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Latvia – Lithuania

DESCRIPTION OF STEAM EDUCATION ACTIVITY "STICKER NUMBER MATCHING"

Topic	**"Find and stick the number! "**
Duration	60 min.
Abstract	Educational activities encourage participants to actively explore the library and discover books through games and collaboration. Participants search the library for stickers hidden in their cards describing books, and when they find the correct answer, they write or stick the book title on a magnetic board. The game is played in pairs, and the team with the most points wins. The activity integrates STEAM principles and encourages critical thinking, creativity, observation, and interest in literature.
STEAM education achievement areas and developed skills	
S (natural sciences)	Participants: • Explore the library environment and the objects in it. • Ask questions, look for cause-and-effect relationships ("Why is this book suitable for the description?"). • Apply observation and comparison skills by analysing book descriptions and content.
T (technologies)	Participants: • Use technological tools (magnetic board, QR codes, library catalogue). • Understand how technology helps organize and systematize information. • Use technology responsibly to achieve learning goals.
E (engineering)	Participants: • Develop an action plan for finding stickers and books effectively. • Solve problems that arise (e.g., inaccurate descriptions or hidden locations). • Work with team members to develop a game strategy and make decisions.
A (arts, other subjects)	Participants: • Create stickers, symbols, or bookmarks based on their own ideas. • Aesthetically present the title of the book they found on a magnetic board. • Express their emotions and impressions in a creative form (drawing, story, discussion).
M (mathematics)	Participants:

	• Count the points collected and compare the results between teams. • Understand the sequence and order (task numbering, point system). • Apply logical thinking and analysis, linking descriptions with correct answers.
Participant competency development ***(underline the competency and its component or components)***	Communication skills (message creation, message delivery and communication interaction, message analysis and interpretation)
	Cultural competence (cultural awareness, cultural expression, cultural consciousness)
	Creativity competence (exploration, generation, creation, evaluation, and reflection)
	Cognitive competence (subject knowledge and skills, critical thinking, problem solving, learning to learn)
	Social, emotional, and healthy lifestyle skills, self-awareness and self-control skills, empathy, social awareness and building positive relationships, responsible decision-making and behavior when assessing consequences, caring for health
Goal of the activity	Encourage children and young people to take an interest in books and libraries, develop their ability to explore, think creatively and logically, and apply STEAM principles when searching for, analysing, and organizing information through games and collaborative activities.
Operational objectives	1. Develop participants' ability to recognize and find books in the library based on descriptions. 2. Develop logical and critical thinking by searching for connections between clues and books. 3. Encourage the ability to use technological tools to search for information and record results. 4. Develop creativity by creating book symbols, stickers, or their presentation on a board. 5. Strengthen cooperation, communication, and teamwork skills.
Operational methods	Research, problem-based learning, creative expression, gamification, discussion, and reflection methods.
Operational strategies	Strategies for active learning, problem solving, and collaboration.
Operational methods and strategies	Stickers – with numbers, symbols, or pictures representing specific books. Task cards – with book descriptions, hints, or questions for participants. Magnetic board or poster – for writing or sticking book titles, marking results. Writing materials – markers, pens, sticky notes. Tablets or smartphones for scanning QR codes Computer for presenting results. Library books – marked with stickers corresponding to the task cards. Decorations or game accessories – coloured magnets, point tokens, symbolic prizes.
Additional measures that are needed to implement the activity	Prizes – symbolic stickers, badges, or thank-you cards for winners. A timer or clock app to keep track of task time. Coloured marking tools – magnets, sticky dots, board markers for marking results. Reflection sheets – for participants' impressions or brief self-assessment at the end of the activity.

Content of the activity		
Stages	Educator's activities	Participants' activities
Before the activity	1. Prepares the library space for the game. Chooses places where the prepared stickers will be hidden on the corresponding books. 2. Creates the structure of the game. Prepares a magnetic or interactive board with places to stick or write team points and book titles. 3. Prepares task cards. Writes book descriptions or clues on each card, which participants will use to search for books marked with stickers. Some stickers can have a QR code attached to them, which links to a short video or question about the book. 4. Organizes the participants into pairs. Prepares the necessary cards and ensures that each pair starts with a different task. 5. Establishes a scoring system and arranges prizes. One point is awarded for each book found correctly; additional points may be awarded for creativity or speed. 6. Checks the progress of the game. Walks around the library to make sure that the stickers are visible, the clues are clear, and the game route is logical and manageable.	
Introduction, motivating participants, exploring their experience, and discussing the activity’s objectives *(15 min.)*	Welcomes participants and creates a friendly, engaging atmosphere. Briefly introduces the activity: • Explains that there will be a game in which participants will have to search for stickers hidden in the library and find books hidden according to descriptions. • Motivates participants. Emphasizes that this is not just a game, but also a fun way to learn about books, develop observation skills, and collaborate. • Invites participants to act as "book detectives" or "treasure hunters." • Finds out more about the participants' experience. Asks questions: *"Who among you often visits the library?" "Have you ever looked for a book based on its description?" "What helps you choose what to read?"* • Listens to several answers and encourages everyone to participate. Discusses the task: • Explains that the aim of the game is to find books marked with stickers based on clues and write their titles on a magnetic board.	Listen, engage in conversation: • Answer questions about their experience in reading, visiting libraries, or learning about books. • Share what books they like, what they have read or heard. • Become familiar with the objectives of the activity. • Learn that there will be a game in which they will have to search for books based on clues and work together as a team. • Understand that the goal of the activity is to learn about books, develop attentiveness, and have fun. • Form pairs (or small groups) according to the educator's instructions. • Listen to the rules. • Learn how points will be scored, how to search for books, and what to do when they find a sticker. Get into the spirit of the game – feel like "book hunters."

	• Demonstrate how to search for books in the electronic library catalogue. Introduce the rules of the game and the scoring system: • Work in pairs or small teams. • The team receives one point for each book found correctly. • The team with the most points wins.	
Practical activity - experimentation ***(30 min.)***	Reminds participants of the rules of the game and the scoring system. Distributes task cards with book descriptions or clues to teams (in pairs). Monitors and moderates the process. Encourages participants to independently search for hidden stickers in the library space. Helps when needed by asking questions or giving additional clues. E.g. *"Could this book be in the game?", "Look in the section where there are lots of fairy tale books."* Ensures safety and order. Monitors that participants handle books and library equipment with care. Helps maintain a playful but disciplined atmosphere. Records the results. When a team finds a book, marks their points on a table or magnetic board. Encourages team involvement and maintains the pace of the game. Motivates and encourages. Praises attentiveness, speed, and cooperation. Encourages perseverance, reminding participants that the most important thing is to participate and learn about books.	Work in pairs or small groups. Get a task card with book descriptions. Together, they discuss which books could match the description. Actively search for stickers in the library. Walk around the library, looking for hidden stickers on books. Compare the book cover, title, and description on the card. Look for help in the electronic library catalogue and on the internet. They experiment with clues. Think logically and creatively, trying out various possibilities. If one book is not suitable, they look for another, learning through trial and error. After marking the correct answer, return to the board. They write down or stick the title of the book they found to their team's place. Monitor their own and other teams' progress. They rejoice in their discovery. Discuss what they have found and what they still need to find. They help each other and cooperate.
Presentation of activity results ***(15 min.)***	Stops the game and invites participants to gather around the magnetic board. Announces that it is time to tally the results. Reviews the board/results summary together with the participants.	Gather around the board. Observe the final results and listen to the educator. Present their findings. Each pair or group briefly describes the books they found and what they liked about them.

