commands, apply logical operations. 4. Create and run programs using gamified programming tools and environments. 5. Test, debug and enhance programs.

Inside the competence areas...
(continued)

Vilnius University

Virtual communication	Safety and copyright
1. Understand purpose and importance of virtual communication. 2. Communicate by the means of digital technologies. 3. Collaborate by the means of digital technologies, share found/created digital resources. 4. Discuss and evaluate possibilities and risks of virtual communication.	1. Perceive the necessity to protect digital devices from malicious software. 2. Protect personal data. 3. Discuss copyright and piracy issues. 4. Protect health while using digital technologies. 5. Protect environment while using digital technologies.

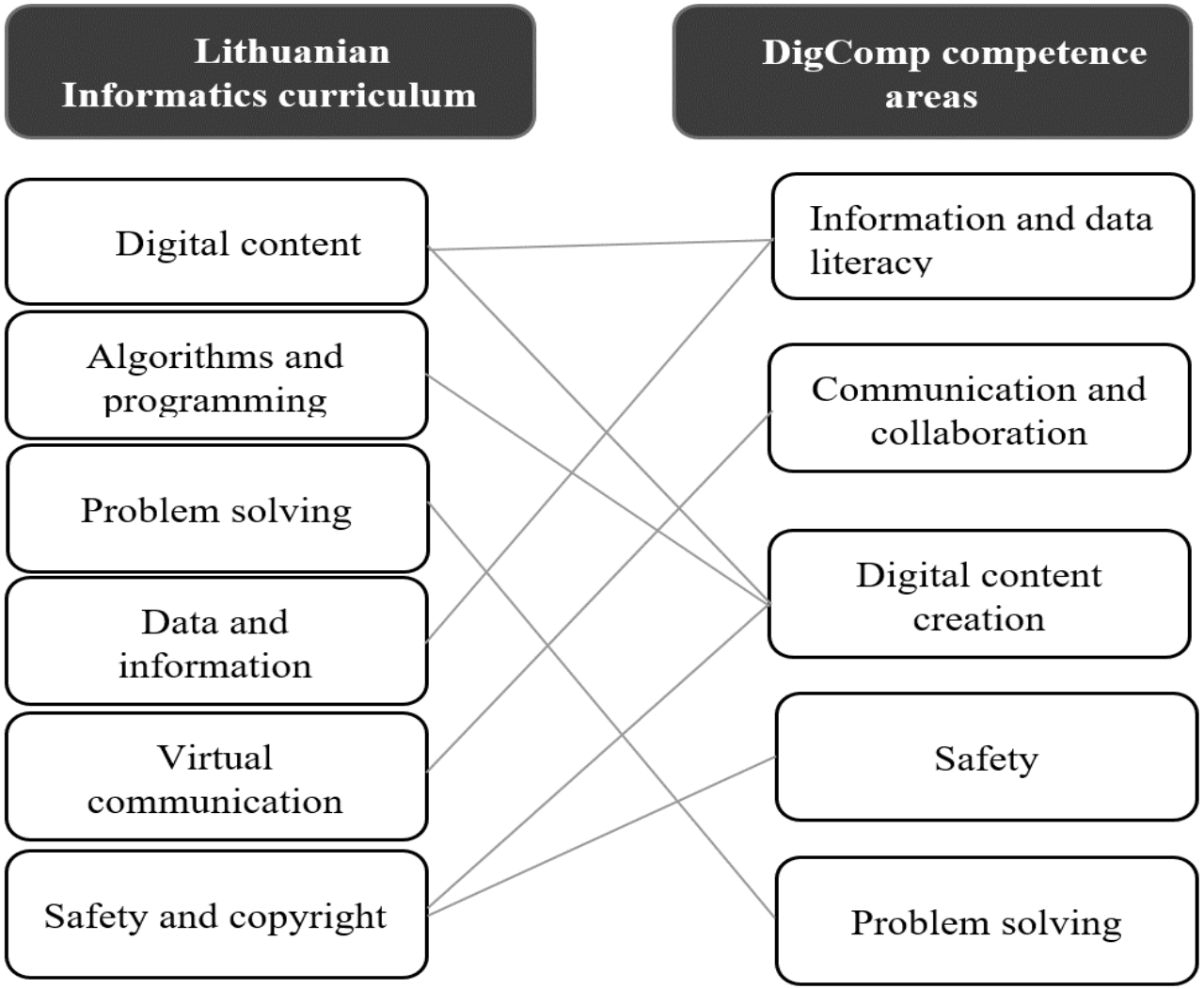
Inside the competence areas...
(continued)

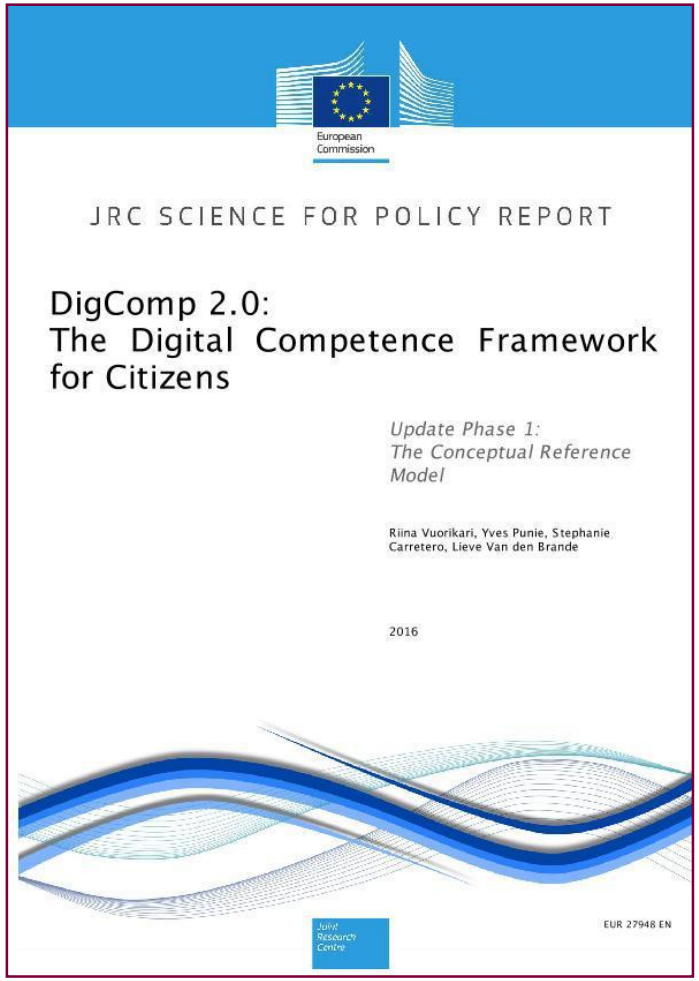
Vilnius University

Problem solving	Data and information
1. Identify problems occurring when using digital technologies. 2. Creatively use digital technologies learning various sub-jects. 3. Select and apply appropriate digital technologies to solve tasks. 4. Evaluate own digital skills.	1. Understand purpose and benefit of data and information management by digital technologies. 2. Search information purposefully using digital technologies. 3. Collect, store, manage data. 4. Discuss and evaluate information relevance and reliability.

