IMPLEMENTATION

GUIDE

MY BOX OF STEAM

Co-funded by
the European Union

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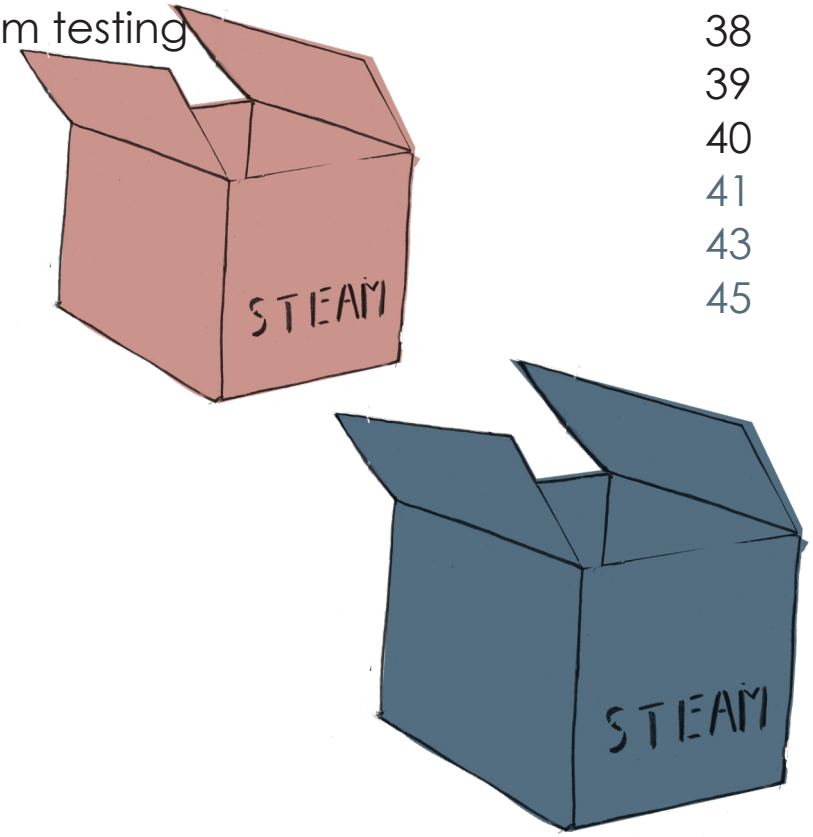

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1. Introduction

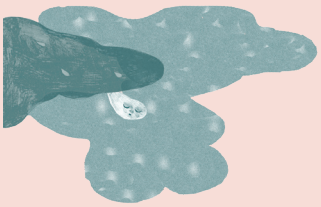
The My Box of Steam project aims to enhance the involvement of elementary school pupils in STEM education while focusing on including not only pupils with fewer opportunities, such as pupils with learning disorders, but also groups that often exclude from studying STEAM, such as girls. In particular, the project will adopt a multidisciplinary approach by using storytelling as a way to enhance the student's creativity and narrative skills within the STEAM framework.
Within the scope of the project, 36 educational boxes were created that are tailored to different aspects of STEAM, offering students an immersive, interactive experience that fosters critical thinking, problem-solving, and innovation.
Each box is a toolkit that brings STEAM concepts to life in a fun and accessible way. They were primarily developed to be used in schools, so they were devised to be easy to use, affordable and in line with the school curriculum.
This booklet describes the different elements of a box shows how to use it easily and gives an overview of all the boxes that we have created. Additionally, in it we also introduce you to our experience of testing them during the project and share best practices for you to implement the boxes into your teaching practice!

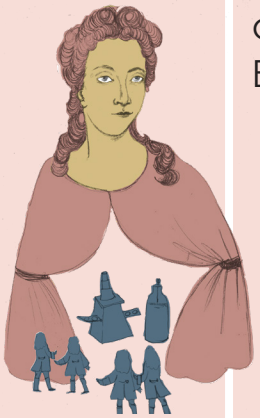
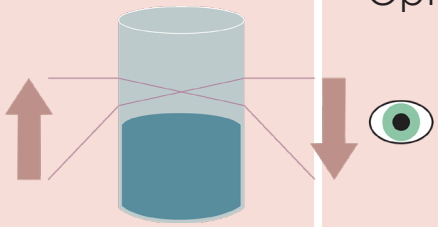

Mathematics
Sciences
Technology

2. An overview of the boxes

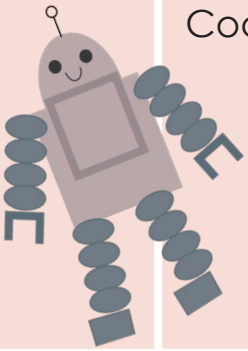
In this chapter, you will find an overview of the 36 boxes that were created. It might be useful for you to see the wide range of subjects we've covered and the skills we have worked on.
The name of the project is My Box of STEAM, and in STEAM, each letter has a meaning.

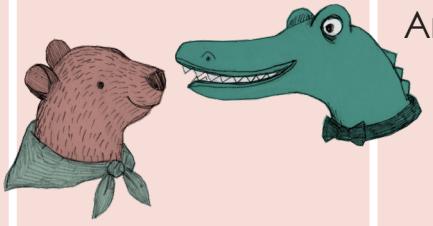
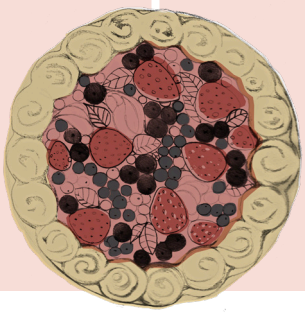
No	Name of the box	Topics	Skills and knowledge
	Sciences		
1.	Botany 	Sciences Arts	• Create a scientific drawing in the style of Maria Sibylla Merian. • Identify a plant using a determination key and artistically represent a plant.
2.	How magnets work	Magnetism, astronomy	• Learning to learn. • Principles of magnetism.
3.	Learn how to use a map 	Algorithmics	• Representation; • Research; • Learning to learn.
4.	Learn the Colours	Colours Art Digital tool for research	• Name the primary colours. • Explain how to obtain the secondary colours.

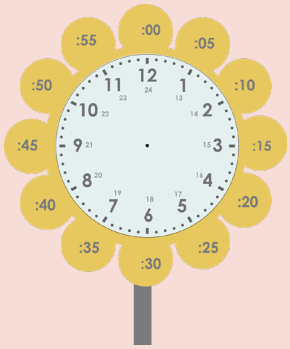
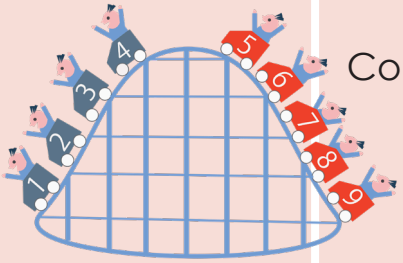
No	Name of the box	Topics	Skills and knowledge
5.	Water cycle 	Water cycle- clouds-rain	• Know and represent the path taken by water in nature; • Identify changes of state and their consequences in the cycle.
6.	Communicating vessels	Communica-ting vessels	• Describe the path taken by a flowing water (river) in nature; • Identify the conditions of flowing from the river to the ocean; • Describe the principle of communicating vessels.
7.	Growing moss	Science 	• Scientific methodology.
8.	States of water 	The Aggregation States of Water	• Recognise the aggregation states of water; • Identify the properties of water in different states of aggregation; • Identify the Irregular Water Dilatation.
9.	Dinosaurs 	Dinosaurs Palaeontology	• Scientific method; • Understand the approach of palaeontologists; • Formulate hypotheses.

10.	Sound 	Music Sound waves	• Types of instrument • Production of sound; • Measuring; • Fine motor skills.
11.	Forces in action 	Forces in action Build	• The ability of simple distance measurements; • The ability to measure the mass of objects; • Know how to build a simple force-measuring instrument; • Measure forces.
12.	Waves 	Physics Waves	• Understanding how waves are formed and how they spread; • Measuring; • Fine motor skills.
13.	How we see 	Light Optics	• Understanding the basic principle of sight; • Observation and logical reasoning; • Understanding the basic principle of sight; • Coding.
14.	Pigments of the Flowers	Pigments of the Flowers Biology	• Simple use of a kettle; • Transfer of liquids into various test tubes and glasses.

15.	Density 	Chemistry/ physics	• Measuring; • Observation and iteration; • Terminology related to density.
16.	Air 	Science Aerodynamics Air pressure	• Perceiving air; • Observation and logical reasoning; • Understanding air pressure; • Fine motor skills.
	Technology		
17.	Clean the ocean 	Solubility Protection of the environment, distillation	• Learning to learn; • Education about climate change; • Problem-solving.
18.	Solar energy 	Sciences technology energy	• Name the different renewable energy sources; • Understand the greenhouse and albedo effects; • Implement a scientific approach to create a solar oven.
19.	Conductors and insulator 	Conductivity Electricity	• Learning to learn; • Scientific representation.