	Reads or discusses how many points each team has scored. Invites the teams to show what books they found. Encourages the participants to briefly share their impressions. Asks questions: *"Which task was the easiest?"* *"Which book interested you the most?"* *"What helped you find the answers faster?"* Announces the winners. Awards prizes or symbolic stickers to the team that scored the most points. Emphasizes that the most important thing was to cooperate, think, and discover books. Moves on to summarizing and reflection. Thanks everyone for participating and prepares to move on to discussing the activity.	Participate in the discussion. Answer the educator's questions and share what was most interesting or unexpected. Celebrate their achievements. Congratulate the winners, celebrate the overall result and the experience of the game.
Reflection ***(10 min.)***	Creates a calm atmosphere conducive to reflection. Invites participants to sit in a circle or at a table. Encourages them to pause for a moment to think about their experiences and discoveries during the activity. Asks open-ended questions that stimulate thinking: • *"What did you like most today?"* • *"What was the most difficult?"* • *"What new things did you learn about books or the library?"* • *"How did you find working in pairs?"* • *"What would you do differently next time?"* Summarizes the participants' answers. Emphasizes that every discovery is valuable, even if not all the books were found. Thanks everyone for participating and praises them for their enthusiasm, creativity, and teamwork. Highlights the strong points of the activity (e.g., *"You noticed the*	Reflect on what they liked, what they learned, and how they worked together. Answer the educator's questions. Share their experiences, insights, and emotions. Mention the most interesting or memorable book. Congratulate the winners and rejoices in the overall result. Understand that a library is not only a place for books, but also a space for exciting discoveries.

	details very well," "You quickly linked the description to the book"). Awards symbolic prizes.	
Assessment evaluation and self-evaluation	Formative assessment takes place throughout the activity, with continuous monitoring of participants' engagement, effort, creativity, and collaboration. The educator evaluates not the final result, but the learning process itself – how participants seek solutions, share ideas, make decisions in pairs or groups, how they respond to challenges and whether they are able to learn from them.	
Recommendations	If participants complete the task quickly, you can add the creation of a bookmark from secondary materials.	
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Recommended books for completing the task	Dešimt negriukų / Agata Kristi. – Vilnius : Židinys, [1992]. – 160 p.. – (Agata ; nr. 2). – UDK821.111-312.4 Keturi žiemos vėjai : pasaka / Algimantas Čekuolis. – Vilnius : Alma littera, 2013. – 70, [2] p.. – ISBN 978-609-01-0872-7. – UDK 821.172-93-34 Mažylis ir Karlsonas, kuris gyvena ant stogo : [apysakos] / Astrid Lindgren. – 5-asis leid.. – Vilnius : Garnelis, [2012]. – 466, [2] p.. – ISBN 978-9986-9205-8-8. – UDK 821.113.6-93. Pepė Ilgakojinė : [apysaka] / Astrid Lindgren. – 4-asis patais. leid.. – Vilnius : Garnelis, [2019]. – 293, [2] p.. – ISBN 978-9955-883-61-6. – UDK 821.113.6-93-31 Penketukas lobių saloje ; Ir vėl nepaprasti nuotykiai ; Sėkmingas pabėgimas : [apysakos] / Enid Blyton. – 2-asis patais. leid.. – Vilnius : Garnelis, [2020]. – 374, [2] p.. – (Šauniojo penketuko nuotykiai ; 1). – ISBN 978-9955-883-66-1. – UDK 821.111-93-31 Septyni pasaulio stebuklai / Hans Reichardt. – [Vilnius] : Mūsų knyga, [2004]. – 48 p.. – (Kas yra kas ; 1). – ISBN 9955-573-94-5. – UDK 94(3):087.5	

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TASK: "DISCOVERY GAME IN THE LIBRARY"

Number	*Name of the book*	*Author*	*Task for a participant*
2	**Astrid Lindgren** *"Pippi Longstocking"*		**Find a book about a wild girl with matching socks, whose title consists of two words.**
7	**Astrid Lindgren** *"The Little Boy and Karlsson Who Lives on the Roof"*		**Find a book about a flying guy whose friend is called Little One, and the title of the book consists of seven words.**
3	**Folk tale "The Three Little Pigs"**		**Find a fairy tale that has the number three in its title.**
4	**Algimantas Čekuolis “Four Winter Winds”**		**Find A. Čekuolis' book, which has the number four in its title.**
5	**Enid Blyton "The Famous Five on Treasure Island. More extraordinary adventures. A successful escape."**		**Find a book with the number five in its title.**

6	**Leigh Bardugo "Six of Crows"**		**Find a book with the number six in its title.**
7	**Who's who. Seven wonders of the world.**		**Find a book with the number seven in its title.**
8	**The fairy tale "The Seven Dwarfs and Snow White"**		**Find a book with seven dwarfs in the title.**
9	**Lithuanian folk tale "Nine Brothers and Their Sister Elenytė"**		**Find a book with nine brothers in the title.**
10	**A. Christie "Ten Little Indians Go on a Trip"**		**Find a book with the number ten in its title.**

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DESCRIPTION OF STEAM EDUCATION ACTIVITY "ORIGAMI AND MATHEMATICAL PRINCIPLES"

Topic	**Origami and mathematical principles**
Duration	60 min.
Abstract	During the practical activity, participants are learning more about mathematical concepts, geometrical principles, develop fine motor skills and creativity. Participants individually create animal figure of their choice using origami technique, and at the end of activity compose a collaborative „Zoo Park “.
Areas of achievement and expected outcomes	
S (natural sciences)	Participants explore animal diversity and their habitats, linking creative work to the natural world: • Name different animals and their habitats. • Explain that animals need suitable conditions (food, water, shelter). • Recognize similarities and differences between animals based on body shape or colour.
T (technologies)	Participants apply paper folding techniques using tools and visual instructions: • Select the appropriate type and size of paper according to the model. • Follow the demonstration steps and work neatly. • Use glue or adhesive tape to reinforce the structure and display it.
E (engineering)	Participants create origami animals by applying structural principles and trial and error methods: • Fold the paper according to the specified sequence of actions to achieve the desired shape. • Observe the result and adjust their actions to improve the structure. • Incorporate their creation into the overall "Zoo Park" composition.
A (arts, other subjects)	Participants creatively decorate origami figures and express their personal aesthetic: • Use colors, patterns, and details to decorate animals. • Create stories or roles for animals for a joint exhibition. • Maintain aesthetic order and are able to present their creative results.

M (mathematics)	Participants apply geometric principles when folding paper: • Recognize and name geometric shapes - square, triangle, rectangle, polygon, rhombus. • Notice and explain the symmetry patterns in the fold. • Compare the sizes and proportions of the figures, applying measurement and comparison skills.
Participant competency development *(underline the competency and its component or components)*	Communication skills (message creation, message delivery and communication interaction, message analysis and interpretation)
	Cultural competence (cultural literacy, cultural expression, cultural awareness)
	Creativity competence (exploration, generation, creation, evaluation, and reflection)
	Cognitive competence (subject knowledge and skills, critical thinking, problem solving, learning to learn)
	Social, emotional, and healthy lifestyle skills, self-awareness and self-control skills, empathy, social awareness and building positive relationships, responsible decision-making and behaviour when assessing consequences, caring for health
	Digital competence (digital content, digital communication, digital safety, problem solving)
	Civic responsibility competence (civic identity and civic power, living in a community while building a democratic society, respect for human rights and freedoms, state building and strengthening statehood in the international community)
Goal of the activity	Strengthen participants' mathematical, creative, and cognitive abilities through experiential activities, folding and creating natural objects (animals) from paper using origami techniques and applying STEAM principles.
Operational objectives	• Introduce participants to origami techniques and their connection to the laws of nature and mathematics, encouraging them to recognize geometric shapes and symmetry. • To enable participants to apply paper folding, construction, and decoration techniques, developing fine motor skills, creativity, and the ability to work in pairs or groups. • Encourage self-expression through the creation and presentation of creative animal compositions, discussing the geometric and aesthetic principles observed and evaluating one's achievements.
Operational methods	Methods of research, observation, problem-based teaching, creative expression, modelling, demonstration, discussion, interpretation, gamification, reflection.

Operational strategies	Experiential learning, problem solving, creative, cooperation strategies.	
Operational tools and equipment	Origami paper (various sizes and colours), cardboard, instruction cards or drawings, glue, adhesive tape, paper clips, scissors, ruler, pencil, set square, felt-tip pens, crayons, paints, stickers, glitter, appliqués, boxes, large screen for demonstration.	
Additional measures that are needed to implement the activity	Boxes for storing materials, rubber bands, double-sided adhesive tape, clips, visual cards or pictures illustrating the steps of the activity, emotion cards for reflection.	
Content of the activity		
Stages	Educator's activities	Participants' activities
Before the activity	Selects a quiet space in the library. Arranges tables and chairs so that it is convenient to move around and work in pairs or small groups. If there are participants with mobility difficulties in the group, ensures that they can comfortably access the space and equipment. Ensures that the space is bright, cozy, and has minimal distractions (no flashing lights, strong smells). Checks that the equipment for displaying images is working properly. Selects the necessary equipment and presents it in separate boxes, rather than all in one place, to make it easier for participants to find their way around. Provides a „quiet corner" / „silence zone" if there is too much noise or stimuli for a participant.	
Introduction, motivating participants, exploring their experience, and discussing the activity's objectives *(15 min.)*	Creates a cozy and safe atmosphere. Seats everyone in a circle or at tables so that everyone can see each other. Explains that an interesting creative activity awaits them today. Asks the participants questions: *„Who among you has been to the Zoo Park?" "What lives there?"* *„Which animal did you like the most?"* Shows original origami, pictures of them, or a short video clip about animals created using origami techniques. Asks to name the animal that has been made. Asks *„And how are they made?"* A brief introduction to origami: The word „origami" in Japanese means: ori - to fold, kami - paper. It is the art of paper folding, which originated in China in the IV century. It is folded	Listen and engage in the conversation. Answer questions about animals and share their experiences. Observe pictures, a film or objects related to origami. Express their experiences and emotions. Tell or show what they know or remember about animals by gestures, facial expressions, drawing. Share their thoughts or memories: *„I like it when..."* Engage in a motivational moment.