Lithuanian curriculum and *DigComp*

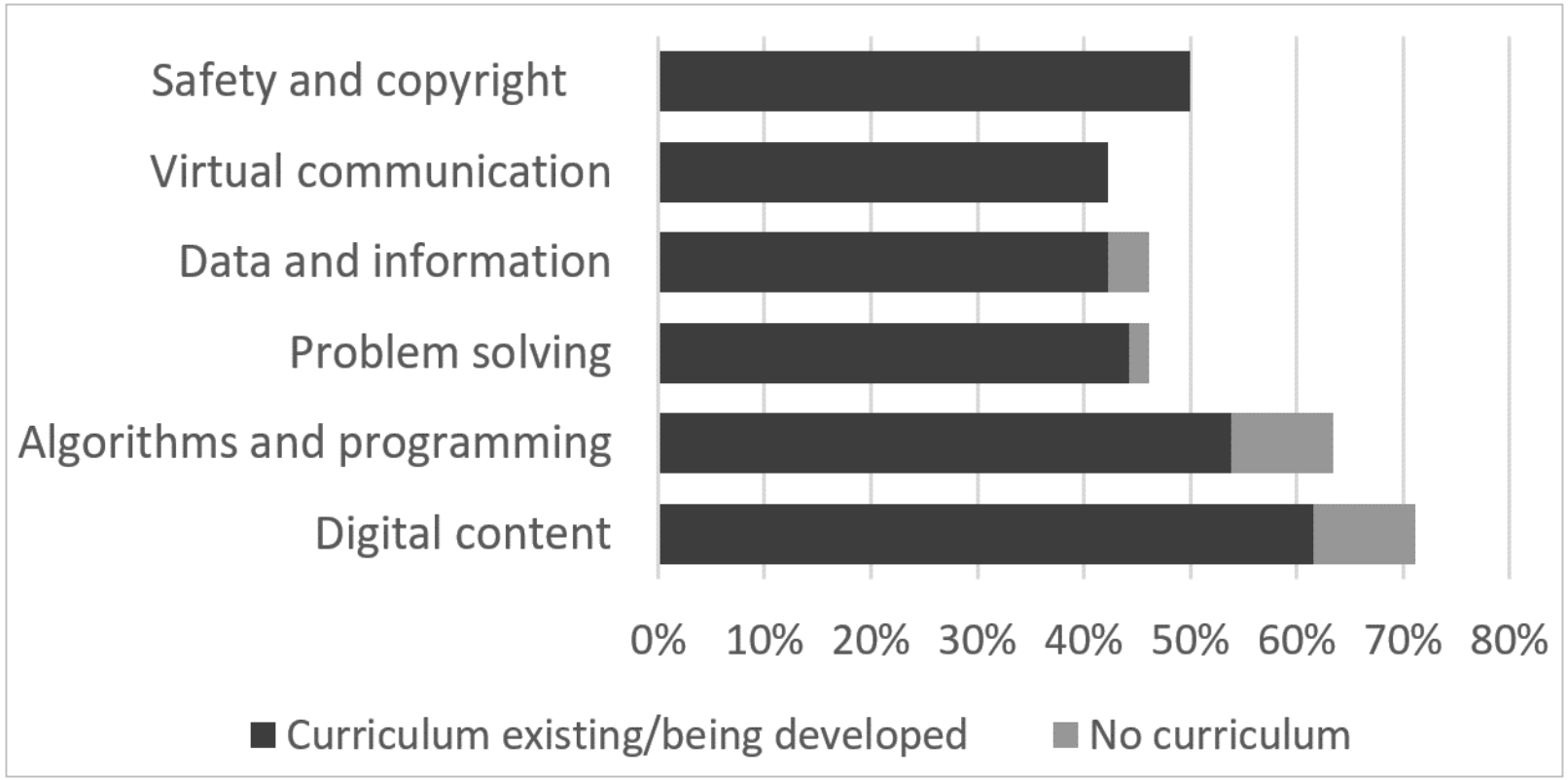
Vilnius University





Comparison with the surveyed countries' topics in primary school Informatics

Vilnius University



N = 52

Primary School Teachers Readiness for Informatics Curriculum Implementation. Lithuanian case

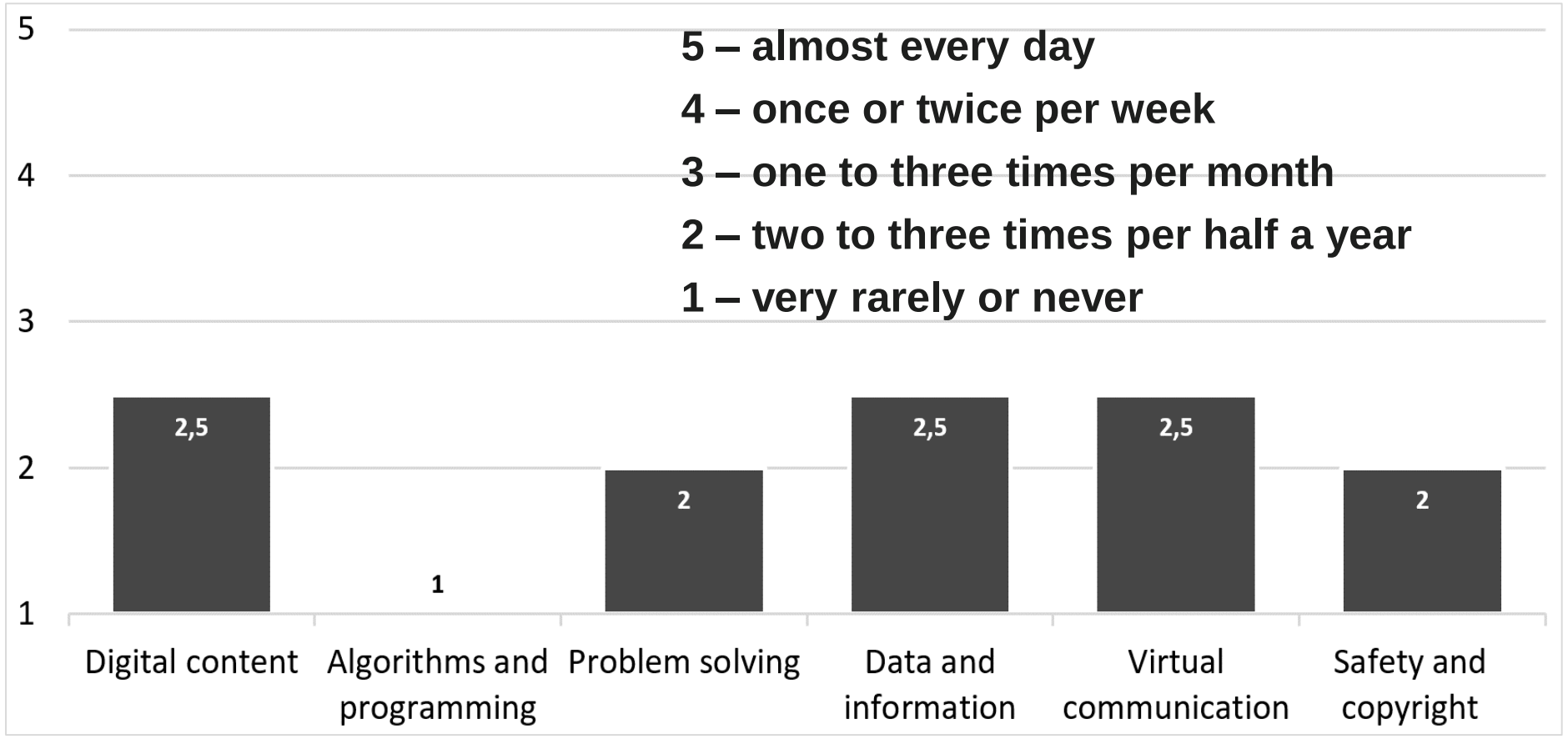
Vilnius University

- 10 schools were selected, where primary teachers in school year 2017/2018 implemented practically draft Informatics curriculum, closely collaborated with researchers who consulted them.
- A year later, 90 more schools have been selected for pilot implementation of Informatics curriculum.
- Before activities with 100 schools have started, in the beginning of school year 2018/2019, a study on teacher readiness to implement the new Informatics curriculum in primary schools has been run.
  - **1342 primary school teachers** (this makes up about 21% of all primary teachers in Lithuania) working in primary schools of different municipalities across all Lithuania.

Students' Informatics skills development during the lessons (generalized results)

N = 1342

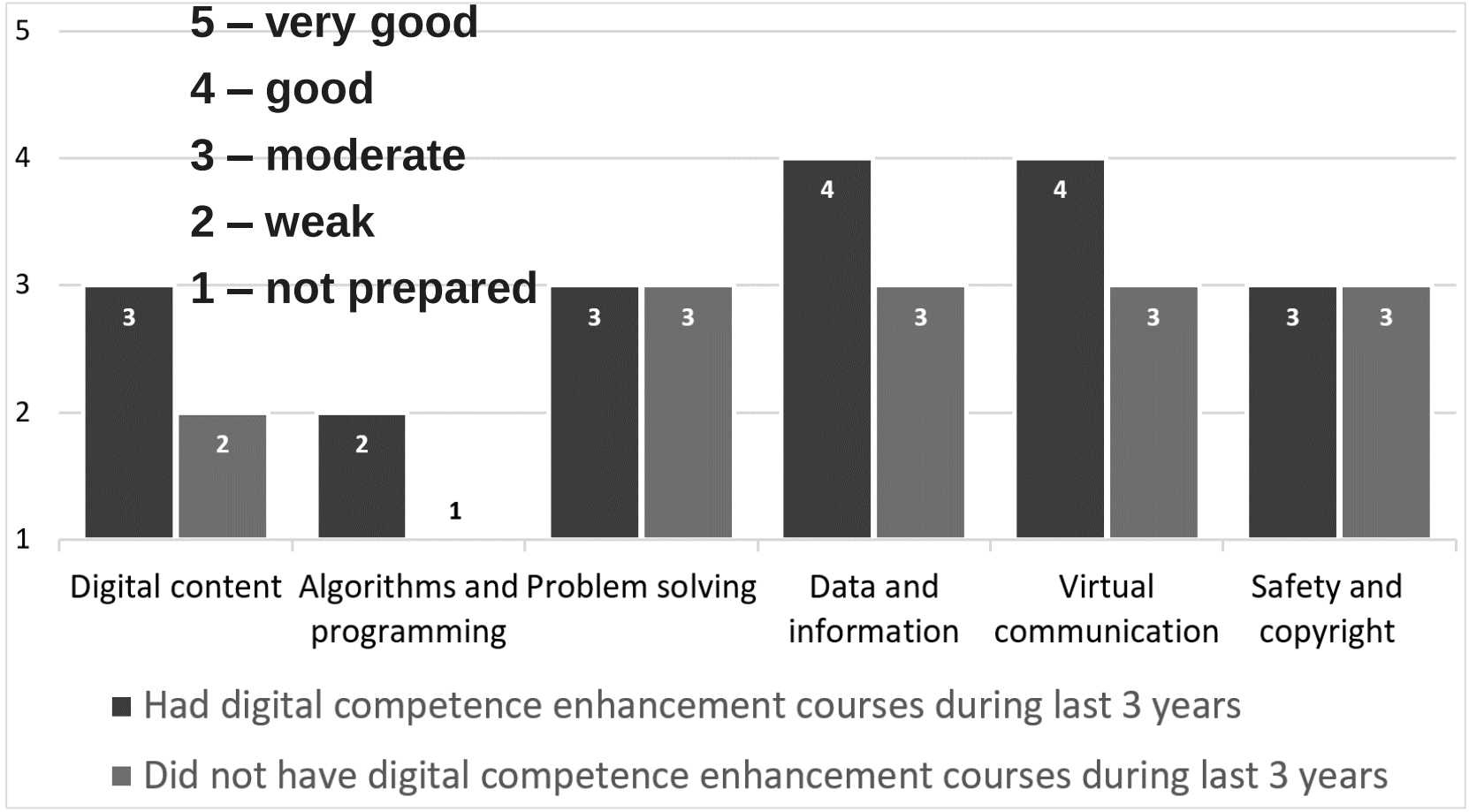
Vilnius University



Primary school teachers' competence self-evaluation to teach Informatics skills

N = 1342

Vilnius University



KURIU IR MĄSTAU. Integruotos Informatikos užduotys – smagių uždavinių rinkinys, padedantis žingsnelis po žingsnelio ugdyti informatinio mąstymo įgūdžius, reikalingus būsimiems kompiuterių, robotų, naujų išmaniųjų įrenginių kūrėjams.