20.	Pinwheel 	Renewable energy Construction	• Engineering; • Fine motor skills; • Type of energy; • Math skills; • Problem-solving skills.
21.	Watermill	Hydroelectric power Water power Water mills 	• Scientific method; • Understanding the power of water through the senses.
22.	Fun DNA 	Science, Biotechnology	• A hands-on activity that introduces students to the concept of DNA; • Simple DNA extraction activity lets students learn about this important biology topic.
23.	Be my Robot 	Computer Science Coding.	• Use symbols to represent data (arrows for the direction); • Setting algorithms; • Understanding how robots operate; • Knowing what the programmer does.
24. 	Sciences in the kitchen	Science, Biotechnology	• Distinguish similarities and differences in yeast fermentation; • Demonstrate how yeast releases CO2; • Students carry out experiments with yeast;

			• Demonstrate the reaction between citric acid and basic baking soda, resulting in carbon oxide gas production.
		Mathematics	
25.	Geometrical shapes	Geometrical figures- introduction to polygons Areas and perimeters	• Use the vocabulary associated with polygons: polygon, triangle, vertex, etc; • Identify polygons.
26.	Solid figures	Geometry Algebra	• Perimeter & area of solid shapes; • Volume of solid shapes.
27.	Multiplication 	Basic Arithmetics	• Pupils can multiply. 
28.	Fractions 	Mathematics	• Counting and reasoning.

29.	Basic arithmetic	Basic Arithmetics	• Pupils can add and subtract.
30.	Time  	Maths- converting a digital clock to an analogue clock Art- making a clock Worksheet with examples of a digital clock	• Converting a digital clock to an analogue clock; • Dividing a circle into equal parts; • Calculating with units of time.
31.	Rounding  	Mathematics Coding	• Rounds a natural number to a given precision; • Rounds decimal fractions to a given precision.
32.	Converting length units 	Measurement Correlations between units of length Conversion	• Measurement; • Converting of units of length; • Correlations between units of length and conversion.
33.	Geometry of flowers 	Fibonacci numbers Fibonacci spiral Geometry of the Universe	• Simple addition operations; • Identify images of flowers that have a Fibonacci number of petals; • Calculate the perimeter and area of a square;

			• Calculate the area and circumferences of the circle.
34.	Centroid 	Geometry	• Math skills; • Balance; • Fine motor skills; • Terminology related to geometrical shapes; • Determining the centroid.
35.	Addition	Addition up to 20. Addend, addend, sum	• Learning to add.
+ 1 Technology			
36.	Sundial 	Time History	• Problem solving; • Learnimg to learn; • Communication. 

3. Storytelling

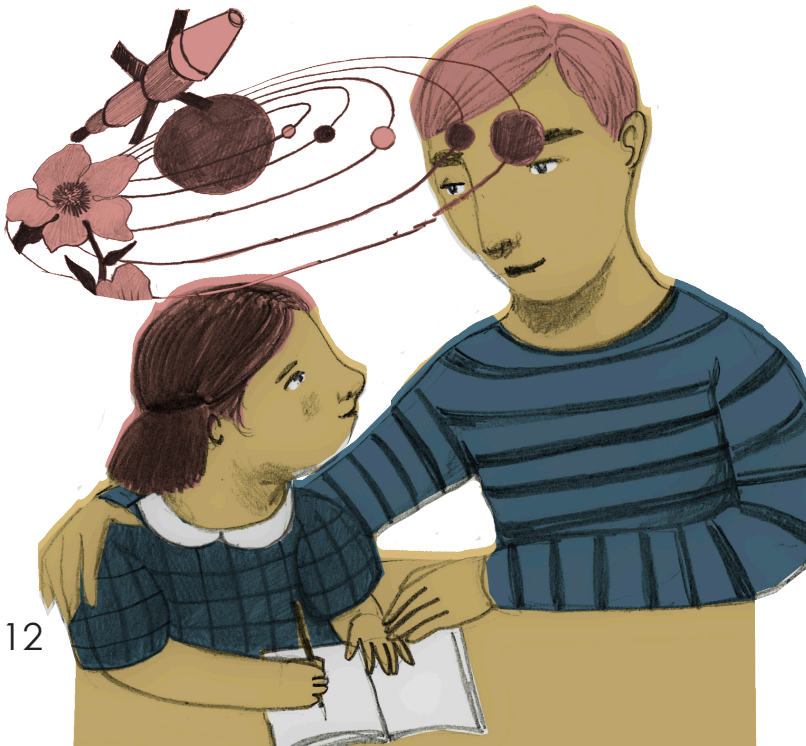
Storytelling, even poetic narration, has the ability to significantly enhance STEM learning by making complex concepts more relatable and engaging. When pupils encounter dry facts or abstract theories, they may struggle to connect with the material. While embedding scientific principles within narratives allows learners to see the real-world applications of these ideas, fostering a deeper understanding and retention.

It is for this reason that each of our boxes contains personalised, tailor-made storytelling resources. Be it a made-up tale or a scientist's biography written in a playful and engaging way, the objective of each one is to help students get more involved in the learning process and enhance their understanding of the topic.

Apart from the stories themselves, the resources also involve a variety of artistic methods and techniques that can further help students approach the subject, such as leporello or antotype technique.

Additionally, storytelling encourages creativity and critical thinking, as students can explore hypothetical scenarios and consider various solutions to challenges presented in the story.

Moreover, stories often evoke emotions, which can lead to a more immersive learning experience. When students are emotionally invested in a character's journey or a scientific discovery, they are more likely to engage with the material and remember the associated concepts. By integrating storytelling into STEM education, educators can create a dynamic and compelling learning environment that inspires curiosity and a passion for discovery.



4. How to use the box

This chapter contains an infographic that describes different elements of the box. Its purpose is to help the user navigate through the documents within a box and use it with ease.

Make your classes fun and engaging

1 Sequence

Learn how to use the box in your class

In this document you can find two different plans on how to use the box with your students. Each of the two sequences has detailed instructions of the proposed activities. You are of course free to use them as an idea and adapt the lesson to your student's needs.

2 Box Notice

How to tell the story

Each box comes with an original story that you can use to make your lesson more engaging. In the box notice you can find instructions on how to use the storytelling elements.

3 Creation of elements

Print, cut and glue

For everything in the box to be affordable, accessible, and functional, some of the elements are made in a really creative way.
You can read this document to find out what you need to do to make all the elements. Additionally, the document also has ideas of alternative methods of creating the elements of the box.

4 Storytelling elements

Find out what we have prepared

As the name suggests, this portion of the box contains all the storytelling elements that we have prepared. The elements will vary depending on the box, but we guarantee that each box will contain an amazing story, and fun and enjoyable elements to craft .

GOOD LUCK!