	without glue. Mathematical knowledge is very important when folding. Finds out about the participants' experience. Encourages sharing personal observations: *„Do you have a pet at home? What kind?", „How do you take care of your pet?"* Allows participants to show what they know through gestures or drawings (this is especially helpful for nonverbal or quieter participants). The educator listens actively and praises each answer (*„Great!", „Yes!"*). Motivates and engages: Presents the task, by usually explaining: *„Our task is to fold a paper animal that will go to look for friends in the zoo we have all created together."* Briefly shows the course of the activity visually (with cards or pictures). Emphasizes that *„The most important thing is to try and enjoy your creation. Each animal will be unique!"* Explains the rules of the activity: *„You can work at your own pace. If it gets too noisy, you can take a break in the quiet corner."*	Express interest, curiosity („I want to fold paper too!"). Understand the task. Together with the educator, identify what they will do (*„I will fold a paper animal"*). Prepare for a start of the creative part of the activity, pledges to work in a calm and friendly way.
Practical activity - experimentation ***(30 min.)***	Briefly explains what they are going to do: *„Now we are all going to fold a chosen animal, which will then go to the zoo to find friends."* Shows sample origami models and slowly and clearly demonstrates the steps for creating one origami model. Uses visual aids for each step (for participants with language or attention difficulties). Encourages participants to choose which animal they would like to fold. Monitors the process and provides assistance. The educator goes around the groups, helping each participant, holding or preparing parts if necessary. Fosters independence: *„Great, try folding another corner yourself."*	Select the desired color of paper. Perform the actions independently or following the educator's example. Fold the animal. Decorate it with origami stickers, patterns, or colors. If necessary, ask for help, work together with a friend or educator. Are proud of the result, share with friends: *„My pet is folded"*. They incorporate the animal they have made into a „Zoo park" shape (by attaching it with sticky tack). Glue on other details (e.g., iridescent animals, letters

	Encourages: *"Each animal will be different and they will all be wonderful!"* Helps participants who need extra support by differentiating tasks. If a participant has difficulty folding, he/she can be given a simpler option or theme (e.g., flowers by the pond in the Zoo). Monitors whether participants are following the process and helps them. Encourages exploration and observation: *„What did you notice while folding?"* Encourages decorating the origami.	ZOO, tree, pond shape, bench, etc.) Observations and conclusions. Communicate with the educator, answer questions. Understand that geometric principles are used in folding.
Presentation of activity results *(15 min.)*	Creates a joyful, festive atmosphere. Announces *„Now it's time to visit the Zoo park we created!"* Turns on soft, pleasant background music to create a festive feeling. Invites participants to show their origami, singly or in pairs. Asks simple, encouraging questions (so that everyone can answer to the best of their ability): • what geometric principle they used (e.g. symmetry), • what friends did the participant's animal find at the Zoo Park? What did they like about folding? Praise each participant specifically: *„Very skilfully folded!" „Your animal is very nicely decorated!"* Invites participants to clap each other or give a „thumbs up". Emotion cards can be used - participants can show how they feel. Offers to take a group photo in front of the „Zoo Park" May give a „Origami Maker" sticker or certificate.	Present their work. Show which animal they folded. Briefly explain (or show with gestures) which geometric principle they applied (e.g., symmetry), which friends their animal found in the zoo park, what they liked about folding, and evaluate the overall work. Are happy with their work and observe their friends' creations. Evaluate and support friends. Express approval by clapping, showing emotion cards, or giving a thumbs up. Learn to listen respectfully to others. Answer the questions: *„What did you learn today?", „What would you like to repeat most?"* Show emotion *(„I'm glad", „It was fun", „I did well").* End the activity on a happy note by taking a photo of everyone working together.
Reflection *(10 min.)*	Summarizes the results, invites participants to share their observations:	Observe their own and their friends' animals, as well as

	In simple words, helps participants to summarize and repeat concepts: „Today we have learnt that origami is the art of folding paper." *„ While creating the origami, it was important to follow neatness and symmetry. "* *„ We folded paper to make triangles and quadrilaterals"* *„ We helped the animals we made to make friends at the Zoo Park"* Can give a symbolic „Origami Maker" sticker or certificate. Praises everyone for their efforts: *„ You are true origami masters and creators!"*	the overall view of the zoo park. Express their conclusions in simple words or gestures. Show how they feel after the activity. Can receive a symbolic "Origami Creator" sticker or certificate.
Assessment evaluation and self-evaluation	After the presentation of the works, the Educator says: *„ You have all been real creators today! Now let's think about how we did and what we have learned."* Reminds students that it's not the result, but the effort and the experience that matters. Provides a simple way of evaluation (visual). Pictures, emotional faces or symbols are used so that participants could choose according to their abilities.	Choose an emotional face/thumbs up/color to show how they did. Answer short questions*:* *„ What was the most fun today?", „ What was the hardest?", „ What would I like to try again?"* Show or tell what they are proud of *(„ I managed to fold it," „ My origami is beautiful!"*). Support each other, applaud their friends' achievements.
Recommendations	Other themes may be used: 1. „Origami City." Groups create city neighborhoods: houses, trees, cars, bridges. In the final stage, all neighborhoods are combined into one city. Emphasis is placed on cooperation and creative planning. 2. „Flying Model Tournament." Participants fold various paper airplanes or rockets. There are competitions for flight distance or accuracy taking place. Engineering thinking is involved: ideas for improvements after the first attempts. 3. „Origami puzzle." Colored paper squares are prepared in advance, and identical modules are folded. All modules are combined into a common figure (star, flower, mosaic). The emphasis is on teamwork, rhythm, and precision of details.	
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DESCRIPTION OF STEAM EDUCATION ACTIVITY "SENSORY LEARNING PATHS"

Topic	**Sensory learning paths**
Duration	60 min.
Abstract	Participants learn about the life cycle of a tree (chestnut), strengthen their counting skills, learn to compare and draw conclusions about the objects they observe, and apply this knowledge to creative activities (e.g., drawing on chestnuts or arranging them). In practical activities taking place indoors, participants move, touch, listen, look, smell, and experience various sensations while exploring natural objects. They learn through all their senses. To make learning an adventure for participants, a cheerful character, **Chestnuty Blacknose,** is brought in to help. The plot of the activity revolves around the participants' journey through colours, smells, sounds, and numbers.
STEAM education achievement areas and developed skills	
S (natural sciences)	Participants develop natural science skills by exploring natural objects and processes: • They examine chestnut fruits and leaves and notice their differences. • Compare and classify objects (big–small, green–brown, distinguish the stages of the natural cycle ("seed–sprout–tree"). • Understand the relationship between cause and effect ("The chestnut fell → a sprout grew → a tree grew from it"). • Recognizes the cycle of life and understands the repetition of natural processes.
T (technologies)	Participants develop technological skills by working with natural materials: • Become familiar with natural materials (chestnuts, leaves, sticks) and learn how to use them purposefully for creativity or construction. • Learn how to safely use simple tools (glue, brushes, awls). • Create objects from chestnuts, plan their steps, and solve practical problems ("How to connect two chestnuts?"). • Practice planning activities from idea to finished result.