Pagal projekto „Informatika pradiniame ugdyme“ gaires parengtas leidinys yra susijęs su integruoto ugdymo vadovėliu „Vaivorykštė“, todėl jame esančias užduotis galima įtraukti į pasaulio pažinimo, matematikos, gimtosios kalbos ar kitų mokomųjų dalykų turinį.

Leidinį papildo metodiškai paaiškinti užduočių sprendimai ir atsakymai, kuriuos galima rasti skaitmeninėje ugdymo priemonėje e.lankos (www.e-lankos.lt) arba leidyklos svetainėje (baltulankuvadoveliai.lt/kuriu-ir-mastau/).

Pradinėms klasėms skirtas
integruoto ugdymo vadovėlis „Vaivorykštė“

www.vaivorykste.eu

9 786094 701214
www.baltulankuvadoveliai.lt

Valentina Dagienė

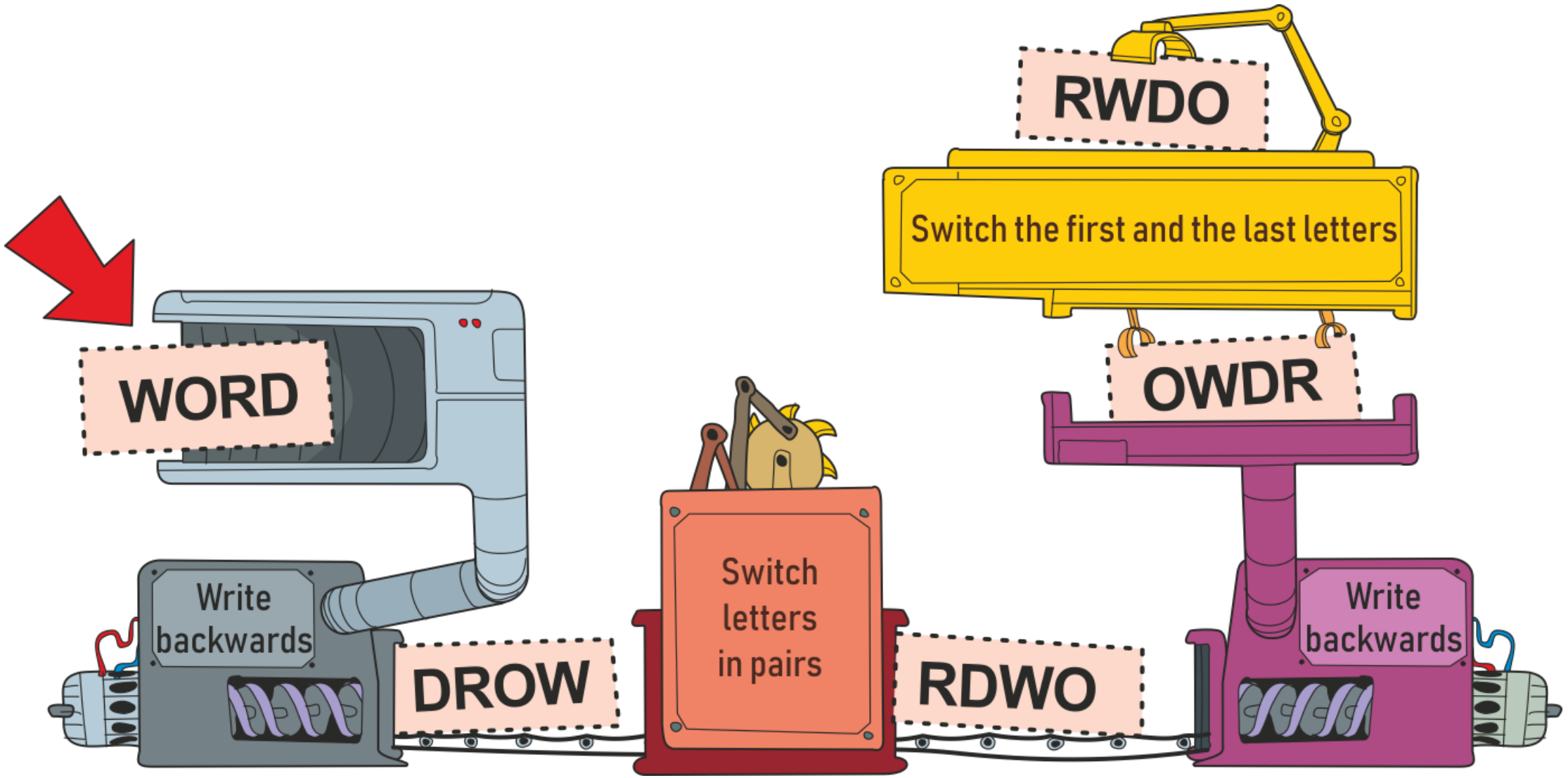
MĄSTAU IR KURIU

Integruotos informatikos užduotys 6–8 metų vaikams

baltos lankos

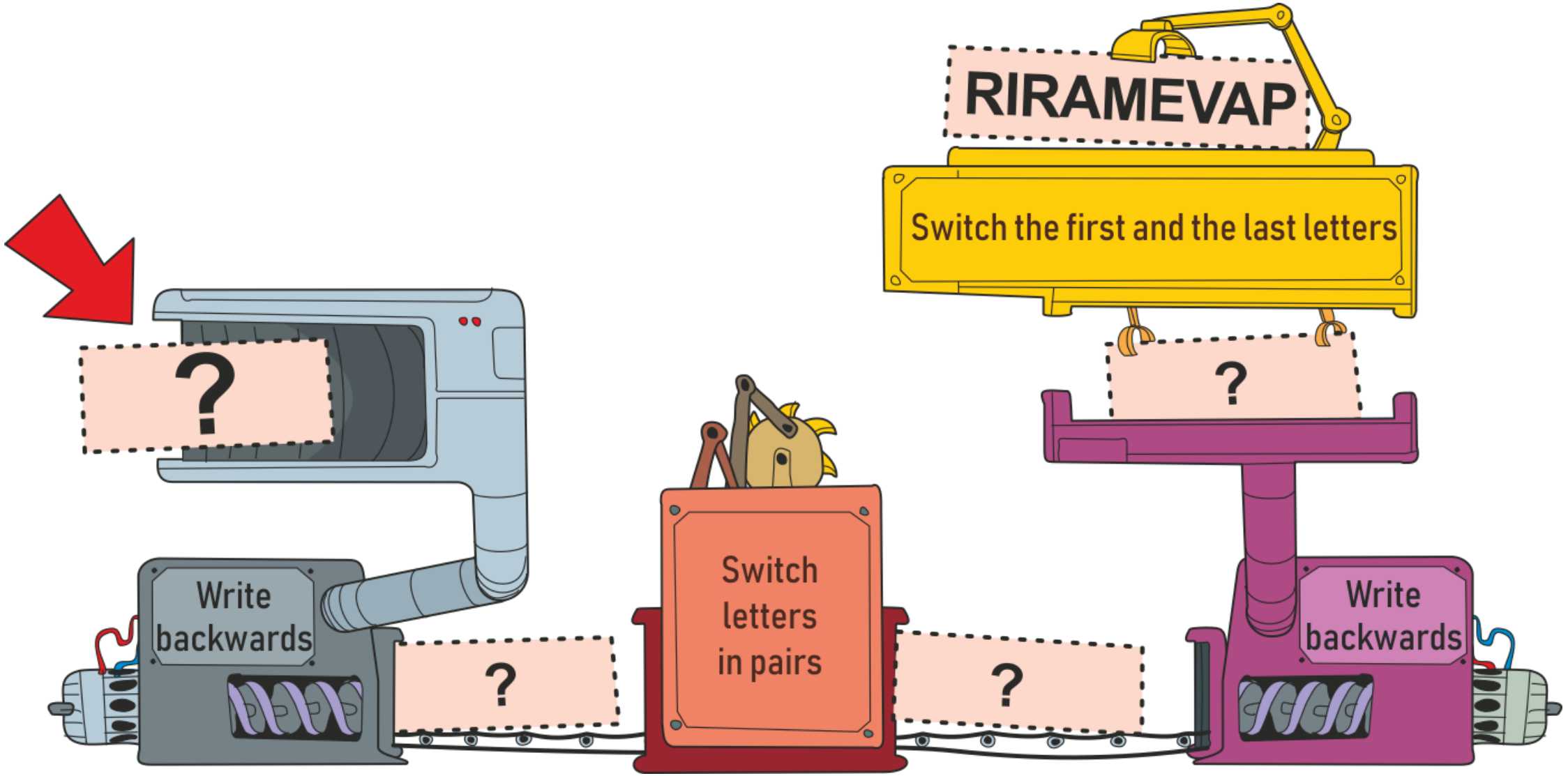
Text machine

The example



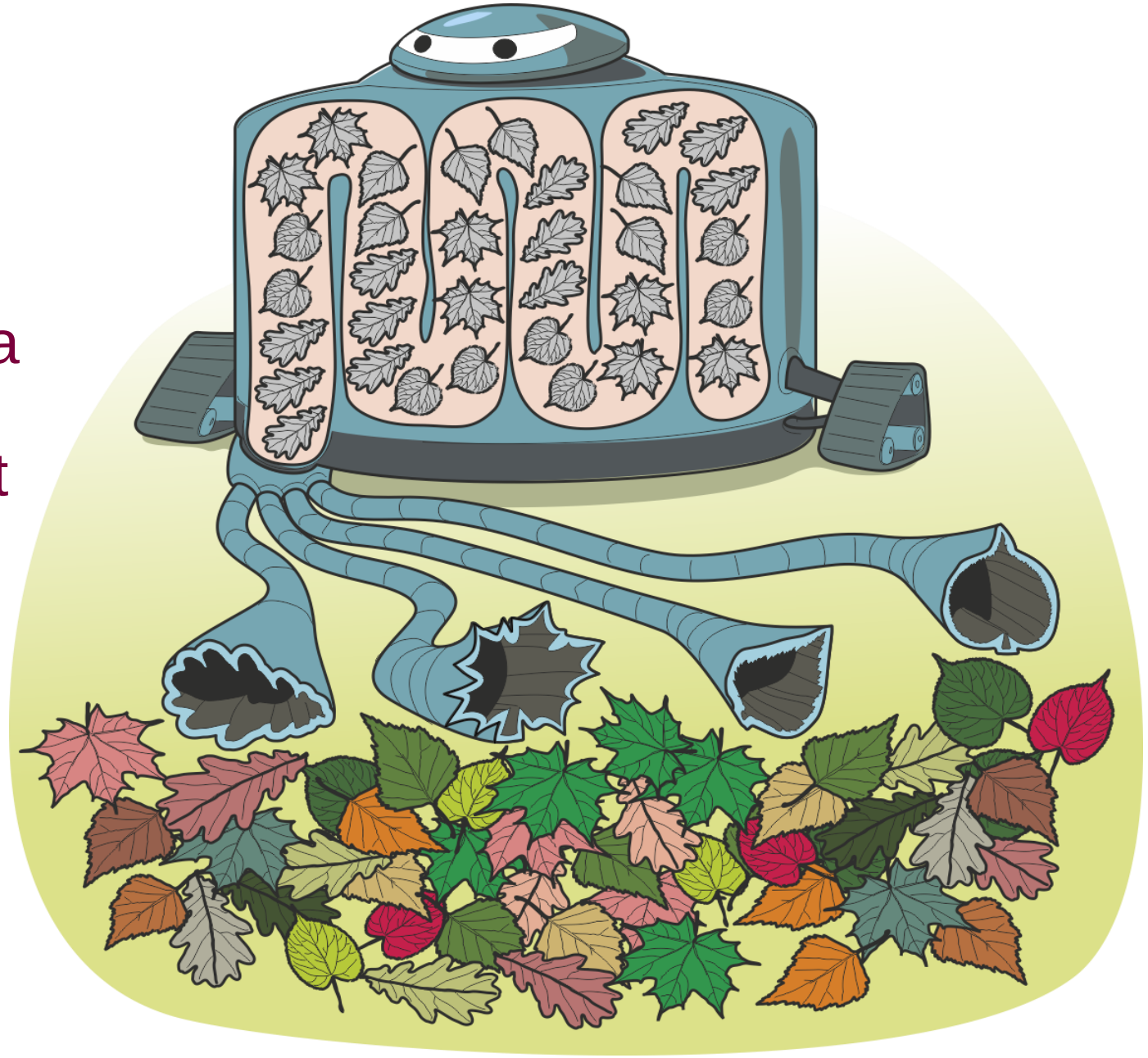
Text machine

Task



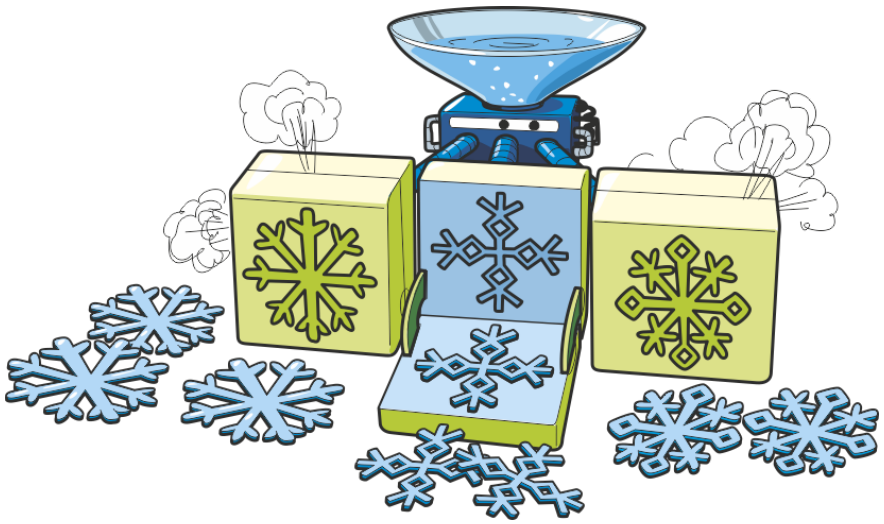
Smart robot pumps in the leaves in a certain sequence.

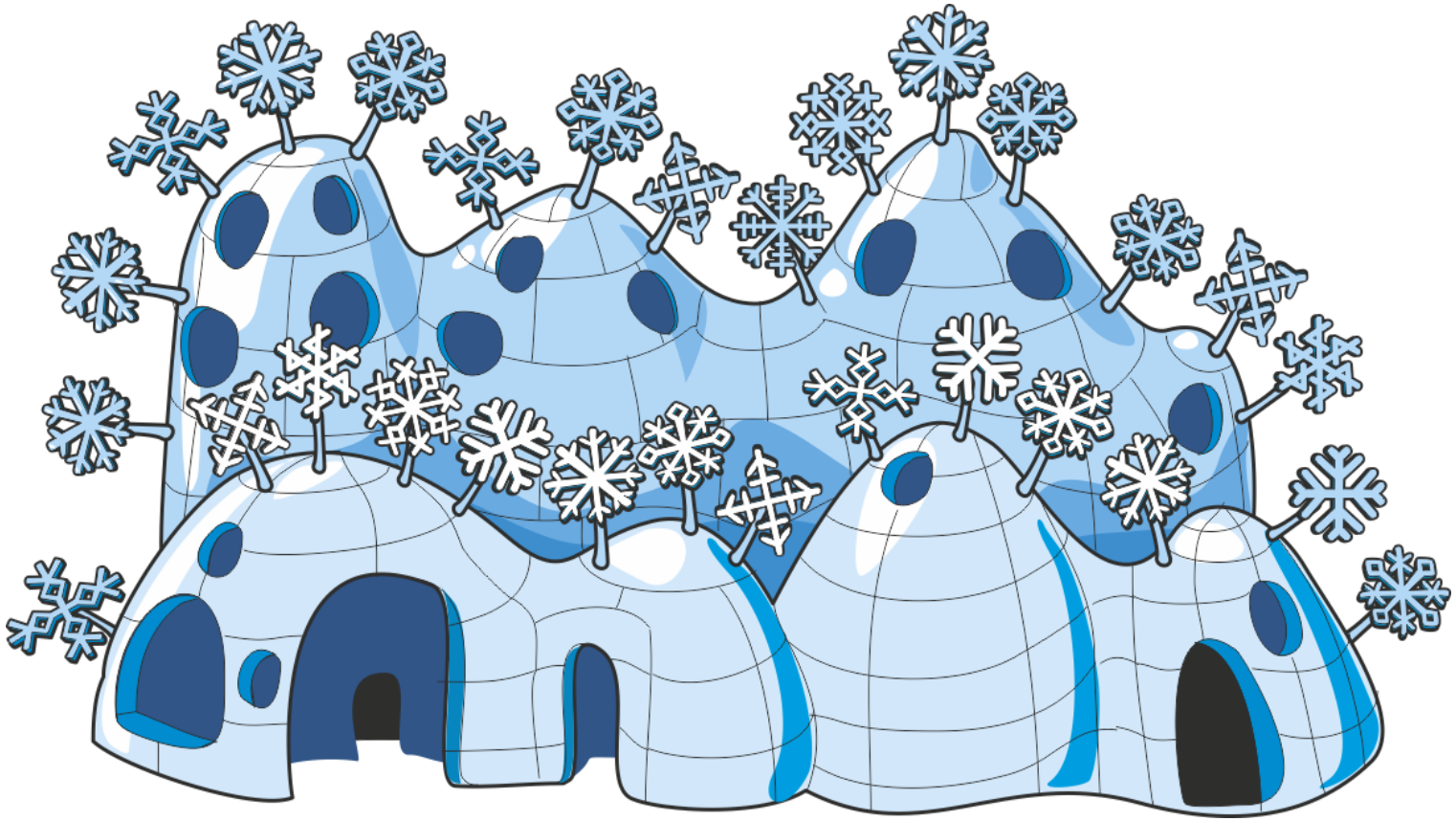
- Do you notice a pattern in a sequence?
- Which is the next leaf robot will pump in now?