5. Testing in Croatia

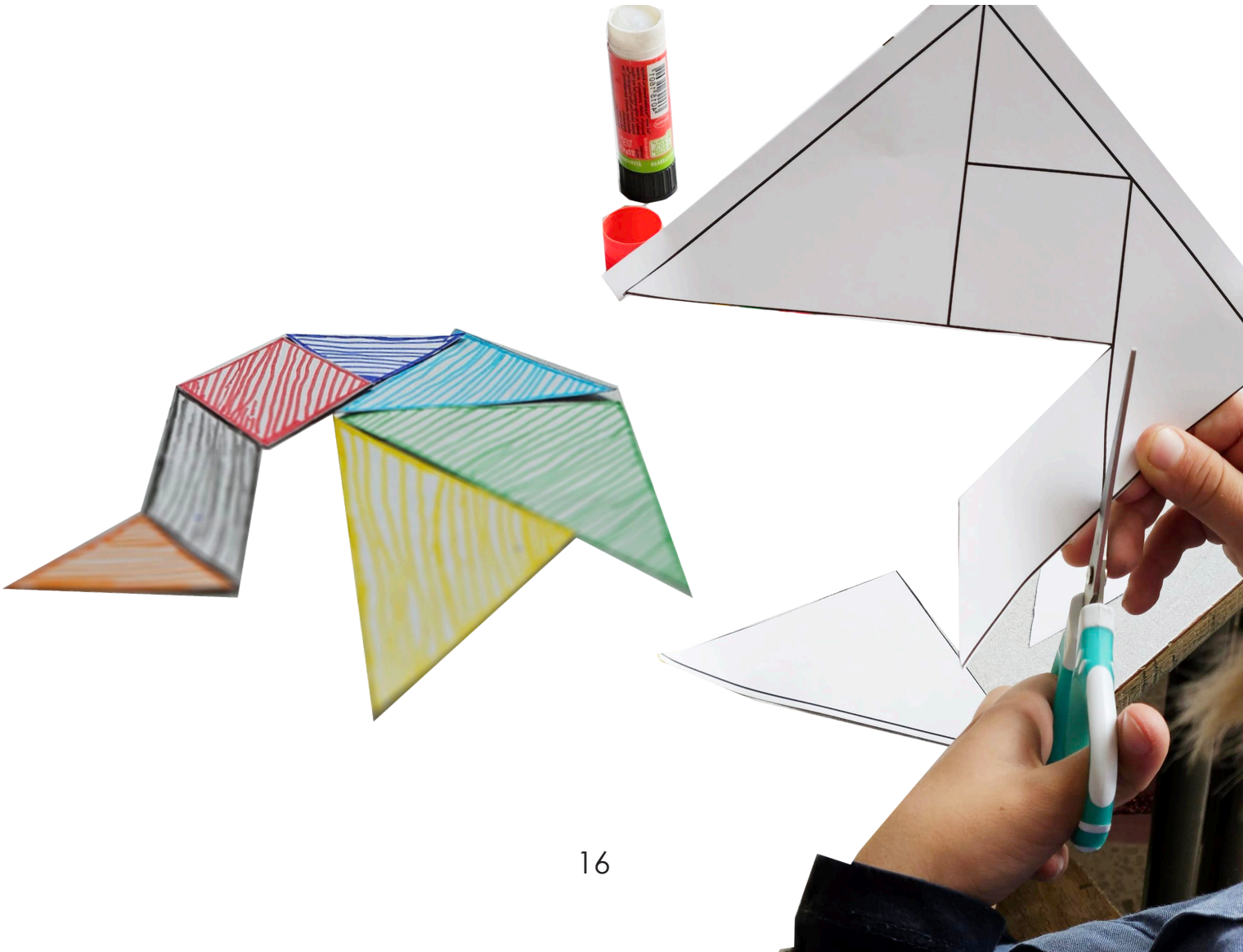
In this section, we share the experience of the testing phase conducted in Croatia, where a total of 11 boxes were tested: “Be my robot”, “Density”, “Fun DNA”, “Geometrical Figures”, “How we see”, “Pigment of flowers”, “Pinwheel”, Science in the kitchen”, “Sound”, “Water Cycle”, “Watermill”.
The boxes were tested in two primary schools. One is located in the city of Osijek, and the other one in Dalj, a rural area. A total of 7 teachers tested the boxes with 142 students.
The feedback from the testing was overwhelmingly positive, both from the teachers and from the students. One teacher said that for her, the best thing was to see the students’ excitement and to hear, "It works, I can’t believe it!"
The experience of two teachers will be presented in the following text.

The Geometric Shapes box

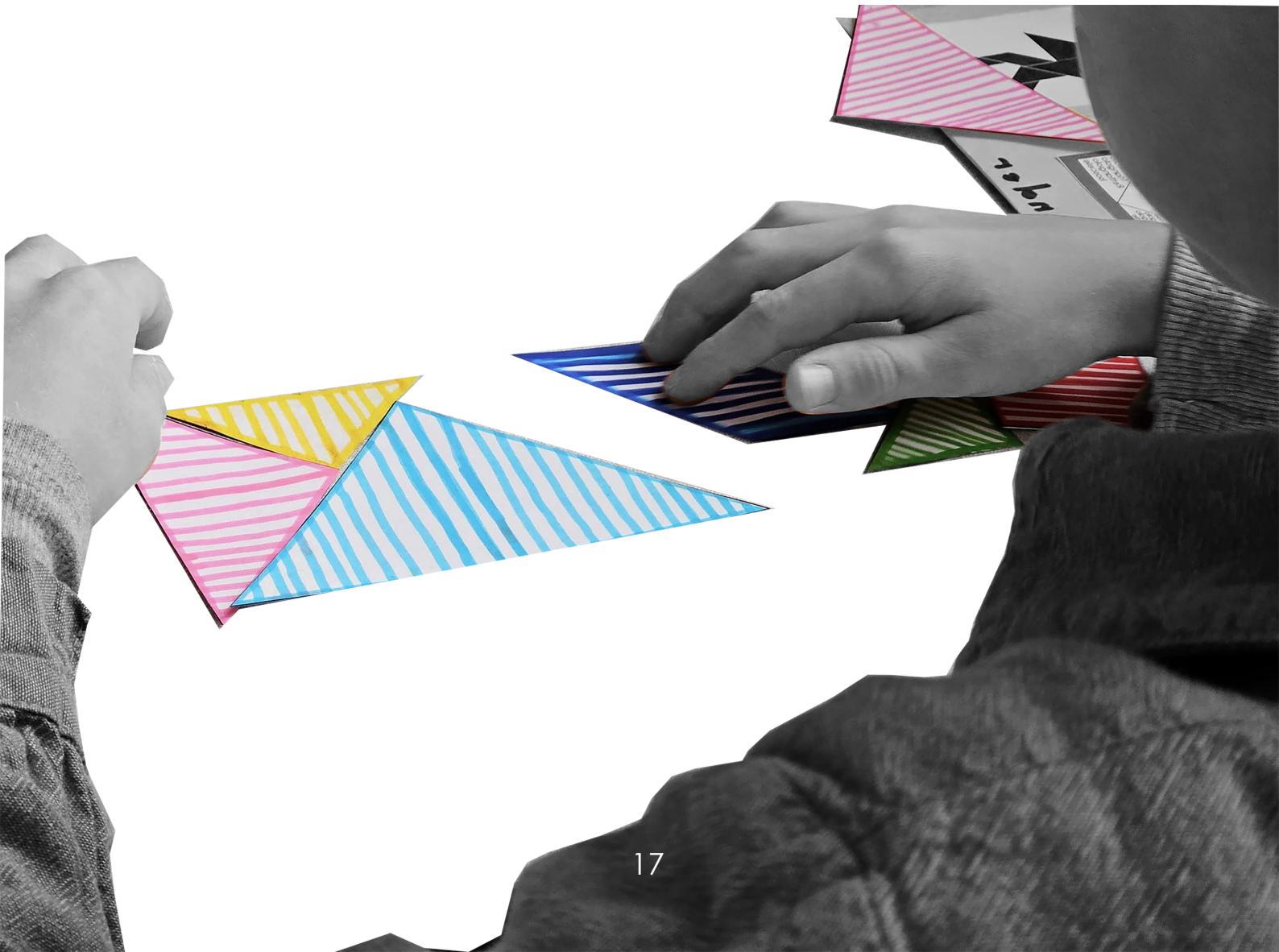
The box was tested in Croatia with 25 second-grade students (8 and 9 y.o.) 14 of whom were girls. The knowledge and skills that are developed during this activity are the recognition of polygons and familiarisation with concepts related to polygons: polygon, triangle, vertex, etc. All of this is in line with the National curriculum for 2nd grade mathematics, which states that “With the students, it is desirable to design as many activities as possible that include assembling and disassembling models of geometric shapes and assembling different puzzles with geometric shapes, such as tangrams. At the same time, they would first put together the puzzles according to the given template, and then they would create meaningful characters themselves according to the given criteria."
The box perfectly fits this criterion, as it allows the students to recreate set patterns or explore their own.
In addition, the box can also easily be used in a cross curricular way. One teacher who tested it combined it with the language class so the students get a more holistic learning experience. The process is described in detail further in the text.
Another great feature of this box is its simplicity. All that is needed to implement the activities are the printouts, scissors, and optionally coloured pencils.

Respecting the capabilities of the students, the offered activities were adapted and realised in the following way: The teacher prepared 25 tangram printouts, and each student got a pair of scissors; then the teacher started reading the story “Geometric Happiness”.
In the part of the story where “The slab was covered with a precious fabric to protect it; the boy put it in his bag and set off.” The teacher covered the tangrams with a piece of cloth and put them in a bag, then continued reading.
In the part where “…he picked up the bag and opened the fabric and, to his horror, saw that the slab had broken into seven pieces of different and perfect shapes.” the teacher gave one tangram to the students. Each one got it on a piece of coloured paper (which represented the cloth). The teacher started cutting her own tangram pieces, and the students followed. While they were cutting, the room was completely silent. They were fully immersed in the story.
When everyone was done, the teacher continued to read the story, and the students followed by recreating the parts of it “the mountain, the boat, the man falling”.
They were really concentrated and quiet.
The teacher continued telling the story, and the students tried to put the mountain together again, then the little goat, and listening to the part "…the boy create wonderful things and objects with the slab pieces.", the students started to create their own characters.