	• Learn to cooperate and share resources in group activities.
E (engineering)	Participants develop engineering thinking by creating simple structures: • Model figures and objects from chestnuts and sticks (little people, bridges, towers). • Understand the principles of stability and look for ways to make the structure stronger. • Solve problems when the structure collapses and try new solutions. • Apply trial and error method, experimenting with different structures. • Plan what they want to create and choose the right design.
A (arts, other subjects)	Participants develop their artistic abilities and creativity: • Express themselves creatively by decorating chestnuts, composing shapes, and choosing colours. • Learn about colours and create colour compositions ("autumn colours," "my chestnut"). • Use their imagination to transform chestnuts into characters, animals, or objects. • Develop aesthetic perception, evaluate their own and others' creations, and enjoy the process.
M (mathematics)	Participants apply mathematical skills in practice: • Compare sizes and quantities ("big–small," "more–less," "long–short"). • Understand quantitative concepts ("one–many," "whole–half," "equal–different"). • Count chestnuts, leaves, stages of the life cycle. • Group, sort, and arrange sequences according to size, quantity, or cycle order ("from seed to tree").
Participant competency development *(underline the competency and its component or components)*	Communication skills (message creation, message delivery and communication interaction, message analysis and interpretation)
	Cultural competence (cultural awareness, cultural expression, cultural consciousness)
	Creativity competence (exploration, generation, creation, evaluation, and reflection)
	Digital competence (digital content, digital communication, digital safety, problem solving)
	Cognitive competence (subject knowledge and skills, critical thinking, problem solving, learning to learn)
	Civic responsibility competence (civic identity and civic power, living in a community while building a democratic society, respect for human rights and freedoms, state building and strengthening statehood in the international community)
	Social, emotional, and healthy lifestyle skills (self-awareness and self-control skills, empathy, social awareness and building positive relationships, responsible decision-making and behaviour when assessing consequences, caring for health)
Goal of the activity	To provide participants with the opportunity to explore autumn natural objects (chestnuts, leaves, twigs), develop their sensory perceptions, creativity, and

	STEAM skills by traveling through various sensory stations and performing listening, touching, smelling, colour, counting, and creative tasks.
Operational objectives	• Encourage participants to explore natural objects through experiential learning, using their senses – touching, smelling, listening, comparing their characteristics, and noticing differences. • Develop creativity and fine motor skills by performing drawing, painting, construction, and decoration tasks at the creative station. • Develop mathematical and logical thinking skills by counting, sorting, and grouping chestnuts and leaves, applying the concepts of "more–less," "big–small," and "whole–half." • Encourage cooperation and communication by performing tasks at the stations, sharing tools, discussing observations, and reflecting on the results of the activities.
Operational methods	Methods of research, problem-based teaching, demonstration, modelling, gamification, creative expression, discussion, reflection.
Operational strategies	Experiential learning, problem solving, creative, cooperation strategies.
Operational tools and equipment	Sensory sensations/sensory stations: • Small natural objects: chestnuts, leaves, twigs, bark – for exploring with your hands. • Containers made of various materials, in which chestnuts can be shaken to produce different sounds (glass, plastic, paper, bag, etc.) – for sound and touch stimulation. • Whole and halved chestnuts – for smelling and recognizing, for understanding the concepts of "whole" and "half." • Tie-up opaque bags. Creative materials: • White and black markers/highlighter pens or white gouache, • Gouache in various colours, brushes, sponges. • Colourful tree leaves. • Small gluing tools or adhesive tape (safe for participants). Safety/hygiene: • Gloves, wet wipes – when working with gouache, chestnuts, or small materials. • Rugs or plastic sheets – protection from dirt or paint.
Additional measures that are needed to implement the activity	Technology/demonstration tools: • A figure or image of **Chestnuty Blacknose** on the screen (drawn, coloured, smiling, with traveller’s attributes – a backpack, boots, a hat). • A large screen
Content of the activity	
Stages	Educator's activities / Participants' activities
Before the activity	Selects a bright, cozy, spacious room suitable for participants to work individually, in groups, or all together. Arranges the furniture so that all participants have access, comfort, and reach to the materials.

	Prepares a sequence of actions for participants ("stops") in the form of pictures (1. We listen, 2. Touch, 3. Count, 4. Draw or construct) so that participants know in advance what to expect. The character **Chestnuty Blacknose** can "show the way" between stops (places his cards next to each task). Provides a "quiet corner" / "quiet zone" if there is too much noise or stimuli for a participant. Selects necessary tools and places them in clearly separated boxes, not all in one place, to avoid chaos.	
Introduction, motivating participants, exploring their experience, and discussing the activity’s objectives *(15 min.)*	Greets the participants and shows/introduces **Chestnuty Blacknose** (a figurine or image on the screen). Introduces the story: *"Today we will be travellers and we will travel along the paths of colours, smells, sounds, and numbers.* **Chestnuty Blacknose** *has invited us on an adventure!"* Asks participants about their experiences: • *"Have you ever held a chestnut in your hand?"* • *"Where do you think chestnuts come from?"* Shows the life cycle of a chestnut using pictures, images on the screen, or objects, explaining in simple terms: 1. A chestnut falls to the ground (seed). 2. A small sprout emerges from it. 3. A young tree grows. 4. A large tree with flowers grows. 5. New chestnuts grow again! Explain the rule of the activity: *"We will travel through the stations. You can go at your own pace. If it gets too noisy, you can take a break in the quiet corner."*	Listen, look, touch chestnuts, twigs, leaves. Try to answer questions or show with gestures/pictures.
Practical activity - experimentation *(30 min.)*	Introduces the stations one by one or all at once, e.g.: • *"Here is* ***the sound station****. Shake the chestnuts in different containers and say which sound is the loudest."* • *"This is* ***the smell station****. Smell a chestnut leaf, a twig, and a chestnut—do they smell different?*	• Travel through the stations and perform the tasks presented there. • At the sound station, shake chestnuts in different containers and compare the intensity of the sounds. • At the smell station, smell a leaf, a twig, and a chestnut, and compare their smells.

	Which smells stronger—a whole chestnut or half a chestnut?" • *"Here is **the number station**. Choose 20 chestnuts. Arrange them from smallest to largest. Arrange as many chestnuts as there are letters in your name." "Arrange your favourite number with chestnuts."* • *"Here is **the colour station**. "Separate the green, yellow, and red leaves from one pile into separate piles."* • *"This is **the creation station**.* *You can choose an activity.* *1) Make your own* **Chestnuty Blacknose** *from chestnuts and sticks!"* *2) "Draw the letter of your name/sun/bird or whatever you like on the largest chestnut you have chosen."* *3) "Draw a happy face on your* **Chestnuty Blacknose** *with a black marker or felt-tip pen."* *4) "Make a chestnut tree from chestnuts, twigs, and leaves."* *5) "Paint a portrait of* **Chestnuty Blacknose** *on a white sheet of paper with gouache."* Encourages exploration with questions: • *"Where is the sound louder – on glass or paper?"* • *"Which smell do you like better – sweet or fresh?"* • *"How can you prevent your tower from collapsing?"* Helps participants who need additional support by differentiating tasks.	• At the number station, collect chestnuts and sorts them by size, numbers, or the letters of their name. • At the colour station, sorts leaves into separate piles according to colour. • At the creation station, choose one creative activity and do it (make a chestnut, draw on a chestnut, arrange a tree, paint a portrait). • Answer the educator's research questions and express their observations. • Try to solve tasks and problems, experiment with different solutions. • Accept the educator's help and work with adapted tasks, if necessary.
Presentation of activity results *(5 min.)*	Gathers the participants in a circle. Asks them to show what they have done. If necessary, says aloud on behalf of the participants: *"Milda says that half a chestnut smells stronger."* Invites participants to show what they liked touching the most / what sound	• Gather in a circle and prepare to share their experiences. • Show their completed tasks or creations. • Tell or show what they did best. • Show what they liked touching the most, what sound they

	they made / how many chestnuts they collected. Repeats the concepts: *"more or less," "big or small," "whole or half."*	succeeded to make, or how many chestnuts they collected. • Listen to other participants' stories and observe their results. • Recognize and use the concepts repeated by the educator ("more-less," "big-small," "whole-half").
Reflection *(10 min.)*	Provides simple reflection phrases with choices: *"Raise your hand if you think the sound of the chestnuts in the glass was louder. Who thinks it was quieter?"* *"To whom did the chestnut smell nice, and to whom – strange?"* *"Where were more chestnuts—in your hand or on the table?"* *"Show me which hand is holding the whole chestnut and which one is holding the half."* Ends the activity on a positive note: *"Today, you were true explorers and creators!* Chestnuty Blacknose *is proud of you!"*	• Tell or show with gestures what they have achieved and what they have noticed. • Compare their experiences with those of other participants. • Express their impressions, emotions, and lessons learned with words, gestures, or by demonstrating the actions they have performed.
Assessment evaluation and self-evaluation	• The participants reflect on what they learned today and what went best for them • Choose one activity or task that they are most proud of. • Evaluate their efforts with words, gestures, or symbols (e.g., give a thumbs up, smile). • Compare their activities with the goals set at the beginning ("Did I manage to sort the leaves? Did the tower I built remain stable?"). • Express what they would like to improve or try next time. • Listen to the educator's feedback on their efforts, creativity, and engagement.	
Recommendations	• To involve specialists: a special education teacher, a physical therapist, an occupational therapist. • Test the paths with participants and observe which elements of the path engage participants more.	
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DESCRIPTION OF STEAM EDUCATION ACTIVITY "APPLICATION OF FAIRY TALE THEME IN STEAM: ALICE THROUGH THE LOOKING-GLASS “