Ice Hotel

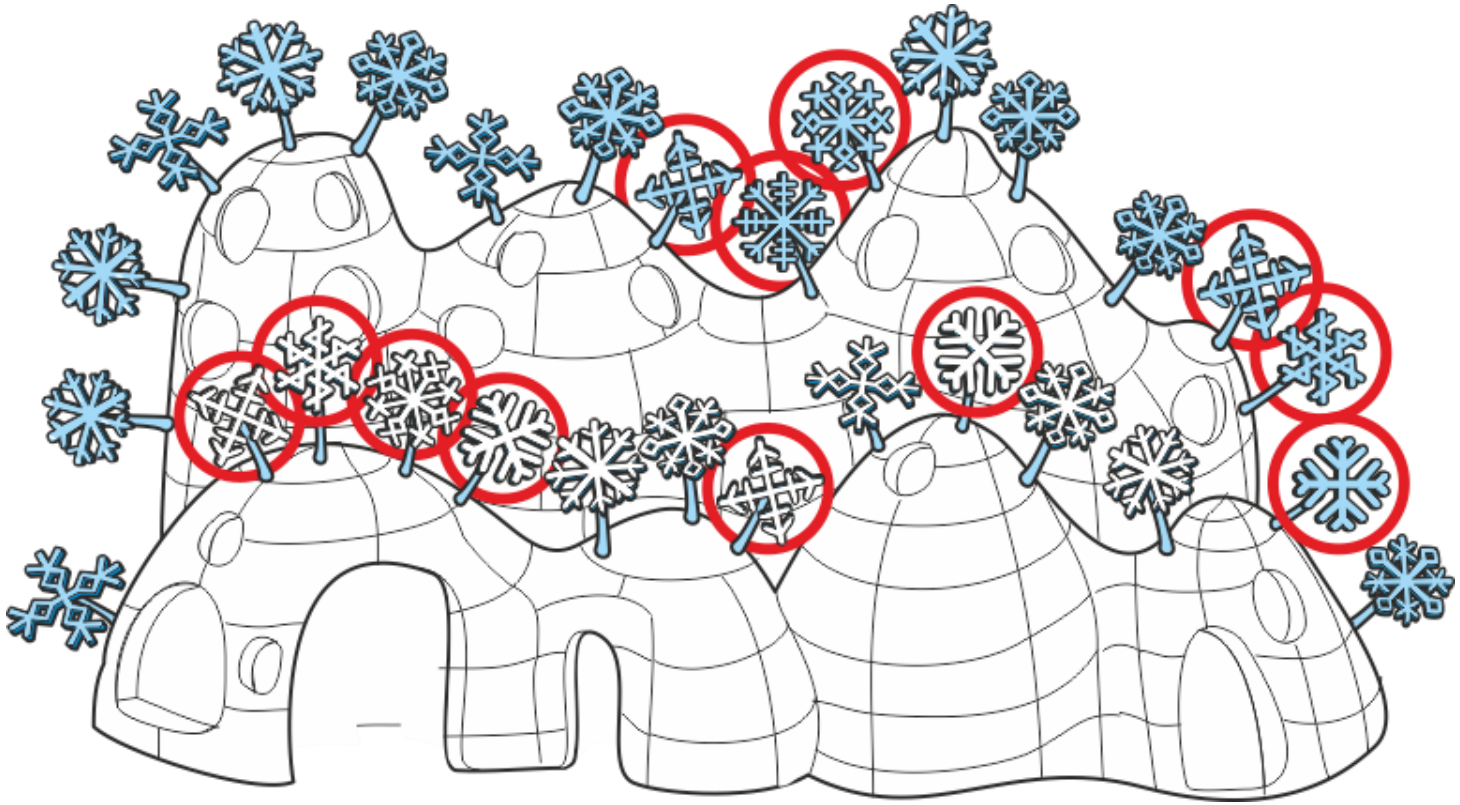
Little Snowflake robot produces three kind of snowflakes for decorating Ice Hotel.





- Mark the snowflakes that could not be produced by Snowflake robot. How many such snowflakes are there? Count them and write down the number.
- Count and write down, how many snowflakes of every kind Snowflake robot has produced

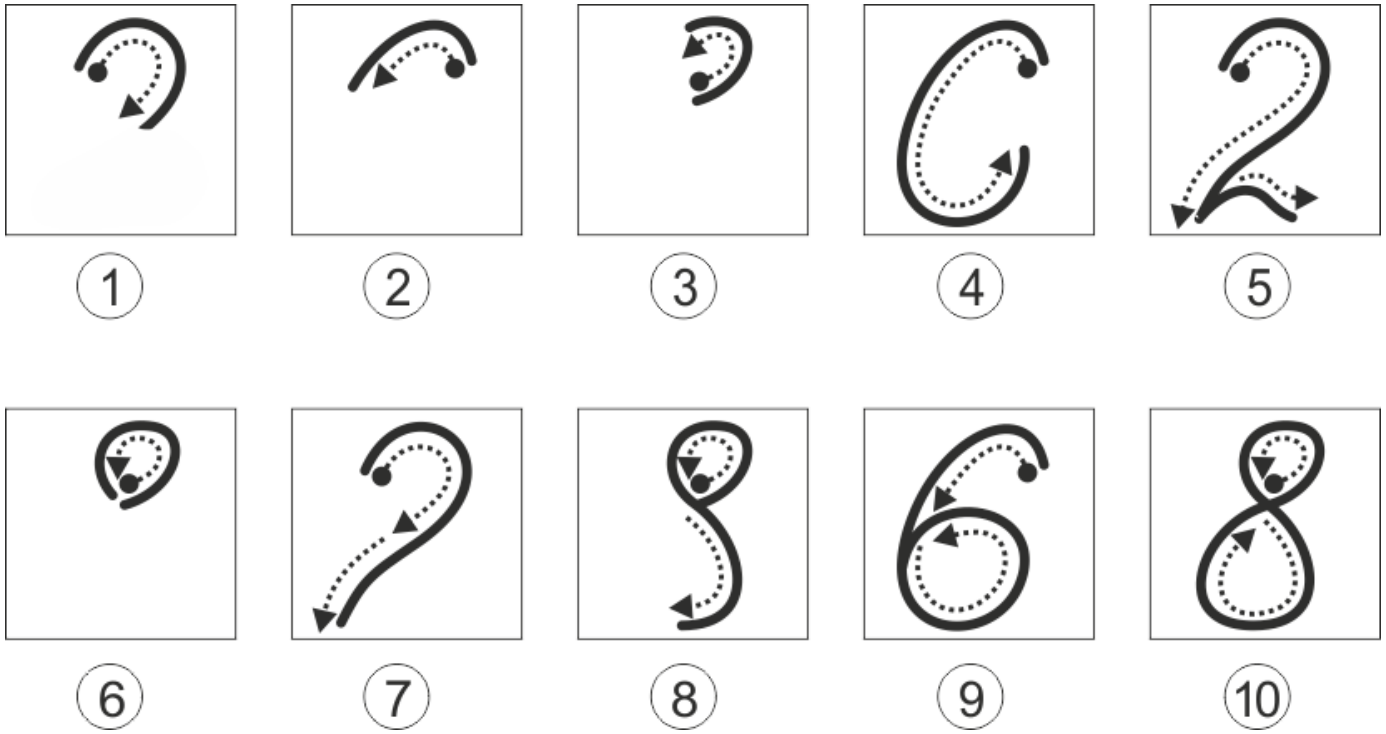
Ice hotel



12 showflakes could not be produced by the Showflake machine

How to write digits 2, 6, 8

We write digits, as well as letters, in a certain order. The order how to write 2, 6 and 8 in steps is shown, but the sequence of pictures is mixed.



Write down **digit 2** writing numbers in a sequence.

Write down **digit 6** writing numbers in a sequence.

Write down **digit 6** writing numbers in a sequence.