When they were satisfied with what they created, they started to create a story revolving around their character. Each student created their own story. They then presented their stories to the rest of the class.
After one story about a tree and Christmas was told, the class agreed that they all would prepare a storytelling evening as a pre-holiday event. Throughout the next week, they wrote down their stories, gave them a title and practised reading it. They invited their families to come to the event and listen to what they had prepared. When the event came, the audience sat down, and each student got to read their story while the character that they made was projected. “The rich and the poor man”, “First time in space”, “The cat and the tree” are just some of the titles of the amazing and interesting stories that were read. The whole experience was enhanced by the “magic” armchair where the students sat and the loud applause from the parents, brothers and sisters.



After the event, in language class, they had read the story one more time and talked about it.
Overall, the preparation was done over 4 classes, with 1 extra class afterwards. They had analysed the characters – from what geometric shapes they were created how many sides those shapes have.
They realised that one shape was unknown to them, so they described it: what are its sides like, how many it had, and how many vertexes it had.
In the conversation about these activities, the students pointed out that they really liked the story and that they liked imagining and creating their own characters. In the repetition of the mathematics content, they showed their knowledge of the shapes that they turned into their pictures.
The students have somehow turned these "Geometric Shapes" into their own little class project.



Density, Fun DNA and Pigment of flowers boxes

A teacher has tested all 3 of these boxes with her 12-year-old students as part of the extracurricular activity "STEM lab". The testing involved 15 students, 13 of whom were girls, who are showing a high interest in STEM and STEAM fields.
Discovering the contents of the boxes was particularly motivating for carrying out the activities. The curiosity to discover what was hidden in the boxes was visible regardless of age.
Despite teaching biology and chemistry for decades, the teacher had not yet had the opportunity to connect elements of storytelling with scientific topics, and she was surprised at how much the students liked it. The stories greatly enhanced the student's involvement and attitudes towards the topics.
The fifth-grade students presented their research on the properties of matter in regular classes in the form of a story they wrote themselves. During the presentation, they emphasised that this way of presentation was inspired by research on the density and pigments of flowers, which they worked on as an extracurricular activity.
The Density and Pigment of flowers boxes are in line with the 5th and 6th grade Croatian science curriculums. The suggested activities are easy to implement and do not require large financial resources, which is very important when it comes to working in classrooms with a large number of students. Both topics can be excellently linked with the cross-curricular topics of Learning how to learn, Sustainable development and Entrepreneurship.
Connecting with the cross-curricular theme Learning how to learn: They allow the teacher to create activities in cooperation with students in which they can learn collaboratively, work in pairs or teams, teach each other, try out different roles and contribute to a common goal.
By implementing the suggested activities, friendship is created, and students are empowered to ask for help and support if they need it.
At the same time, the skills necessary for implementation in scientific research are acquired, such as the organisation of the worktable, preparation of tools and materials, and experiential learning is enabled.
Connection with the cross-curricular theme Sustainable development: the teacher is given the opportunity to explain in an interesting way how economic activities affect the environment and society, and for the students to gain a sense of the rational use of natural and personal assets.

Connection with the cross-curricular theme Entrepreneurship: It was particularly visible with the implementation of the Flower Pigments activity, during which the students gave innovative ideas on how they can colour the natural soaps that we plan to make soon.
The proposed activities in the box Fun DNA are very valuable for stimulating scientific curiosity and gaining visions about scientific facts, but the essence of genetic predictions is relatively difficult to acquire with understanding.

The biology curriculum provides the basics of genetics for the 7th and 8th grade students, although two potentially gifted students understood how genetic information is coded. The storytelling elements were used to direct girls towards and empower them to engage in the world of science, more than understanding the discoveries of Rosalind Elsie Franklin.
After the testing, the teacher stated: "As a biology and chemistry teacher, I find the boxes to be beautifully designed with clearly written instructions."

6. Testing in Estonia

Some statistics

The schools that tested the boxes are in Martna and Palivere in Lääne-Nigula county. 9 primary school teachers were involved in testing the boxes, 7 from Martna and 2 from Palivere.
11 boxes were tested, two from the first Conception: Learn the Colours, Water cycle, 6 from the second conception: Dinosaurs, Growing moss, Sound, Watermill, Multiplication and Basic Arithmetics, 3 from the third conception: How we see, Addition and Air, The boxes were tested by 158 pupils, 61 of them girls.

Process

The boxes have been tested both in and outside the classroom. The methods applied were Inquiry-Based Learning, Project-based Learning, Experiment-based Learning, Outdoor Learning, and Game Based Learning.
During each testing period (February 24, April 24 and October 24), we followed the next steps.

Before the testing

1. Review of all boxes
2. Choose a box suitable for the class and a sequence
3. Check of materials needed for activities
4. Collect the materials, print out the storytelling materials

If it was needed, we modified the box with our own worksheets, songs, experiments or games etc

Testing the boxes

1. Follow the sequence
2. Guide students

After testing

1. Collect feedback from the pupils
2. Collect feedback from the teachers
3. Analyse what went smoothly and what didn´t so well
4. Exchange of views with colleagues

Box Learn the Colours
Strengths of the Learn the Colours STEAM Box

1. Practical learning approach
The strength of the STEAM Box Learn the Colours can be seen in the learning of the theme of colours through a variety of practical activities:

- Listening to a fairy tale about the interactions between the different colour tribes, students will be able to make their own puppets based on examples of the three colour tribes, so that later on, everyone can play with these puppets and experiment with creating secondary colours.

- Making a colour wheel allows students to actively engage in learning about primary and secondary colours, not just by passively learning but by creating new knowledge themselves through hands-on activities.

- By learning about the artists Loretta Grayson and Friedensreich Hundertwasser and their work, students will gain an understanding of the wonderful world of colours that these great artists used in their work. In addition, the information on the internet also develops young people's digital skills.

2. Integration between subjects
The box perfectly combines the theme of colours with other disciplines, in particular art, but also computer science.
A variety of activities (making puppets and colour wheel, information learning, creating an original work of art) support the integration of different subjects in the treatment and successful acquisition of the subject.

3. Visual learning
The visual representation of these processes is essential for the acquisition and understanding of primary and secondary colours. Playing with puppets of different colours, mixing colours and looking at the work of great artists makes it much easier for students to understand how colours have evolved around us.

What could be added?
There are several ways to complement or extend the Sequence.
One of the options is to give older students the task of creating a colourful poster about the artist they are studying on an internet site. With this activity, students would further develop their various digital competencies.
Alternatively, they could be invited to organise an exhibition of their artwork to give fellow students a good opportunity to enjoy their excellent work. It is also a good way for students to develop their collaboration and communication practices.

Conclusion
The Learn the Colours STEAM Box provides an effective and practical approach to teaching colours (primary and secondary colours, warm and cool colours, complementary colours).

Box Watermill
Strengths of the Watermill STEAM Box

1. Lots of practical activities
The box consists of lots of interesting hands-on activities to gain knowledge, skills and conclusions.
The first experiment with the ping pong ball was funny.
It was a lot of fun to direct a jet of water at the ping pong ball through different instruments (hoses, tops, saucepan, straw, water gun, etc.).
The distance the ball rolled over was measured, and whether it rolled fast or slow was recorded. As a result of the experiment, the children found that humans can make the force of water work in their favour. From that conclusion, it was easy to go to the next experiment - building the watermill.
Creating a physical model, such as a watermill, allows students to actively harness the power of water rather than passively learn about it. Building the model themselves develops students' hands-on activities. By testing the model at a later stage, students can see how the speed and amount of water poured onto the wheel affects the speed at which the wheel moves. In this way, they have figuratively understood how one energy is transformed into another.
This experience reinforces the concept in a way that reading a textbook does not.

2. Clear Instructions
The instructions and explanations provided are generally clear and structured, helping learners follow the sequence of activities without feeling overwhelmed.

3. Interdisciplinary Connections
The box does an excellent job of linking science to other disciplines, like mathematics, technology, physical activity and art. The presence of activities that explore the power of water gives a possibility to measure the distance, time and create connections between speed and distance etc. The same activity gives the possibility to bring pupils outdoors and let them be physically active. Storytelling elements improve students' creativity, handicraft skills, and even acting skills.

Areas for Improvement
No comments for improvement were made by the teacher. The only comment is that to find the materials needed to build a waterwheel, the teacher must be creative - not everything can be bought in the shop.