Topic	**Application of fairy tale theme in STEAM: Alice Through the Looking-Glass**
Duration	60 min.
Abstract	The educational activity "Alice Through the Looking-Glass" invites participants to immerse themselves in a world of science and imagination, where fairy tales meet physics. Based on Lewis Carroll's story about Alice, the activity explores mirror reflections, the path of light, and symmetry, linking this to the basics of optics and creative STEAM education. Using a Tri-fold mirror, flashlights, and colored filters, participants conduct interactive experiments, observe light reflections, and learn about angle equality and multiple reflections. In the creative part, they create their own images of the "mirror kingdom," developing their imagination and ability to apply scientific knowledge in artistic activities. The activity fosters curiosity, critical thinking, creativity, teamwork, and encourages the discovery that science can be as magical as a fairy tale.
Areas of achievement and expected achievements	
S (natural sciences)	Participants explore light reflection, symmetry, how mirrors work, and the laws of reflection: • Understand that light travels in a straight line and reflects at the same angle at which it strikes. • Explain why mirrors flip left and right. • Recognize reflection phenomena in everyday life.
T (technologies)	Participants use technological tools (filters, mirrors) for experiments and presentation of results: • Are able to use technological tools for research. • Apply technological tools when creating a "light path" or "mirror code."
E (engineering)	Participants construct the experimental environment – they adjust the angles of the mirrors and plan the path of light: • Model the arrangement of mirrors according to the desired effect. • Understand how changing the angle affects the number of reflections.
A (arts, other subjects)	Participants create images of the "kingdom of mirrors," draw symmetry, and form aesthetic patterns: • Create visual works using scientific principles. • Use their imagination and aesthetic perception to convey scientific phenomena.
M (mathematics)	Participants apply the principles of angles, shapes, and symmetry in their activities: • Recognize geometric symmetry. • Are able to explain how a change in angles changes the direction or number of reflections.
Participant competency development (underline the	Communication skills (message creation, message delivery and communication interaction, message analysis and interpretation)
	Cultural competence (cultural literacy, cultural expression, cultural awareness) Creativity competence (exploration, generation, creation, evaluation, and reflection)
	Digital competence (digital content, digital communication, digital safety, problem solving)

<table>
<tr><td rowspan="3">competency and its component or components)</td><td>Cognitive competence (subject knowledge and skills, critical thinking, problem solving, learning to learn)</td></tr>
<tr><td>Civic competence (civic identity and civic power, living in a community while building a democratic society, respect for human rights and freedom, building the state and strengthening statehood in the international community</td></tr>
<tr><td>Social, emotional, and healthy lifestyle skills, self-awareness and self-control skills, empathy, social awareness and building positive relationships, responsible decision-making and behavior when assessing consequences, caring for health</td></tr>
<tr><td>Goal of the activity</td><td colspan="2">Through interactive experiments with a Tri-fold mirror, mirror writing, and light reflections, participants are introduced to the basics of optics (the law of reflection, symmetry), fostering curiosity, creativity, problem solving, and collaboration.</td></tr>
<tr><td>Operational objectives</td><td colspan="2">1. To explain how light reflection works and why the image in a mirror is reversed from left to right.
2. To explore the symmetry and multiple reflections created by mirrors using a Tri-fold mirror.
3. To conduct experiments with light, mirrors, and colors, observing and recording the results.
4. To apply scientific knowledge creatively—create your own image of the "mirror kingdom" and present discoveries to the group.</td></tr>
<tr><td>Operational methods</td><td colspan="2">Research, problem-based learning, creative expression, demonstration, discussion, reflection, storytelling methods.</td></tr>
<tr><td>Operational strategies</td><td colspan="2">Experiential learning, problem solving, creative and collaborative strategies.</td></tr>
<tr><td>Operational tools and equipment</td><td colspan="2">Materials
Tri-fold mirror (15–20 cm, framed in wood or plastic)
Small mirrors (2–3 per group, acrylic or plastic)
Flashlights or LED light sources (1–2 per group)
Colored cellophane sheets or filters (3–4 colours)
Sheets of paper (white and colored, A4 size)
Pens, pencils, markers, highlighters
Mirror writing cards (with the words: ALISA, MIRROR, QUEEN, WORLD, CODE)
Markers and decorative stickers (for display, reflection)
Napkins or microfiber cloths (for cleaning mirrors)
Boxes or envelopes for tool kits
Stopwatch (for time management during experiments)
Equipment
Tables (3–4) – for experiment stations (mirror writing, three way mirror, light travel).
Chairs for participants (according to the number of groups).
Board or stand for presentations and reflection ("Mirror Gallery").
Light control option (curtains or adjustable lighting).
Projector or document camera (not essential, but useful for demonstrations).
Music player/speaker (for introductions and to create a creative atmosphere).
Electrical sockets or extension cords (if additional lighting equipment is used).</td></tr>
<tr><td>Additional measures that are needed to implement the activity</td><td colspan="2">Timer or stopwatch (for time management and monitoring activity stages)
Tool boxes or baskets (for storing group sets)
Adhesive tape (for securing tools, protecting mirror edges)
Waste bin or bag (for collecting tools after the activity)
Curtains or light control devices (for controlling light intensity)
Whiteboard or poster for recording the course and results of the activity
Sticky notes, markers (for reflection and marking ideas)</td></tr>
<tr><td colspan="3">Content of the activity</td></tr>
<tr><td>Stages</td><td>Educator's activities</td><td>Participants' activities</td></tr>
<tr><td>Before the activity</td><td colspan="2">Prepares the space for education:
• Chooses a bright, quiet room with tables where the lighting can be adjusted.</td></tr>
</table>

	• Prepares one three-sided mirror (15–20 cm) on each table. • Sets up a separate "light corner" with flashlights, colored filters, cellophane, and sheets of paper for experiments. • Protects the edges of the mirrors with adhesive tape or other means (especially if the mirrors are made of glass). • Sets up a small exhibition area where the participants' work and discoveries will be presented at the end. Prepares an individual set of materials for each group of 4–5 participants: Tri-fold mirror 2–3 small mirrors Flashlight or small LED lamp Set of colored cellophane/plastic 3–4 sheets of paper, 2 pens/markers Mirror writing cards with inscriptions (e.g., *ALISA, MIRROR, QUEEN, WORLD, CODE*) Reflection task sheet for recording observations Stickers or mini objects (e.g., crowns, flowers, figurines) for creative tasks Prepares educational content: Reviews the basic principles of optics that will be presented to participants: Angle of incidence = angle of reflection A mirror does not flip the world upside down, but flips from left to right The smaller the angle between the mirrors, the greater the symmetry Prepares a short introductory story that will engage participants in the activity. For example, *"Alice approached the mirror. It wasn't just glass-it was another world where everything looked familiar, but upside down..."* Prepares discussion questions that will encourage participants to think and come up with hypotheses: *"Why do you think everything in the mirror looks left-right?"* *"What would you see if there were two mirrors in front of you?"* *"How many times would you see yourself if the mirrors were at an angle?"* Performs a safety check: Checks if the equipment is safe: no sharp edges, no broken mirrors. Reminds participants of the rules: do not shine flashlights in each other's eyes, handle mirrors with care. Makes sure that the mirrors are stable on the surface and do not slip. Provides napkins or a soft cloth for cleaning the equipment after the activity.	
Introduction, motivating participants, exploring their experience, and discussing the activity's objectives *(10 min.)*	Creates an engaging atmosphere. Plays calm music or sound effects (e.g., the sound of a mirror shining). Introductory story: *"Do you remember Alice, who one day saw a mirror and decided that it was not just a piece of glass, but a door to another world? She stepped through it... and everything changed: words seemed backwards, the world was upside down, and people were like reflections. "* Asks:	Become involved in the story. Listen to the story about Alice and imagine what the world behind the mirror looks like. Answer the questions: *"How would you feel if everything were the opposite?"* *"Would you recognize yourself in the mirror if it showed not only you, but also several reflections of you?"* Share their experiences: Tell where and how they have seen reflections. Show hand movements and compares how they look in the mirror (e.g., raises a hand and sees