Image in a computer

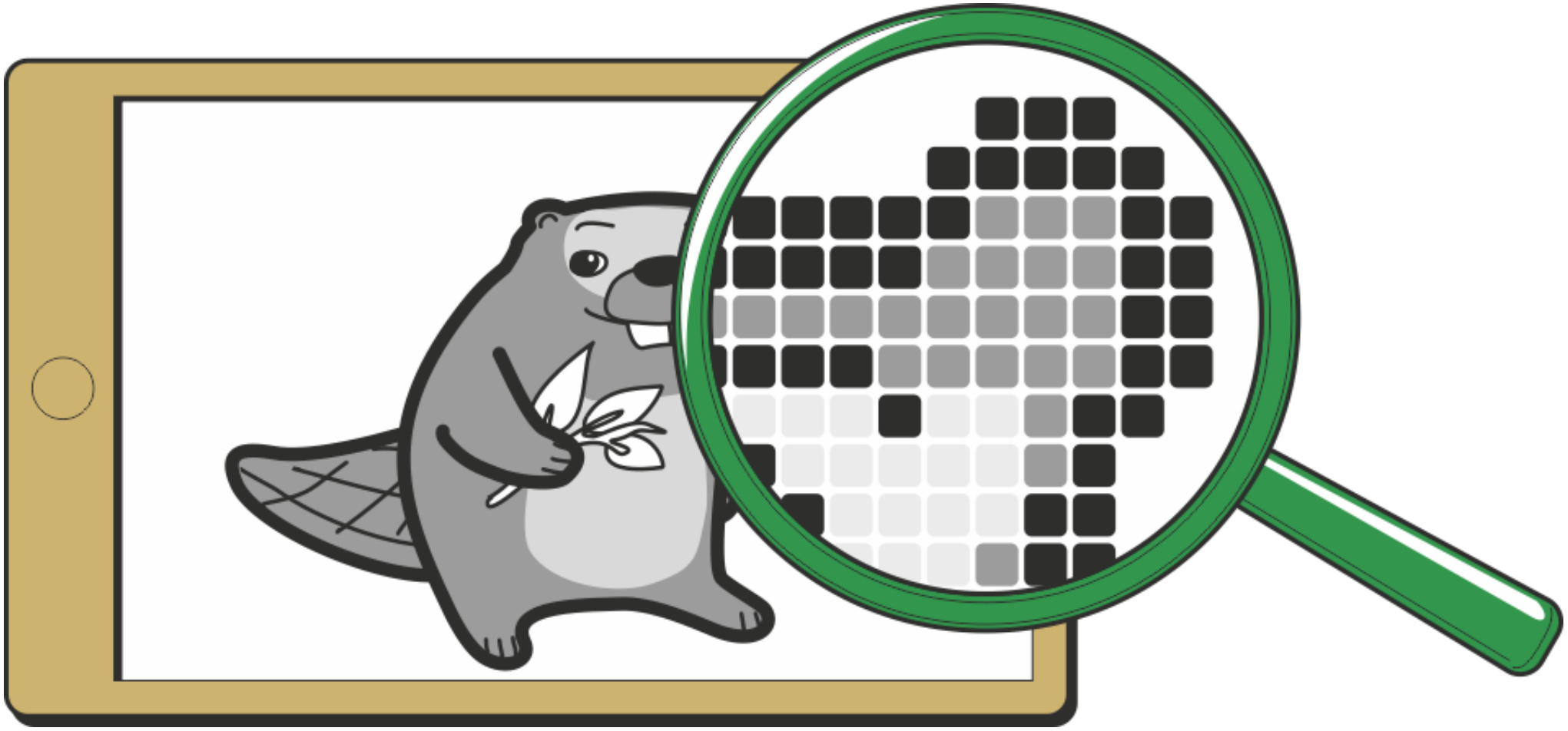
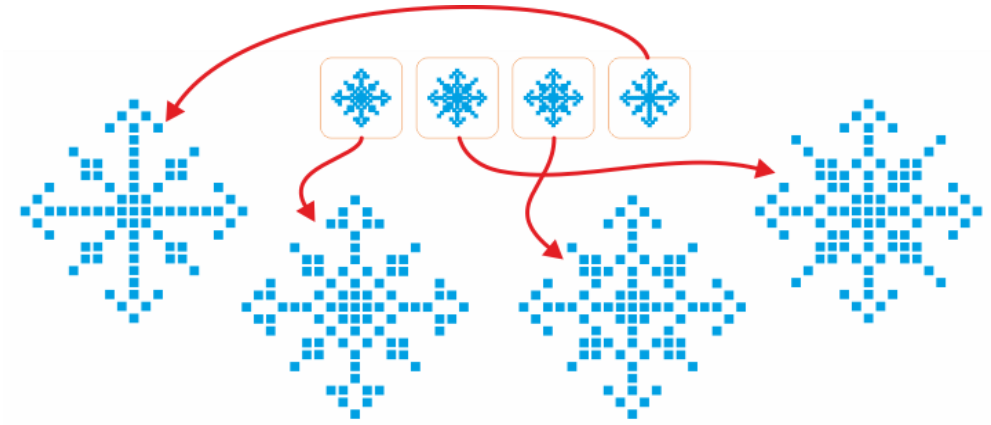
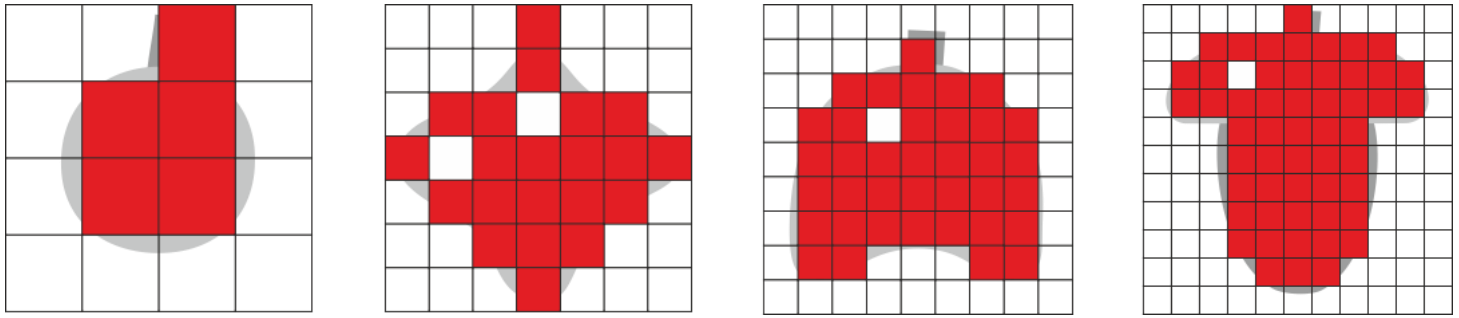


Image in a computer



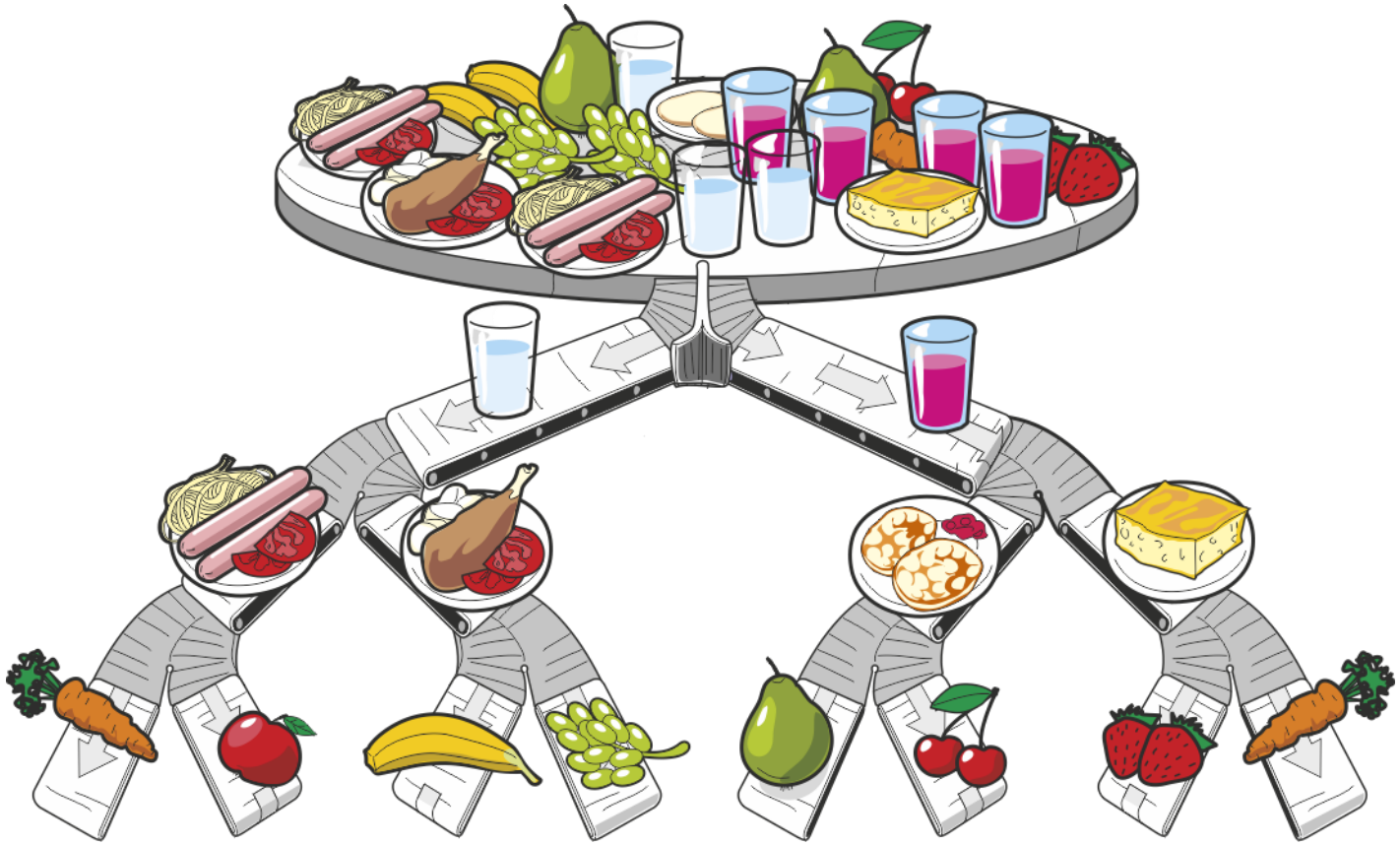
Small snowflakes were magnified several times. Connect with lines small snowflakes, corresponding the magnified ones.



Food machine

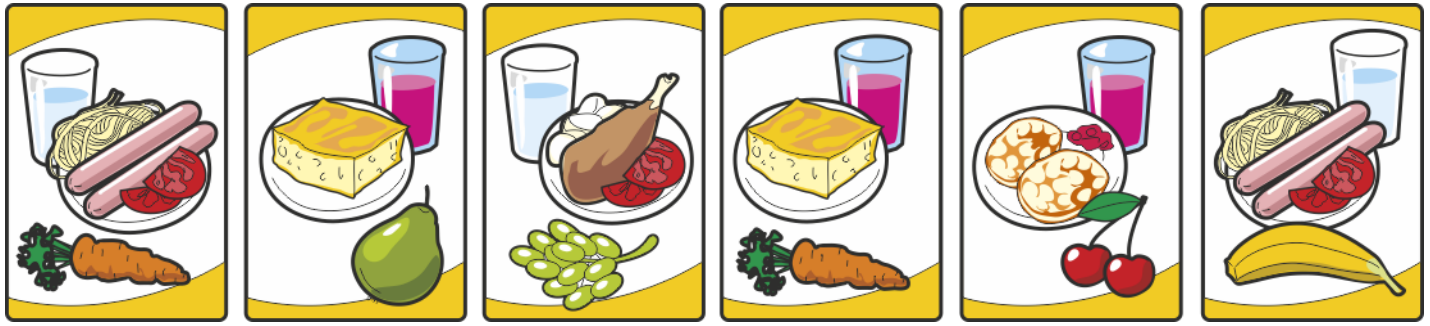
A food dispenser delivers meals in the canteen.
The advertisement posters depict several lunch sets.

Mark with plus sign (+) the lunch sets that can be delivered by the food dispenser.