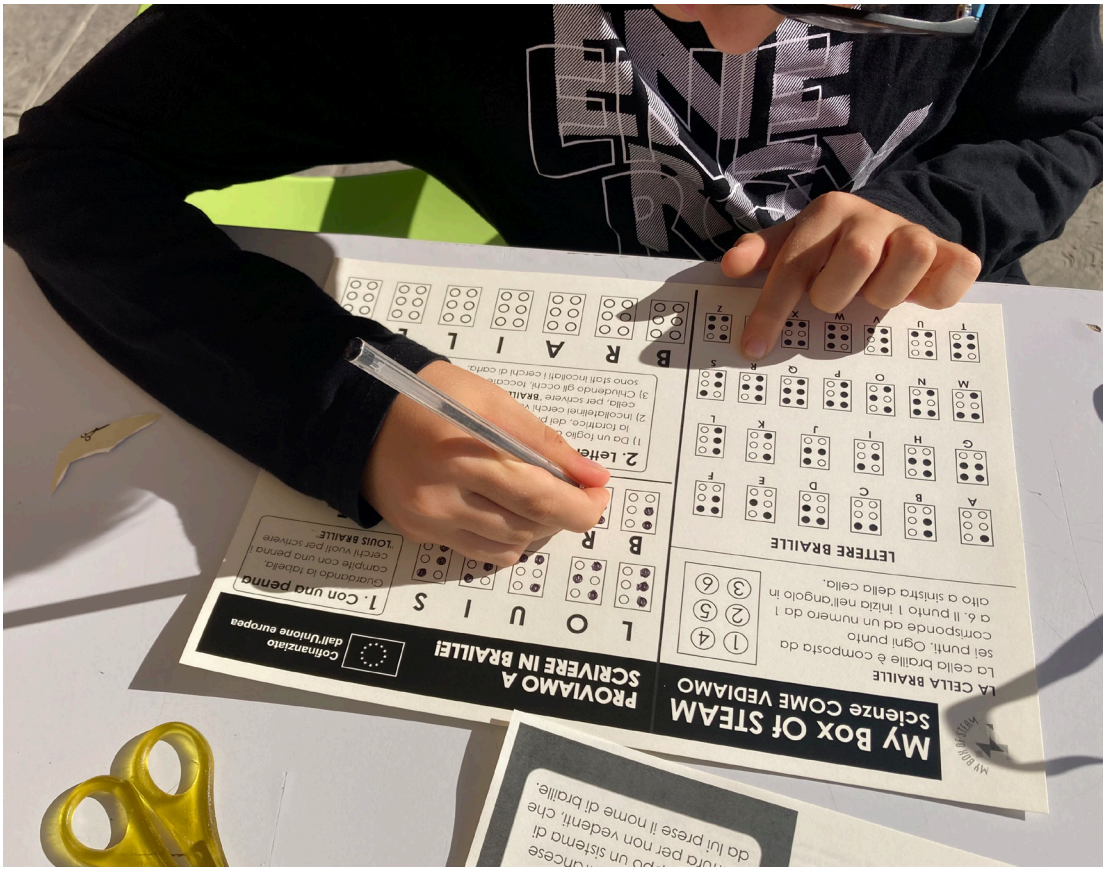
Conclusion
The experiments in the box are easy to carry out if you have an imagination for the means of controlling water. One of the main strengths is that the activities can be carried out outdoors.
We recommend this box to every teacher who teaches at the first level of education.

Box How we see
Strengths of the How we see STEAM Box

1. Cross-Disciplinary Connections
This box integrates science and language, i.e. Braille as a way for visually impaired people to read by touching. A Braille is like a code, so it integrates programming with hands-on activities.
This integration of different subjects shows students how everything is interconnected in real life.

2. Hands-On Learning Experience
The simple tasks in the box, writing BRAILLE using colouring in circles and, in another case, glueing circles on thicker paper, develop students' fine motor skills. This kind of glueing is also sure to develop accuracy and focus.

3. Understandable guide to action
The guidance provided, with relevant explanations, is clear and structured. They help learners to follow the sequence of activities and to act accordingly.



Areas for Improvement

The second sequence for pupils from II education level did not cover 1 hour with our students.

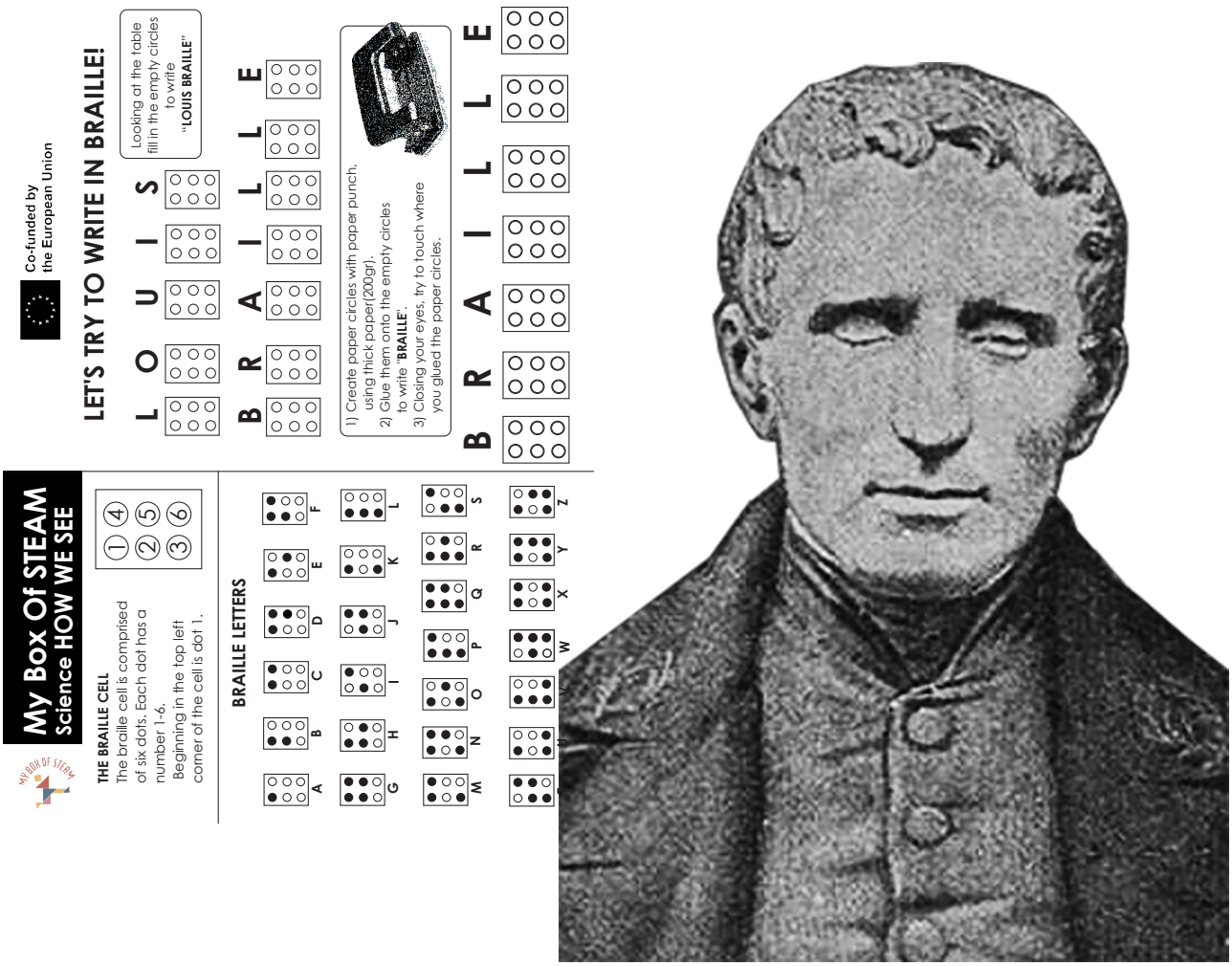
There should be more hands-on activities. We added an exercise (Write your name in Braille and let your classmates guess whose name you are touching) more to cover our time, 45 minutes.

In the first sequence for young pupils, we should find better ways to link the storytelling elements to the classroom activities.

Conclusion

The action plan, the instructions and the Braille narrative in Sequence 2 greatly develop students' imagination.

The story of the blind boy Loius makes a deep impression on students and develops their empathy, while the practical exercises of reading and writing in Braille show students how visually impaired people have to cope in life.



7. Testing in Romania

Some statistics

The schools that tested the boxes are located in Timisoara and Timis County. 14 primary school teachers were involved in testing the boxes. 12 boxes were tested by 319 pupils, 163 of them girls.

How did we do it?

Testing a STEAM box effectively involves evaluating its educational value, ease of use, safety, and overall engagement for the target audience. Here's a step-by-step approach to testing a STEAM box that Romanian teachers followed (the teachers decided together on the next steps in testing):

Steps in testing

1. Review the Contents:
- Check inventory to ensure all materials are present.
- Assess the quality of components for safety and suitability.
- Examine instructions for clarity and ease of understanding.