	"Do you think mirrors can really show a different world?" *"Where do you see mirrors or reflections every day?"* *"Have you ever tried writing or drawing something and looking at how it looks in a mirror?"* Encourages reflection on previous experiences, asks questions: *"Where do we see our reflections?" (e.g., in water, in a window, on a phone, on a spoon).* *"Have you noticed that when you raise your left hand, it looks like you are raising your right hand in the mirror?"* Uses a mini demonstration: Shows the letter "L" or the word "ALISA" – how it looks in the mirror. Asks participants to guess how other letters will look (e.g., "M," "S," "K"). Emphasizes that mirrors do not flip things upside down, but from left to right. States the goal and objective of the activity, explaining it to participants in an understandable way: *"Today, we will also travel to Alice's mirror kingdom. Only our miracles will be real – scientific. We will find out how mirrors, light, and reflections work, create our own mini world of mirrors, and maybe even discover a new way of seeing the world! "* Emphasizes learning objectives: *"We will learn how light reflects off a mirror.* *We will see how symmetry is created.* *We will use a tri-fold mirror to create our own 'mirror kingdom'.* We will *try mirror writing, like Alice."* Introduces the rules and tools. Shows the Tri-fold mirror and explains how it works. Emphasizes safety rules: We handle mirrors with care and do not use them as toys. We do not shine flashlights in people's eyes. Shows the tools to each table and explains that they will be used later during the experiment.	the "opposite movement" in the mirror). Participate in a short game called "Who is a reflection and who is a person?" – participants take turns copying each other's movements like mirrors. Identify expectations and understand the task, and answer the question: *"What would you like to learn or find out about mirrors today?"* Together with the educator, they summarize the goal of the activity: *"Today we will explore how light is reflected and how mirrors can create miracles."* Prepare for the activity: receive a set of group tools, divide roles (who will observe, who will draw, who will write, who will hold the mirror).
Practical activity - experimentation *(30 min.)*	Introduces the objectives of the experiments. Explains that there will be three experiments related to Alice's world: 1. *Alice's code (mirror writing)* 2. *The Kingdom of Symmetry (Tri-fold mirror)*	Perform the "Alice Code" experiment (mirror writing) • At the station with mirrors, paper, and cards, try to read the mirrored word (e.g., ALICE, WORLD).

	3. *"The Journey of Light – the Law of Reflection"* Divides participants into small groups (3–5 participants each) and names them "Mirror Writing Wizards," "Symmetry Creators," and "Light Engineers." Assigns each group to start with a different experiment and rotates stations after 10 minutes. Leads the experiment "Mirror Writing – Alice's Secret": Shows how the word looks in the mirror. Explains that "The mirror changes direction: left becomes right. This is not magic, but a property of the path of light." Encourages participants to write the word "ALISA" backwards (from right to left). Encourages them to compare how it looks in the mirror. Observes, helps read the mirror text, explains the idea of coding. Organizes the experiment " Tri-fold Mirror – the World of Symmetry." Shows the Tri-fold mirror: Briefly explains: "Three mirrors allow you to see not one, but many reflections. This is how a kaleidoscope is created." Encourages: "Place a small object (e.g., a crown, a figurine) in the middle. How many times do you see it? What do you notice if you change the angle between the mirrors?" Helps to draw the angles of the reflections on paper or to draw the visible "star" shape. Encourages exploration of colors: a colored filter or transparent object can be added. Organizes the experiment "The Journey of Light – the Law of Reflection": Prepares a goal ("queen's crown") and several small mirrors on the table. Explains that "Light always travels in a straight line, but when it hits a mirror, it reflects at the same angle at which it hits." Demonstrates with a flashlight: the light hits the target through reflections. Encourages groups to come up with their own light path (e.g., "three reflections to the crown"). Monitors whether all participants are involved. Asks open-ended questions: "What would happen if...?" Encourages hypotheses: "What do you think would happen if you turned the mirror at an angle?"	• Write their names backwards and check it with a mirror. • Create a short "secret message" for a friend. • Discuss: "Why does everything look upside down in the mirror?" Perform the experiment "The Kingdom of Symmetry" (*Tri-fold* mirror): Place an object (e.g., a figurine, a crown) between three mirrors. Observe how many reflections are visible. Count and draw patterns (stars, flower shapes). Change the angle between the mirrors and observe the difference. Experiment with colored cellophane to see how the color of the reflection changes. Describe or draw their "image of the kingdom of mirrors." Perform the experiment "The Journey of Light – the Law of Reflection": Use a flashlight and small mirrors. Try to direct the light beam at a target (e.g., a crown). Observe how the light changes direction when it is reflected. Count how many times the light is reflected. Try out the "colored light path" using filters. Participants after the experiments: Fill out short reflection cards: "Which experiment was the most interesting?", "What new things did I learn?", "What else would I like to try?" Prepare to present their discoveries during the final part of the activity.

Presentation of activity results *(10 min.)*	Creates the mood for the presentation: Says an introductory phrase, emphasizing the importance of discovery: "*Alice has returned from the mirror kingdom with new ideas. Now it's time for you to share what you saw on your journey!"* Prepares an "exhibition table" or "mirror gallery" where groups can display their work: mirror writing sheets, symmetry drawings (tripod mirror), etc. Explains the presentation process. Each group briefly (1-2 min.) presents one of their discoveries. Other participants can ask questions or say what they liked the most. Moderates the participants' presentations and reflections. Invites the groups to present in turn: "Mirror Writing Wizards" – show their coded words and how they can be read. "Symmetry Creators" – present the patterns of a three-sided mirror, show how the number of reflections changes when the angle is changed. "Light Engineers" – show how a ray of light traveled from the source to the target. Asks the groups reflective questions: "What surprised you the most today?" "How did the mirror help you discover something new?" "Where can we apply these discoveries in our lives?" (e.g., mirrors, architecture, photography, design) Summarizes and gives meaning to the activity, thanks all participants:	Prepare for the presentation. Each group agrees on what they will present, who will speak, what they will show (work, drawing, demonstration), and what they will say about their discovery. Prepare to display the work on a table or wall ("mirror gallery"). The groups present their experiments one by one: Mirror writing group: shows how their words look in the reflection and explains why this is so. Tri-fold mirror group: shows the drawing or writing they saw and says how many reflections there were. The light group: shows how the light "traveled," how many times it bounced, and whether it hit the target. Listen to others, ask questions ("How many times did your ray bounce?" "How would you get more reflections?"). Older participants write a short discovery sentence on a card: "I learned that..." "I was surprised that..." Participate in a joint reflection: • Tell what they liked the most. • Choose one new piece of knowledge or skill that they will take away with them. • At the end, everyone creates a "mirror circle" – they stand in a circle and repeat each other's gestures like mirrors, symbolizing the reflections of Alice's world. At the end of the activity, they answer questions on the board: What have I discovered today? What was the most fun? What surprised me? What else would I like to try?

	"Each of you became little inventors today. You saw the world differently – like Alice Through the Looking-Glass"	
Reflection *(10 min.)*	Creates a calm atmosphere for reflection: *"Let's close our eyes and remember what we saw in the mirrors today. Shining lights, reflections, symmetries – like Alice's journey through Wonderland."* Turns on a small light source or projects the reflection of the mirror onto the wall – symbolically returning to the "real world." Explains that now we will talk about what we have learned and experienced.	Participants sit in a circle around the "mirror table." Each participant takes turns completing the sentence: • *"I liked it best when..."* • *"I was surprised to learn that..."* • "*I would like to try..."* Younger participants can use gestures (e.g., a beam of light), while older participants can use words.
Assessment of achievements self-assessment	Explains the meaning of self-assessment to participants: *"Each of us has been explorers today. Now let's look at ourselves as if in a mirror— what have we learned, what has been successful, and what would we like to do even better next time?"* Emphasizes that this is an opportunity to reflect on your journey through the world of mirrors. Gives the participants a self-assessment task. Distributes a verbal questionnaire to the participants (with faces for the younger ones and sentences for the older ones).	Fill out a self-assessment card. For younger children (8–10 years old) — a simple form with drawings or faces: Question — Yes — Slightly — I'm still learning I understood how light reflects off a mirror ☐ ☐ ☐ I learned what symmetry is ☐ ☐ ☐ I created or saw the pattern of my reflections ☐ ☐ ☐