Could you get:

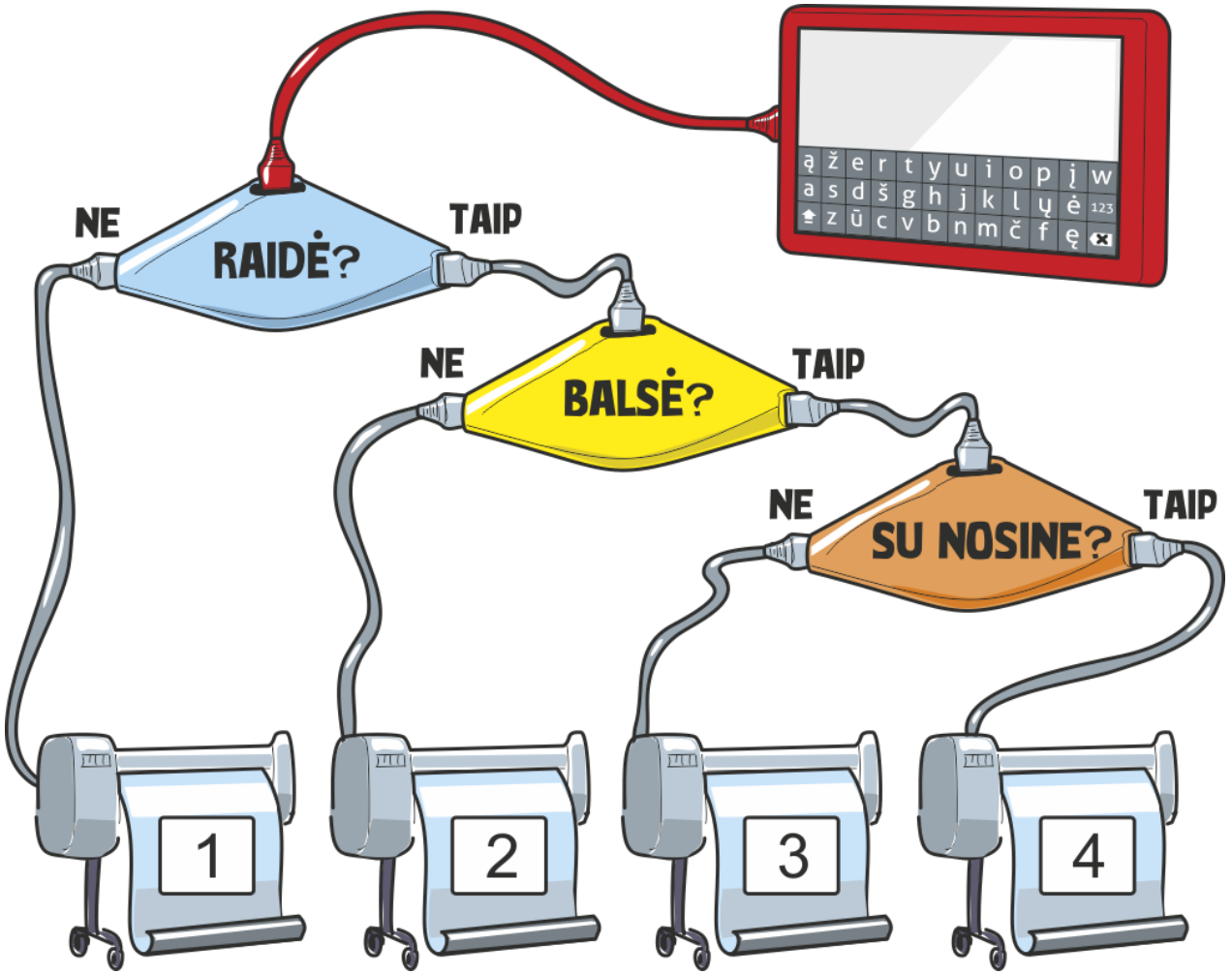
- a glass of water, chicken leg and carrot;
- a glass of juice, pudding and strawberries.

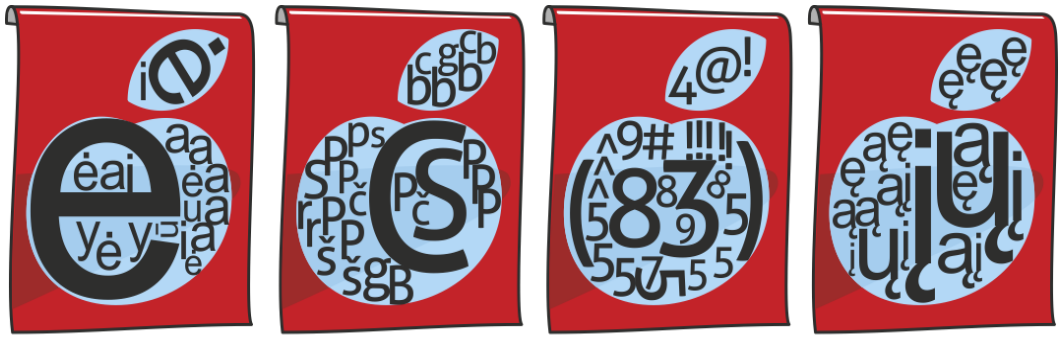


Poster machine

A poster machine designs posters from various characters.

Which printer prints which poster?





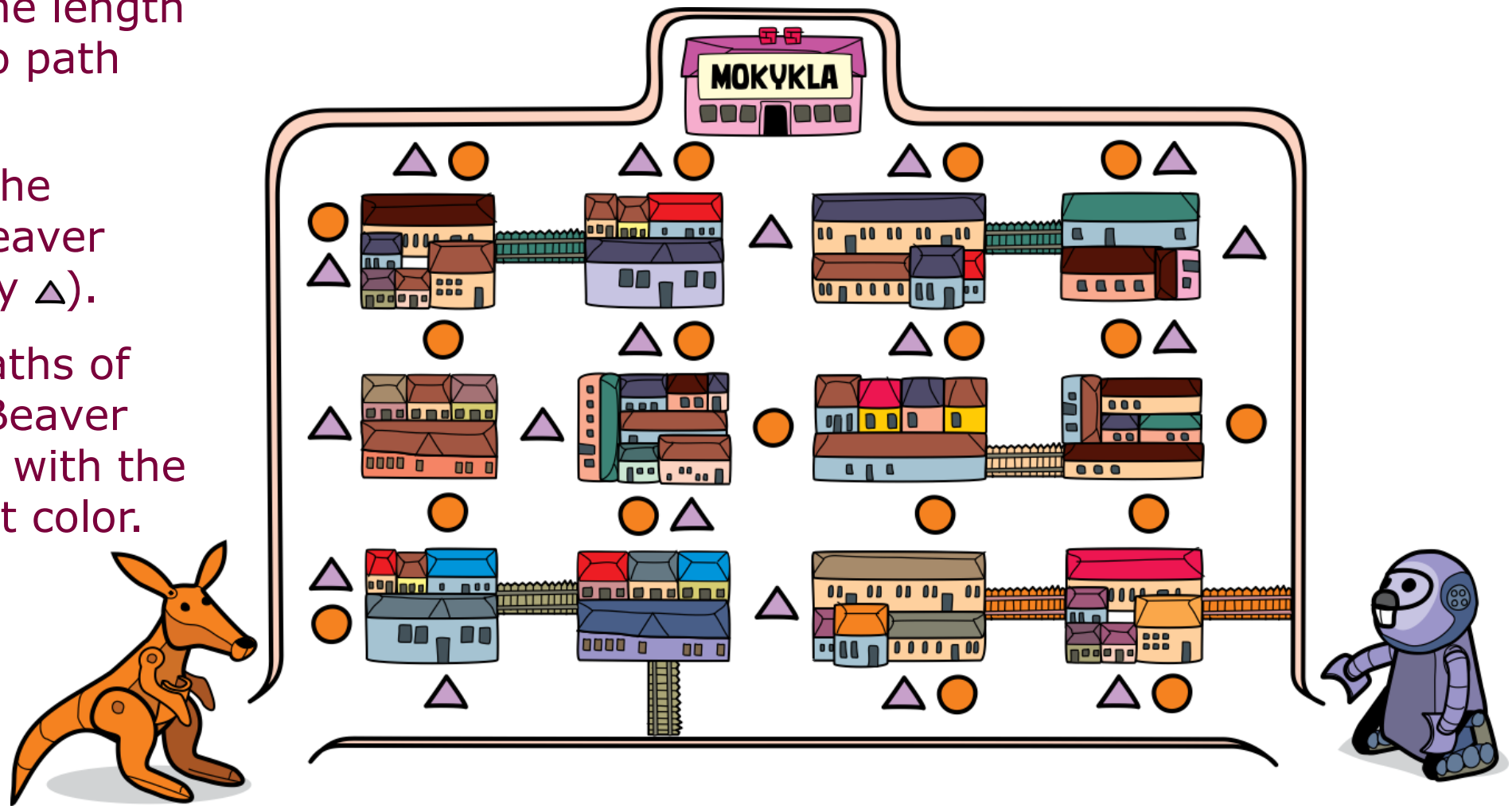
Beaver and Kangaroo

Kangaroo robot moves by paths marked with ● , Beaver robot's path is marked with ▲