2. Test the Experiments/Activities:
- Follow instructions accurately and note any unclear areas.
- Consider how easy the setup is for the target age group.
- Ensure all experiments work correctly and have educational value.

3. Engagement and Fun Factor:
- Evaluate the challenge level and engagement of activities.
- Check if the box is fun to use and maintains interest.
- Determine if the activities offer replay value.

4. Safety:
- Check for hazardous materials or components, especially for younger children.
- Identify tasks requiring adult supervision and ensure they are clearly mentioned.

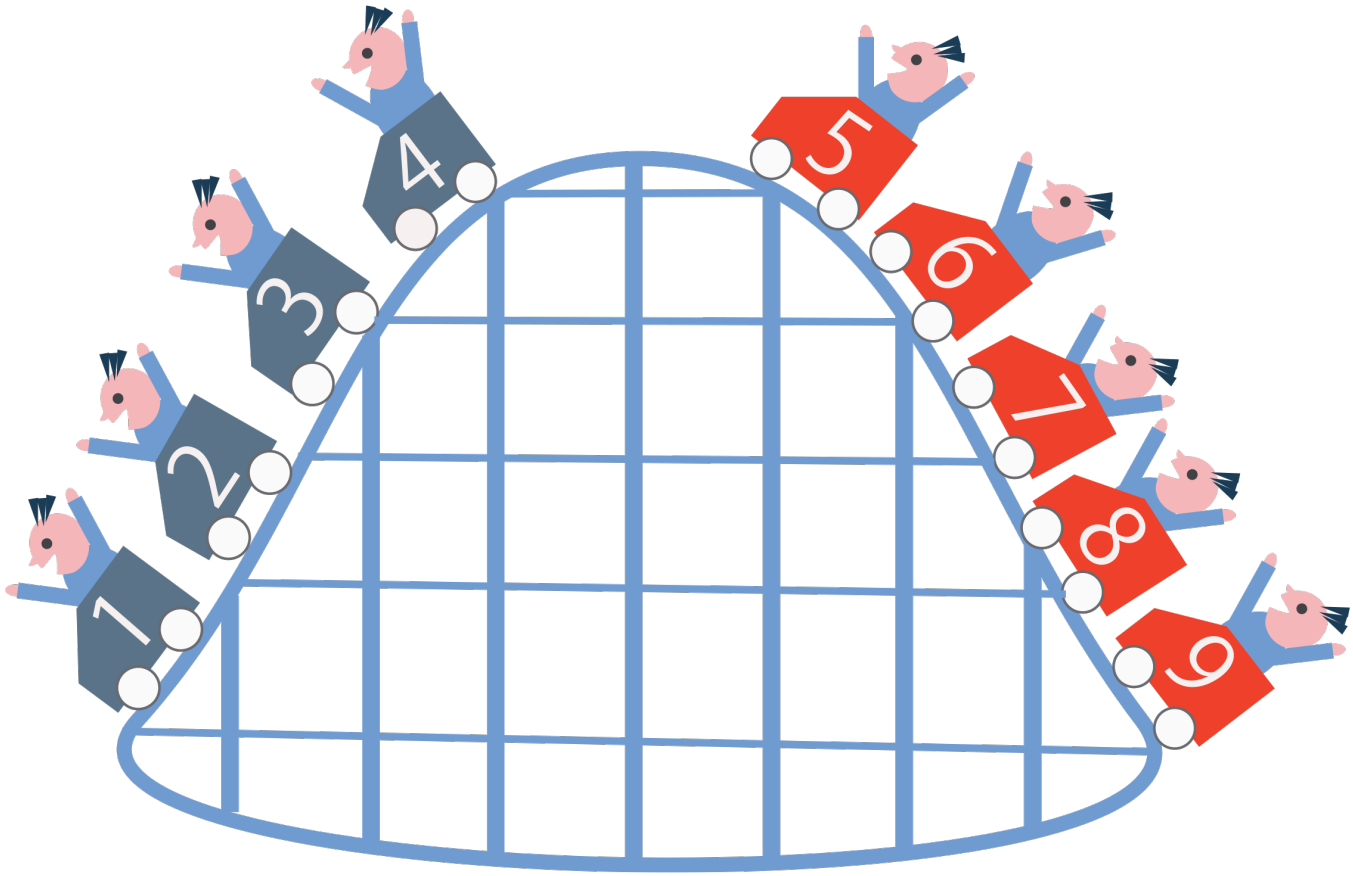
5. Learning Outcomes:
- Evaluate whether the user has learned key STEM concepts.
- Test if the box helps in developing problem-solving and critical thinking skills.

6. Feedback from Target Audience:
- Use user testing and surveys to gather feedback on difficulty and enjoyment.

7. Comparison with Competitors:
- Benchmark the STEAM box against similar kits for value and uniqueness.

8. Documentation and Reporting:
- Document testing results and provide recommendations for improvements.

The boxes have been tested both in and outside the classroom. Some activities also involved collaboration with the family, with parents getting involved in carrying out home experiments with their children.
The methods applied were Inquiry-Based Learning, Project-Based Learning, Experiment-Based Learning, and Outdoor Learning.
Introducing STEAM educational materials to accompany the traditional educational path involves first of all the idea of opening one's mind to a different approach. The ‘My box of STEAM’ boxes convey a new concept of learning: the idea of learning while having fun and storytelling as forms of transmission for information.



Box Geometry of flowers

Testing a STEAM box focused on Fibonacci numbers and the geometry of flowers can be an exciting way to connect math and nature.
The Geometry of flowers STEAM Box, designed to introduce students to the
fascinating world of Fibonacci numbers and their applications, is a valuable educational tool.

Strengths of the Geometry of flowers STEAM Box

1. Hands-On Learning Approach
The biggest strength of the Geometry of flowers STEAM Box lies in its hands-on approach to teaching. The inclusion of physical models, such as spirals or grids, allows students to actively engage with the Fibonacci sequence rather than passively learning about it. For example, using nature-inspired models such as pinecones or sunflower heads helps students visualise the Fibonacci spiral in the real world.
This tactile experience solidifies the concept in a way that reading from a textbook cannot.

2. Interdisciplinary Connections
The box does an excellent job of linking mathematics to other disciplines, particularly biology and art. The presence of activities that explore how the Fibonacci sequence appears in nature, such as the

arrangement of leaves or the growth patterns of certain plants, fosters interdisciplinary learning.

3. Visual Learning
Another strength is the visual representation of Fibonacci numbers. For students who are more visually inclined, seeing how the Fibonacci sequence creates beautiful spirals and patterns can make the concept easier to grasp. The box includes graphs and illustrations to show how Fibonacci numbers grow, helping students understand both the numerical and visual progression of the sequence.

4. Clear, Step-by-Step Instructions
The instructions and explanations provided are generally clear and structured, helping learners follow the sequence of activities without feeling overwhelmed. This clarity in instructions allows both teachers and students to explore the Fibonacci concept without needing advanced prior knowledge of mathematics, making it accessible to a wide audience.

Areas for Improvement

1. Incorporating More Diverse Testing
Including more interactive forms of testing, such as puzzles, problem-solving tasks, or even coding exercises, would allow students to apply their knowledge in creative ways. This could encourage a more thorough comprehension of Fibonacci's applications across different fields.

2. Adaptive Learning Features
The STEAM box could benefit from adaptive learning features that cater to different skill levels. Not all students approach mathematics with the same background or confidence, so providing optional challenge activities for advanced learners or scaffolding for those who struggle would make the box more inclusive. For instance, offering an advanced track that incorporates more complex mathematical concepts like recursive formulas would engage students who want to delve deeper into the topic.

3. Technology Integration
While the box is rich in hands-on physical activities, the integration of digital components could further enhance learning. The inclusion of an app or online resource to accompany the box might provide simulations or visualisations that can't be replicated with physical models alone.

Conclusion
The Geometry of flowers STEAM Box provides an effective, hands-on approach to teaching a mathematical concept that is often considered abstract and difficult. Its strengths lie in its interdisciplinary focus, clear instructions, and visual learning aids, which make it engaging and accessible to a wide range of students. However, by incorporating more diverse assessments, adaptive learning, digital integration, and cultural context, the box could offer a more comprehensive and personalized educational experience. Improving these aspects would make the Geometry of flowers STEAM Box an even more powerful tool for fostering both mathematical understanding and curiosity.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Box How magnets work

Testing a STEAM box focused on how magnets work should assess its ability to explain magnetic concepts, provide hands-on experimentation, and make learning fun and engaging.

Strengths of the How Magnets Work STEAM Box

1. Hands-On Learning Experience
A primary strength of the STEAM box is its focus on experiential learning. The inclusion of various magnetic objects, such as bar magnets, iron filings, and magnetic compasses, allows students to directly observe magnetic phenomena.