	Explains that on the cards they need to: • mark what they learned, write or mark how well they cooperated, • draw or choose what their mood was during the activity. The educator walks among the groups, talks to individuals, observes and discusses the results: *"What did you succeed at most today?"* *"Which moment was a real discovery?"* *"What else would you like to know about mirrors?"* *Summarizes the achievements of the whole group:* *"Today, you not only learned about reflections, but also created them yourselves – through light, colors, words, and ideas."*	I collaborated with friends ☐ ☐ ☐ I enjoyed this activity ☐ ☐ ☐ For older participants — a reflexive questionnaire with written answers: 1. *What new things have I learned today about light or mirrors?* *2. What was the most difficult, but most interesting thing?* *3. How have I contributed to the group's work?* *4. How is this activity similar to the work of a real scientist or creator?* *5. What would I like to explore further?*
Recommendations	Educational guidelines: • Create a playful atmosphere, incorporate elements from „Alice Through the Looking-Glass"– questions, dialogues, unexpected plot twists. Let the participants feel like adventurers. • Emphasize that science is a path of discovery, and mistakes are not failures, but important steps toward deeper understanding. • Encourage active exploration—less theory, more practical activities and experiments. • Pay attention to the age differences among participants. • For younger participants, visuality, playfulness, and emotional engagement are important. • Older participants are already able to analyze, ask questions, and think critically. • Involve all participants: switch roles, assign different tasks – every participant should have the opportunity to test themselves. • Maintain a positive, encouraging tone: celebrate even small achievements – this motivates. For example: "Great observation of the angle!", "That's a real scientific discovery!"	
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Latvia – Lithuania

DESCRIPTION OF STEAM EDUCATION ACTIVITY "CREATING A PUZZLE FROM SHEETS OF PAPER"

Topic	**Creating a puzzle from sheets of paper**
Duration	60 min.
Abstract	The activity "Creating puzzles from sheets of paper" develops creativity, logical thinking, spatial perception, and problem-solving skills by applying STEAM education principles. During the activity, participants will create their own unique puzzle from paper: they will draw, plan, and experiment with shapes, colors, and construction. Using creative technologies (e.g., a puzzle-making machine), they will experience firsthand how art, engineering, technology, and mathematics come together in a single creative process. The activity encourages problem-solving, planning, diligence, and collaboration, providing an opportunity to explore the possibilities of creative tools and experience the joy of discovery. At the end of the educational program, participants present their creations, reflect on the process, evaluate their achievements, and discuss what they would like to improve or try in the future.
STEAM educational achievement areas and skills developed	
S (natural sciences)	• Participants observe and explore materials – how paper of different thickness and structures affects the strength of the puzzle. • Experiment with mixing colors, the effects of light and shadow, and analyze how light reflects off different surfaces. • Learn to draw conclusions from their experiments: which cutting or gluing method is stronger and more aesthetically pleasing.
T (technologies)	• Use a jigsaw or cutter – learn to use tools safely and purposefully. • Understand the purpose of technology in creativity: how a mechanism helps to achieve precise shapes. • Try out virtual jigsaws (e.g., Jigsaw Planet), applying digital skills.
E (engineering)	• Participants design the structure of the puzzle: they decide how many pieces there will be, how they will fit together, and how to keep it sturdy. • Develop planning, testing, and problem-solving skills by testing whether the puzzle pieces fit together. • Learn to create a model and improve it—if one version does not work, they try another.
A (arts, other subjects)	• Create colorful, aesthetic drawings, develop artistic taste and a sense of composition. • Combine colors, figures, and shapes, expressing emotions and imagination. • Art is connected with other subjects—literature (book characters), history (cultural motifs), nature (landscapes, animals).
M (mathematics)	• Use geometric shapes and proportions – measures, draws, and calculates details. • Become familiar with symmetry, angles, width, and length, and develops spatial thinking. • Calculate how many pieces are needed for a puzzle and what size they should be so that the whole is complete.

Participant competency development (underline the competency and its component or components)	Communication skills (message creation, message delivery and communication interaction, message analysis and interpretation)
	Cultural competence (cultural awareness, cultural expression, cultural consciousness)
	Creativity skills (exploration, generation, creation, evaluation, and reflection)
	Digital competence (digital content, digital communication, digital safety, problem solving)
	Cognitive competence (subject knowledge and skills, critical thinking, problem solving, learning to learn)
	Social, emotional, and healthy lifestyle skills, self-awareness and self-control skills, empathy, social awareness and building positive relationships, responsible decision-making and behavior when assessing consequences, caring for health
Goal of the activity	To develop participants' creativity, spatial thinking, and problem-solving skills by applying STEAM (science, technology, engineering, arts, and mathematics) principles in creating and constructing individual paper puzzles.
Operational objectives	• To familiarize participants with the process of creating puzzles, the properties of paper, and creative technologies. • To develop participants' ability to plan, construct, and test their own puzzles by applying the principles of engineering thinking. • Encourage participants' creative self-expression through drawing, color matching, and shape composition. • To develop participants' ability to collaborate – share tools, test their friends' creations, discuss the results. • To strengthen participants' mathematical and spatial awareness – measure, count, use geometric shapes.
Operational methods	Research, problem-based learning, demonstration, creative expression, discussion, reflection, storytelling methods.
Operational strategies	Experiential learning, problem solving, creative and collaborative strategies.
Operational tools and equipment	Materials: • Colored and white paper (A4, A5 format) • Cardboard (for the puzzle base) • Pencils, markers, crayons, watercolors • Scissors, glue, rulers, erasers • Sticky labels or envelopes for storing puzzles Equipment: • Puzzle-making machine (do-it-yourself type) • Paper cutter • Photo punch (shape punch) • Tablets or computers (for virtual puzzles, e.g., Jigsaw Planet) • Projector or screen for displaying examples
Additional measures that are needed to implement the activity	• A4 plastic folders or binders for storing works • Adhesive tape or double-sided adhesive tape • Napkins or paper towels for cleaning the work area • Cutting mats (to protect the work surface) • Tablecloths or protective covers • Display stand or cork board for exhibiting works • Camera, tablet, or phone for photographing works • Timer or clock for tracking activity stages • Waste bin for collecting paper scraps • Labels or stickers for marking puzzle names/authors
Content of activities	

Stages	Educator's activities	Participants' activities
Before the activity	Prepares materials and equipment: • Checks that the puzzle-making machine is working. • Prepares colored paper, cardboard, glue, scissors, pencils, markers, and rulers. • If a virtual part of the activity is planned, provides tablets/computers and an internet connection (e.g., for the Jigsaw Planet platform). Prepares an example of the activity: • Creates one sample puzzle (e.g., from a drawing or photo) to show participants the result. • If available, shows both a manual sample and a digital version (a photograph of the creation in a virtual puzzle). Sets up the workspace: • Places one set of tools on each table for each participant or pair. • Ensures that the environment is safe—cutting tools should only be used under adult supervision. Introduces the topic and motivation: • Gives a short introductory talk about the meaning of puzzles and the connection to STEAM (how art, math, and technology come together in one project). Prepares slides or photos with inspiring examples.	• Familiarize themselves with the theme of the activity: • Listen to the educator's explanation about puzzles, their structure, purpose, and how the activity will proceed. • Discuss what puzzles they have seen or solved at home. • Consider a creative idea: • Decide what their puzzle will depict – nature, a character from a book, an animal, space, or a library theme. • If necessary, make a quick sketch on a draft sheet. • Prepare the workspace: • Tidy up the table and prepare the necessary tools. • Discuss with the educator how to use cutting tools safely. • Agree on the rules of cooperation: • Since the activity will be done in groups or pairs, agree on how to share the tools and time. • Discuss what to do if the puzzle pieces get mixed up.
Introduction, motivating participants, exploring their experience, and discussing the activity's objectives *(15 min.)*	Greets participants and creates a positive atmosphere: • Briefly introduces the topic of the activity: "*Today we will become creators and engineers—we will make our own puzzle out of paper, and each piece will become a tiny part of the whole!*" • Shows an example (a ready-made puzzle or a short demonstration with a puzzle-making machine).	• Actively participate in the conversation and share experiences. • Talk about their favorite puzzles, experiences at home or school. • Try to identify the skills needed to put together a puzzle (e.g., patience, attention, planning). • Formulate their expectations, say what they expect from the activity,