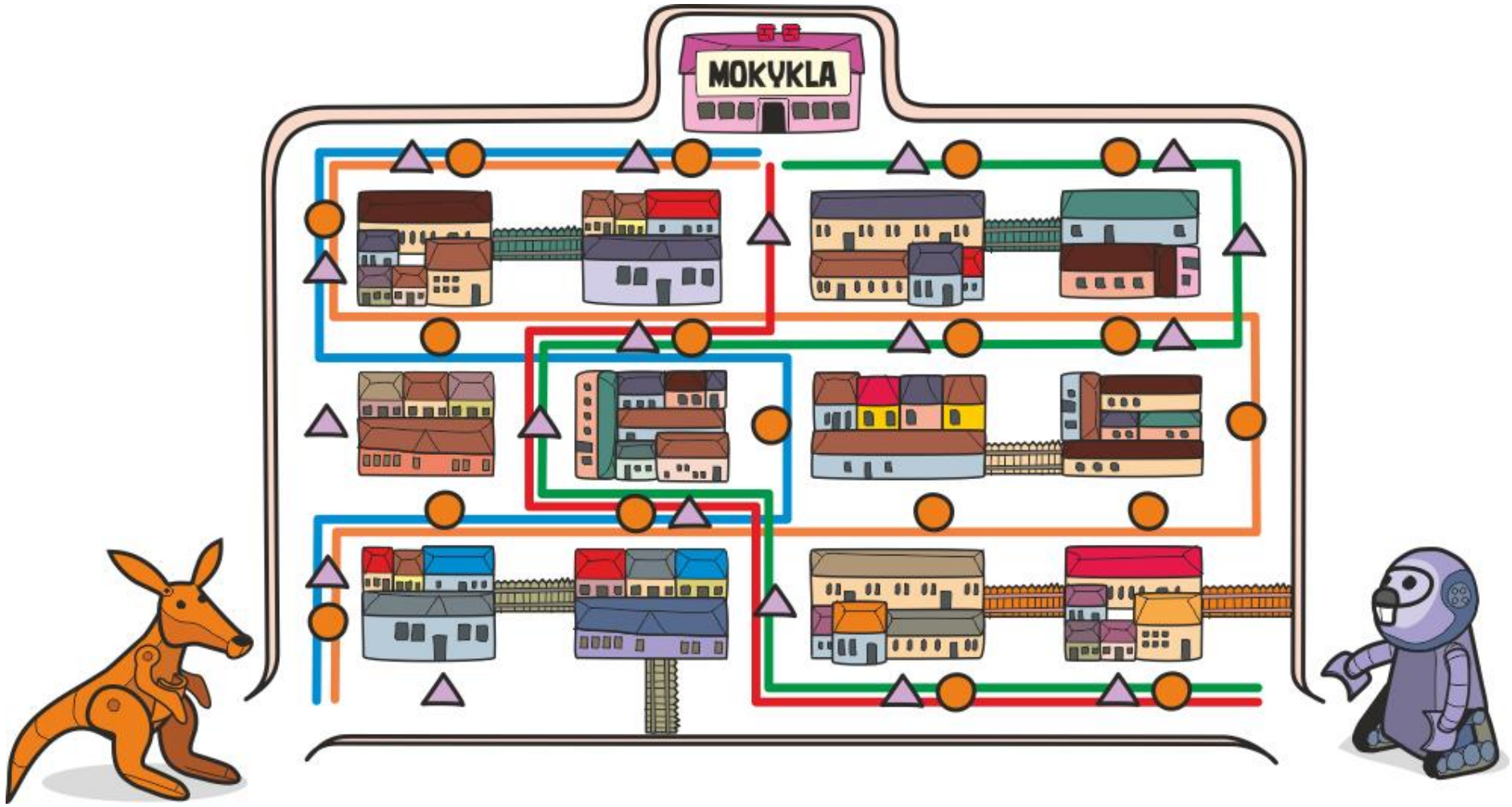
1. Write down the length of the Kangaroo path (how many ●).

2. Write down the length of the Beaver path (how many ▲).

3. Find more paths of Kangaroo and Beaver and mark them with the lines of different color.

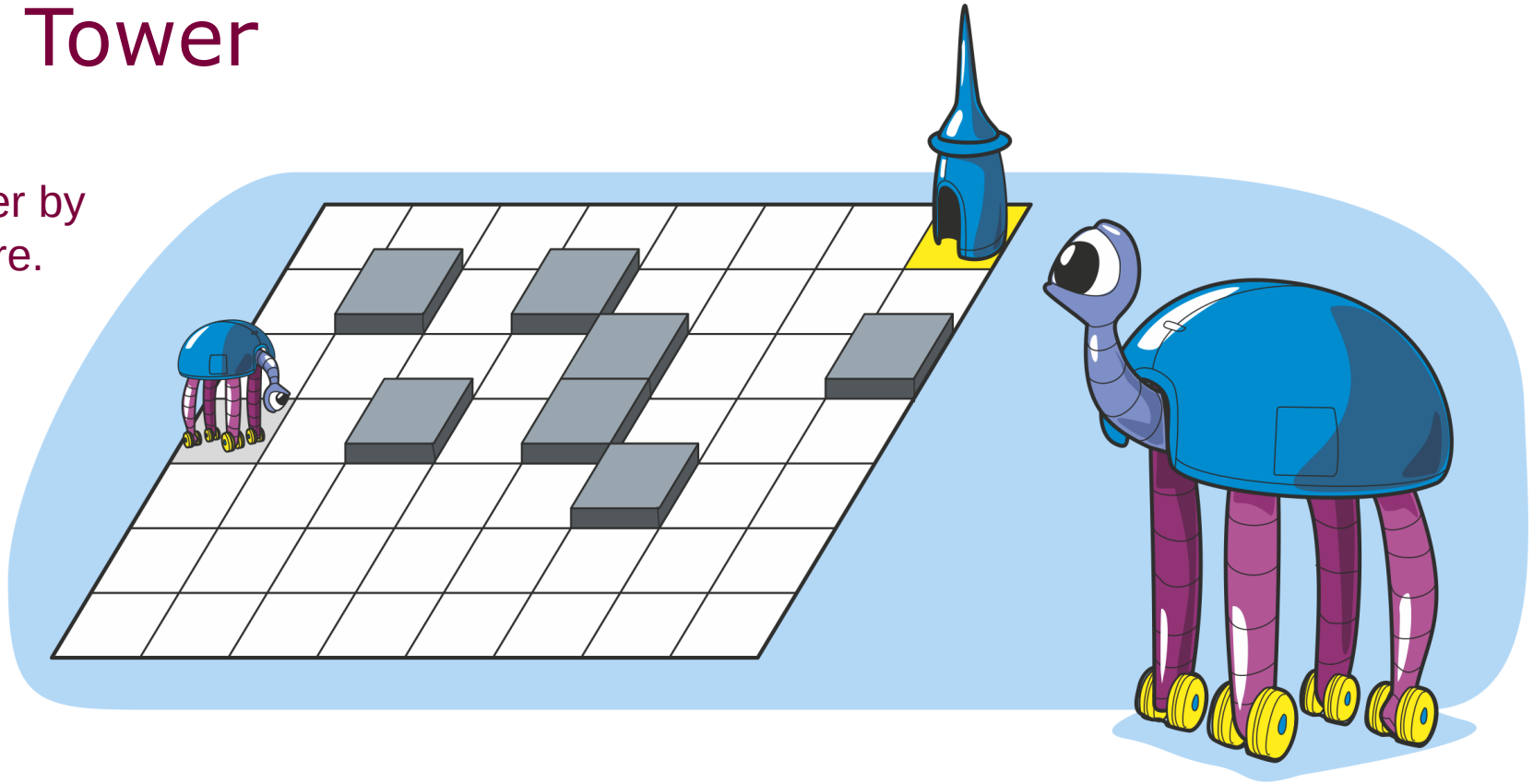


Beaver and Kangaroo



Robot and the Tower

Robot should reach the Tower by walking from square to square.



The programmer has made a program out of movement direction commands marked by arrows:

→	↓	→	→	→	↓	→	→	↑	↑	↑	←	↑	↓	→	→

However, he made a mistake (bug).
The program can be corrected by rotating one of the arrows. Fix it.

Conclusions (1)

Vilnius University

We address the three main challenges when introducing Informatics in primary school: 1) curriculum development; 2) teacher preparation; 3) research of implementation process and what should be taught.

Active participation of experts representing 52 countries in the study we run, indicates the importance of the problem.

Informatics in one or another way is taught in the majority of surveyed countries (83%) in primary education. However, there are a lot of **differences** in the level of Informatics implementation.

In **21%** of surveyed countries (91% of these countries belong to the European region) Informatics for primary education **curriculum is under active development** at the moment.

Conclusions (2)

Vilnius University

Only 17 out of 52 surveyed countries (33%) **introduce Informatics in grades 1 or 2**.

19% of countries **start teaching Informatics in grade 5 or 6** while in some countries (including Lithuania), grade 5 is a start of basic level of secondary school.

At the moment of research, **countries pay priority to separate subject** of Informatics in primary education rather than integrated. In Lithuania, we select integrated way of teaching Informatics.

Conclusions (3)

Vilnius University

The results have shown that still more attention should be payed to primary teacher education.

Training in primary teacher education programs, **mostly limited to digital literacy**, dominates among all countries and even those who have introduced an Informatics-related curriculum in primary education, or such a curriculum is being developed.

Ongoing initiatives and experience in Lithuania (Informatics curriculum for primary school, pilot implementation in 10, then in 100 schools, collaboration with scientists, business representatives, teacher training activities and research) can serve as one of the possible models for countries who are going to implement Informatics in primary education.

Conclusions (4)

Vilnius University

Evaluation of teacher readiness to implement Informatics curriculum is an important element in the transformation phase.

If there are initiatives of integration of Informatics elements into regular lessons nation-wide, even when there are no compulsory Informatics subject, this is a **good indicator for launching** Informatics as a new subject.

The future steps of the research include qualitative analysis of experience of difference countries.

Thank you very much to all international experts who took part in the survey on Informatics in primary education for active participation and collaboration

Thank you for your attention!

Contacts:
Valentina Dagienė, valentina.dagiene@mif.vu.lt
Tatjana Jevsikova, tatjana.jevsikova@mif.vu.lt
Gabrielė Stupurienė, gabriele.stupuriene@mif.vu.lt

Vilnius University

This project has received funding from European Social Fund (project No 09.3.3-LMT-K-712-13-0390) under grant agreement with the Research Council of Lithuania (LMTLT)

Vilnius University