2. Encouraging Inquiry-Based Learning
Another strength of the box is its ability to stimulate curiosity and critical thinking. The open-ended nature of some experiments encourages students to ask questions and investigate further. For instance, students are prompted to explore what happens when multiple magnets are combined or to investigate whether non-metal objects exhibit magnetic properties. This inquiry-based approach helps learners develop problem-solving skills and fosters a deeper understanding of how magnetism works in the real world.

3. Cross-Disciplinary Connections
The STEAM box makes efforts to link magnetism to other scientific disciplines, particularly physics and engineering.
This cross-disciplinary aspect not only expands students' understanding but also shows them how magnetism is applied in real-world technologies, from electric motors to compasses.

Areas for Improvement

Improved Feedback and Assessment Tools
While the activities promote exploration and discovery, there are limited opportunities for students to assess their own understanding of the material. Including quizzes, reflection questions, or worksheets that help students summarise what they've learned could reinforce key concepts.

Jane Marcet
(1769 - 1858)

Michael Faraday
(1791-1867)

Additionally, a digital companion app or online resource could provide interactive quizzes and real-time feedback to assess learning progress.

Conclusion

The How Magnets Work STEAM Box excels in making the fundamental concepts of magnetism accessible and engaging through hands-on activities and visual aids. It effectively fosters curiosity, critical thinking, and inquiry-based learning, making it a strong educational tool for students at various levels.

Carl Friedrich Gauss
(1777 – 1855)

André-Marie Ampère
(1775 –1836)

Wilhelm Eduard Weber
(1804–1891)

The strength of all STEAM boxes

Storytelling in STEM education offers numerous strengths by making complex concepts more relatable and engaging. It transforms abstract ideas into real-world scenarios, allowing students to visualise and connect with the material. Through stories, STEM lessons become less about memorising facts and more about understanding processes and applications. Storytelling also enhances retention by linking information to emotions and experiences, making it easier for students to recall and apply knowledge. Moreover, stories inspire curiosity, spark creativity, and foster critical thinking, helping students see the human side of science, technology, engineering, and mathematics and their impact on everyday life.

Testimonials from Romanian teachers

What are the strengths of the boxes?
"Integrated activities maths-reading-arts"
"Teaching by doing. The students understand better"
"The stories"
"The way they were conceived, the novelty they bring. The story. That accompanied the activities"
"The experiments proposed"

Conclusion
The box testing was received with great enthusiasm by both teachers and students in Romania. The students listened with great interest to the stories and then learned concepts and notions by doing, experimenting, and playing. Teachers have created learning contexts that are different from textbooks.

8. Testing in Italy

In Italy, 20 STEAM boxes were tested with a total of 338 students, including 187 girls, with 11 teachers participating in the testing.

Teachers' evaluations from testing

Teachers who took part in the tests confirmed that the STEAM boxes have proven to be an excellent educational tool, integrating multiple disciplines such as math, science, technology, arts, and reading in a practical and engaging manner. They highlighted the intuitive nature of the activities, which help students understand abstract concepts. Especially, the high-quality graphics and educational materials, combined with storytelling, create meaningful and positive learning experiences. Additionally, the boxes reinforce essential scientific skills like observation, concentration, patience, and care. They also promote group work and fine motor skills development, making learning both effective and enjoyable for students.

In class with dinosaurs

Thirty-seven students (including 20 girls) from Primary School XX Giugno, under the guidance of two Teachers, explored the "Dinosaurs" box. Among the various STEAM boxes we tested, this one dedicated to dinosaurs was definitely one of the favourites. Beyond school, children are passionate about this topic from a very young age, and often, when asked, "What do you know?" they respond correctly and in detail about the names, habits, and differences between various species and geological eras.

Our lesson began with reading the biography of Mary Anning. The story really impressed them a lot: the fact that a girl their age made important discoveries excited them, while the difficult conditions and era in which the palaeontologist lived sparked many debates. The shadow play activity, where we introduced the bodies and skeletons of prehistoric animals, was also a big hit. Students were asked to project shadows of previously cut-out shapes and trace their outlines. This moment was done in small groups, promoting collaboration and sharing. It was an extremely playful activity with important pedagogical benefits: through play, the children put their skills into practice. In drawing the shadows, they had to coordinate their movements, which also helped develop their fine motor skills (holding the shape and tracing the perimeter of the projected shadow - all while laughing!).

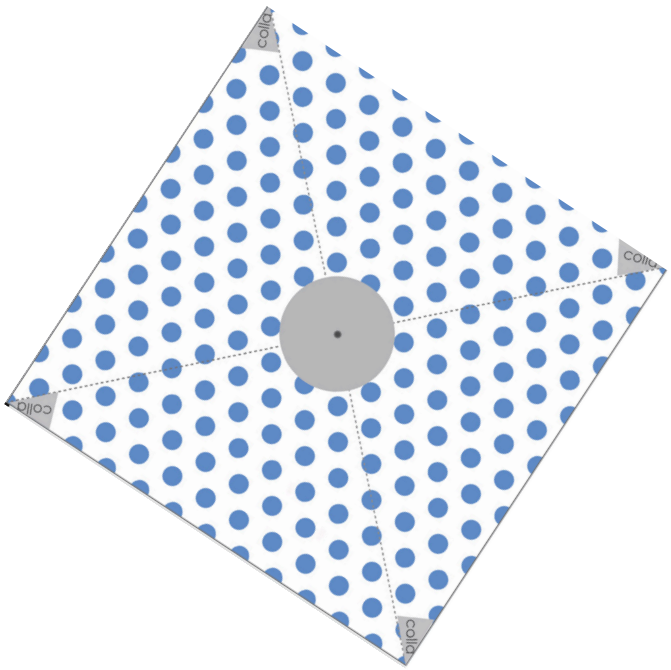
This activity introduced the next one, which was more scientific in nature and very well-received by the children. In our case, since the school does not have any outdoor spaces, we opted for small basins containing sand, in which we hid reproductions of dinosaur bones and footprints, asking each of them to turn into miny palaeontologists. Everyone participated, preparing the "search site", excavating with tools, and most importantly, recording their findings with detailed descriptions. Often, the children drew on their own knowledge, while others referred to books and classroom materials. In the end, we asked each student to read and share their descriptions, just like in a real scientific debate.

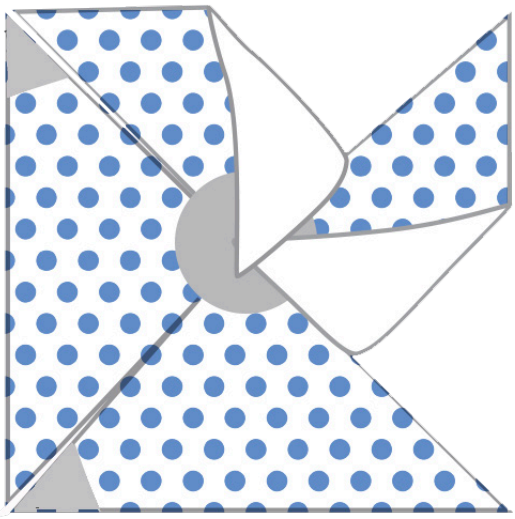
Inclusion

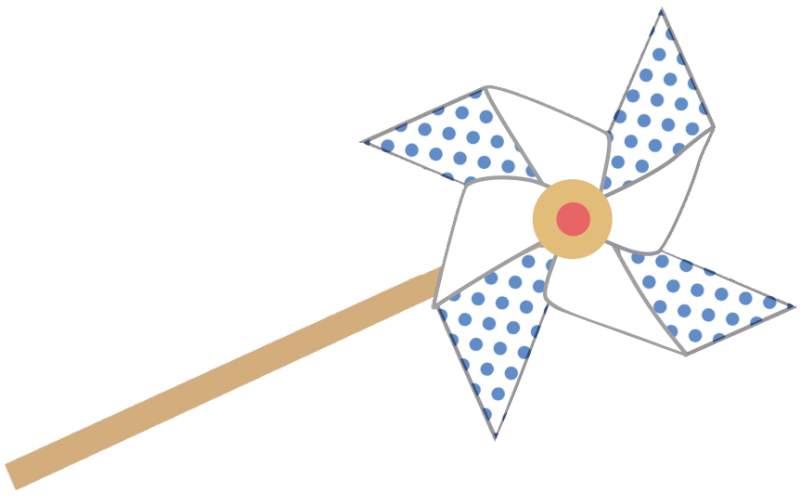
Each box is designed to be inclusive, to support students with learning difficulties and to show how scientific-mathematical pathways are open to everyone without distinction. The aim is to encourage everyone to follow their own interests and passions, showing that there are no exclusive paths, and making it all very natural, simple and irrefutable that everyone has the right to follow the path they have chosen. However, many biographies in the project show that this was not always the case in the past, the story of the life of the first palaeontologist, Mary Anning, highlights how many difficulties she had to overcome to see her work recognised. The story provided the cue to emphasise how difficult it was in the past for girls to pursue a scientific career, thus opening up a debate to which the two classes contributed with comments and reflections, emphasising mutual respect beyond gender. Both the girls, who were directly challenged, and the boys reiterated how unfair it was for less affluent people, especially if they were female, to be excluded from university studies and scientific careers. We asked them to form mixed working groups of three, a maximum of four members, leaving each group to regulate themselves in the required activities: the division of the "field", the excavation, the notes and then the description of the work done. In terms of gender, the boys and girls managed themselves equally, alternating in the "direction" of the work to be done. The groups have a dual purpose of being supportive for students with learning difficulties. The group, in a natural way, supports and helps those students who have difficulties, thanks to the mutual sharing, in a supportive way they exchange the data gained from the activity, in a kind of mutual support.
"Enthusiastic! I am very happy to have had the opportunity to learn, experiment, and challenge myself as a teacher through these different methodologies and tools. Storytelling is a privileged channel to orient the child, to get them passionate and to create a "meaningful" context." Teacher Lucia

9. Testing in Belgium

Two tests were conducted with primary pupils to explore the “Pinwheel” box, which focused on understanding wind energy through the hands-on creation of pinwheels.
In the first test, 12 primary pupils (including six girls) under Madame Céline’s guidance engaged with the Pinwheel box. They created pinwheels by cutting, folding, and assembling materials like paper, corks, and wooden sticks. Blowing on the pinwheels brought the concept of wind energy to life, connecting it to real-life applications such as wind turbines. The included story about a playful wind captured their imagination, making learning both fun and meaningful. Madame Céline highlighted that the activity met pedagogical goals effectively, with students clearly grasping how wind energy can be harnessed.
The instructions were straightforward, and the hands-on nature made it easy to integrate into the classroom.
In the second test, Madame Manon led 20 Primary 5 pupils (including eleven girls) in exploring the Pinwheel box. This activity opened with a discussion on renewable energy, then moved into constructing pinwheels. As students observed their pinwheels spinning, they grasped the conversion of wind energy into mechanical energy, much like a wind turbine. Madame Manon noted the activity's success in making renewable energy tangible and engaging for students.







10. Testing in FRANCE

YuzuPulsehas tested the boxes with two structures: the Albert Camus primaryschool in Tourcoing and Forum des Sciences in Villeneuve d'Ascq, with a total of 55 pupils (50% of girls), 2 teachers and 1 educator.
Several boxes were tested in the Albert Camus primary school: the Sundial, Water Cycle and How we see. The first two boxes were tested with the presence of a YuzuPulse employee in the classroom, the last without to see if the teacher was able to use the resources without help from one of the partners of the project. We sent reminders to the school to ask them to test the boxes, and they happily obliged. Due to new regulations in the French school system, the tests were harder to conduct than anticipated, but those three tests ensured that we had reached enough pupils. Overall, the teacher and the pupils were glad to use the project's boxes. The teacher we reached advertised for the project in his school and, although there has been no additional testing so far from his colleagues, several have asked for more information about the project. YuzuPulse presented the project to 20 teachers during the school's monthly teacher's meeting. During the tests, the teacher would introduce the topic to the classroom and comment on what we would present to make the experiment fit within the French curriculum.

The pupils looked quite engaged during the tests, and most of the classes participated actively. They were most impressed with the experiments and cheered happily when the food colouring entered the water in the Water cycle box. They also enjoyed tracing a giant sundial in the schoolyard. The teacher liked the concept of the boxes and volunteered to test some more. He noted some difficulties, including the amount of time required to complete the activities: in his opinion, more time can be necessary for writing activities. In his opinion, the boxes represented a great opportunity for children to discover STEAM, but they would need more time to understand the concept. This may be linked to the fact that he tends to add more information to the boxes in order to include them in his lesson plans. The Clean the ocean box was tested with Forum des Sciences during the National Science Festival.

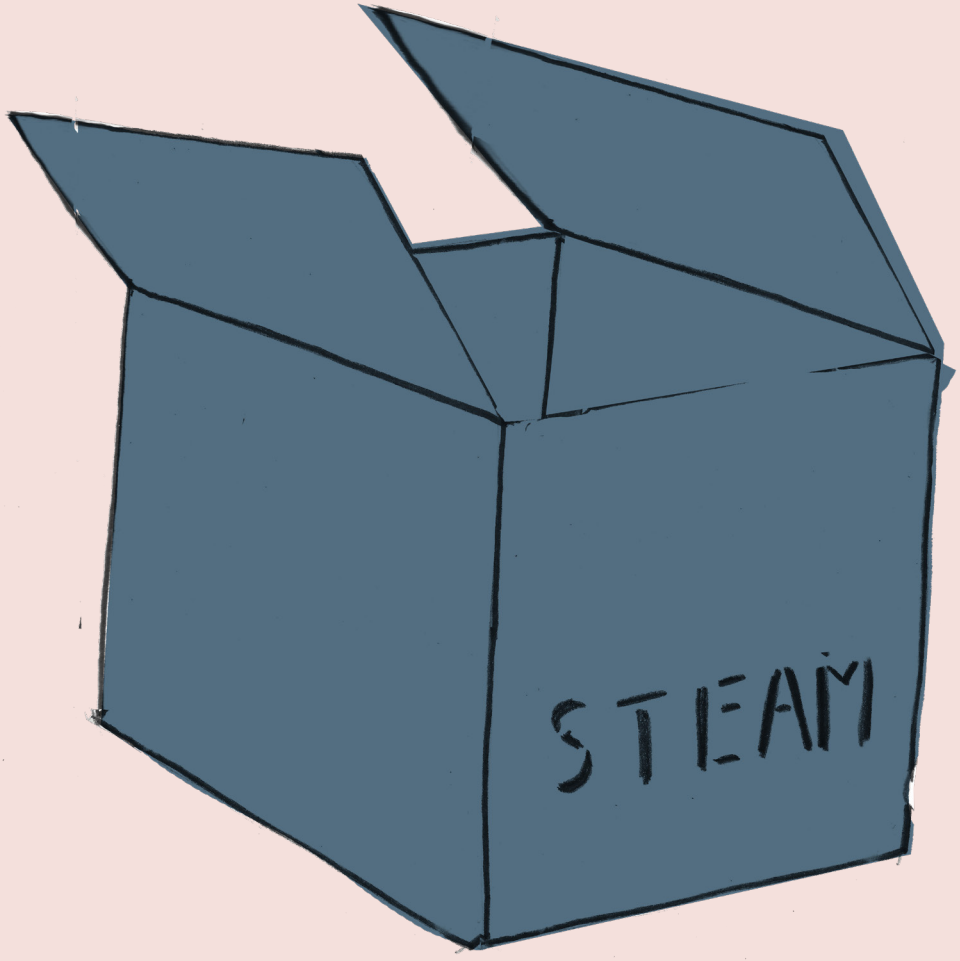
Since this structure is not a school, we tested the box without any teachers and were able to try the resources right „out of the box"! This time, the pupils participated voluntarily and experienced putting things in and out of water.

The activity was a success, both the children and parents enjoyed taking part in it.

11. Conclusions

The conclusion of the report evaluates STEAM boxes, highlighting their effectiveness in enhancing educational experiences through interdisciplinary approaches, hands-on activities, and clear instructions. While some areas for improvement are identified, the overall potential to enrich student learning is emphasised. The testing process involved thorough evaluations of educational value, ease of use, safety, and engagement, alongside feedback from teachers and users.
Various learning settings, including inquiry-based and experimental learning, were utilised. Moreover, the incorporation of storytelling in STEM education is presented as a means to make complex concepts more relatable, fostering creativity, critical thinking, and emotional engagement, ultimately creating a more immersive learning experience.

The learning boxes were utilizsd in diverse educational settings, encompassing inquiry-based, project-based, experimental, outdoor learning, and gaming. The evaluation process involved reviewing and selecting suitable boxes, preparing materials, and gathering feedback from both students and teachers. Incorporating storytelling into STEM education enhances the relatability and engagement of intricate concepts, promoting better understanding and retention. Each box is equipped with tailored storytelling resources, including fictional narratives, scientist biographies, and artistic techniques such as Leporello or antotype methods. Activities were customised to align with students' capabilities, and the feedback received from the testing phase was predominantly favourable.
The report serves as a basis for future implementations in schools. Feel free to download any STEAM box and apply it to your classroom.



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