	Motivates participants: • Asks questions that stimulate interest and creative thinking: • *"Have you ever tried to create your own puzzle?"* • *"What do you like about puzzles – the picture or the brain teaser?"* • *"Do you think puzzles are related to art or mathematics?"* • Emphasizes that this activity combines STEAM areas – art, geometry, technology, and creativity. • Finds out more about the participants' experience • Asks questions to find out what puzzles the participants have already seen or solved at home or at school. Discuss what shapes or themes are most common in puzzles. • Explain the purpose and task of the activity • Clearly present what will be done today: • *"Our goal is to create a personalized puzzle from our own drawing, using paper, creativity, and engineering thinking."* • Explains that after the creation there will be a practical part – exchanging puzzles, so it is important to create carefully. • Introduces the tools and safety rules • Demonstrates how to use the puzzle-making machine and emphasizes safe behavior. • Demonstrates the layout of the workspace and materials.	what they would like to create or try. • Choose a theme for their creation (e.g., an animal, a book cover, a nature scene, space). • Familiarize themselves with the tools and workspace • Examine the puzzle-making equipment and tools, and prepare the workspace. • Listen to the educator's explanations about the work process and safety. • Get involved in the start of the activity • Show curiosity and ask questions about the activity. • Prepare to move on to the creative part (drawing).
Practical activity - experimentation *(30 min.)*	Encourages participants to be creative: • *"Every puzzle is unique – just like your thoughts and ideas. It is important to try, discover, make mistakes, and try again."* • Emphasizes that experimentation is part of STEAM, where art is combined with scientific research activities. • Observes and advises, helping participants choose the right sheet size, colors, and shape design. • Answers questions and helps if there are difficulties with the cutting machine or drawing the puzzle lines. • Encourages participants to think aloud ("*How many details are you planning? How will you make sure the puzzle doesn't get too thin?*").	Creative experiment – drawing: • Participants draw their own picture or design on a sheet of paper based on a chosen theme (e.g., nature, library, space). • They use colors, shapes, and patterns, paying attention to clear boundaries between details. • Engineering process – cutting the puzzle • Using scissors, a cutter, or a puzzle-making machine, they cut their creation into 6–12 pieces.

	• Encourages experimentation with materials and shapes Suggests trying different methods: • cutting the puzzle by hand (with scissors) or using a cutting machine, • gluing it onto a foam base to make it stronger, • using a photo puncher to cut out geometric or decorative shapes. • Emphasizes the importance of accurate measurement and thoroughness. Helps to test and evaluate the result • When the participant has cut out their puzzle, asks them to put it back together to check that everything fits. • Encourages participants to exchange puzzles – this is how the experiment with different solutions and designs takes place.	• They try out different cutting techniques – straight, wavy, geometric patterns. • Learn to plan – where to start, how to ensure that all pieces are intact and fit together properly. Testing and collaboration: • Put your puzzle back together and check that all the pieces fit together correctly. • Exchange puzzles with other participants – try each other's creations, compare complexity, design, and interest. • Help a friend if a piece does not fit – develop critical thinking and teamwork skills.
Presentation of activity results *(5 min.)*	Organizes the presentation of results: Invites participants to show their puzzles to their classmates. • Creates an "exhibition" atmosphere – all works are displayed on tables, boards, or specially prepared areas. • Encourages participants to take pride in and show respectful interest in each other's creations. Asks reflective questions: • "*What did you like most about this process?"* • *"What were the biggest challenges?"* • *"What did you learn about puzzles or your creative abilities?"* Summarizes achievements and STEAM connections Notes that during the activity, participants applied: • mathematics (shapes, proportions, planning), • engineering (connecting parts, precision of construction), • technology (use of tools), • art (colors, creative design). Emphasizes that each work is a unique combination of creativity and science.	Briefly present their puzzle: • what its theme is, • how many details it has, • how they created it. Show how the puzzle stands out or fits together. Share insights and emotions: • Tell what they did best, what new things they had discovered. • Express what feelings arose while working – joy, challenge, curiosity. • Observe and evaluate the work of others • Listen to presentations, ask questions, praise friends. Learns to respectfully evaluate the work of others.

Reflection *(10 min.)*	Creates a calm, summarizing atmosphere (in a circle, at tables, or in front of the exhibited works). Asks questions that help participants reflect on the activity: • *"What new things have you learned or discovered today?"* • *"What did you like most about this process?"* • *"What would you do differently if you were to create another puzzle?"* Encourages participants to celebrate themselves and their friends. Helps participants evaluate their achievements: • Offers a simple evaluation method: – I did very well; – I succeeded, but I can still improve; – I would need help next time. For example, participants raise the appropriate card or finger sign according to how they feel. • Summarizes the STEAM developed skills • Science: observation, experimentation, drawing conclusions. • Technology: use of tools in creativity. • Engineering: planning, precision, structure. • Art: design, color coordination, creativity. • Mathematics: shapes, symmetry, proportions. • Emphasizes that these skills were evident in the work of each participant. Provides recommendations for further development Suggests ideas for continuing the activity: • create a larger group puzzle (e.g., library theme), • try a virtual puzzle (e.g., on the Jigsaw Planet platform), • combine with other STEAM activities – scanning drawings, designing shapes on a computer, 3D puzzles.	Reflect on their experiences • Identify what was most interesting, what worked best, what was difficult. • Share how they felt during the creative process and testing. • Evaluate their achievements. • Use the symbols or short form provided (e.g., write on a sticker or card): • *"I liked the most..."* • *"I learned..."* • *"Next time I would like to try..."* Express ideas for the future: • Suggest what would be interesting to create next time (e.g., a themed puzzle about a fairy tale, a book, the seasons). • Share how the activity could be improved.
Assessment of achievements Self-assessment	Observation: the educator observes the participants' work during the process, noting signs of creativity, effort, and cooperation. Discussion/reflection: a brief verbal reflection after the activity—participants share what went well and what was challenging. Analysis of work: the final result is evaluated – the completed puzzle (originality, completeness, logic of construction). Assessment and self-assessment are focused on the participant's growth, the creative process, and experience, rather than just the result. Possible assessment criteria: • Creative approach and unique idea.	Participants evaluate their achievements using a simple scale or symbols. Examples of self-evaluation (understandable to participants): – I did very well, I am satisfied with my work. – I did well, but I would still like to improve. – It was difficult, I would like some help next time.

	• Ability to plan and construct a puzzle model. • Proper use of tools and equipment. • Attentiveness, thoroughness, effort. • Ability to cooperate and help others. • Reflective ability – ability to identify what has been learned.	
Recommendations	The educator can: 1. Before the activity, show a short 1–2 minute video or photo collage of how the puzzle-making machine works or what a paper puzzle looks like after cutting – this stimulates curiosity and helps participants understand the process. 2. Combine puzzle creation with reading promotion programs – create puzzles based on the covers or characters of favorite books. 3. Take photos of the created puzzles and turn them into virtual ones using the *Jigsaw Planet* or *Puzzle Factory* platforms. 4. Organize a "Puzzle Day" at the library, where participants will create a group puzzle on the theme "Our Library" or "My City." 5. Use a game element – a character (e.g., "Puzzle") can accompany students through the tasks.	
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Internet platforms	Jigsaw Planet is a free online platform that allows users to create and assemble virtual jigsaw puzzles. Users can upload their own images (e.g., a student's drawing or photograph), select the number of pieces and the shape. Puzzles can be played individually or shared via a link. See https://www.jigsawplanet.com/ Puzzle Factory is an interactive platform for creating and assembling puzzles online. You can choose from a variety of themes (nature, art, animals) or upload your own image. You can set the number of pieces, choose the shape, and share the puzzles you have created with others. See https://puzzlefactory.com/

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DESCRIPTION OF STEAM EDUCATION ACTIVITY "APPLICATION OF FAIRY TALE THEMES IN STEAM: THUMBELINA"

Theme	**Application of fairy tale themes in STEAM:** Thumbelina
Duration	60 min
Summary	During the activity, participants immerse themselves in the world of the fairy tale *Thumbelina* and explore it through the prism of STEAM. They explore the concepts of scale and proportion, measure and compare objects, and calculate how many times Thumbelina's world is smaller than their own. In the practical activity, participants experiment with walnut shells – they observe whether they float and use them to build a small Thumbelina 's house or boat. Creative tasks are combined with mathematical and nature observations. Participants touch, measure, observe, compare, construct, and decorate, using all their senses. The activities are playful, using Thumbelina as a character who invites them to travel into the world of the little ones – a world of colors, shapes, numbers, and imagination.
Areas of achievement and expected outcomes	
S (natural sciences)	Observation, exploration, and experimentation with natural phenomena. Participants: Observe and describe the properties of materials (the strength of a nut shell, buoyancy). Explain why some objects float and others sink. Conduct an experiment and record observations. Understand that the laws of nature apply even in the world of fairy tales.
T (technology)	Purposeful use of technology in creativity. Participants: Use technology to present or document their work. Store and use technical tools appropriately (ruler, glue, measuring tools). Understand that technology helps to create, monitor, and share results.
E (engineering)	Designing structures, solving problems, experimental thinking. Participants: Build a stable *Thumbelina's* house or boat. Use design steps: plan, test, improve. Understand the principles of stability, support, and balance. Apply creative solutions in practical situations.
A (arts, other subjects)	Creative expression, aesthetic perception, integration of literature and art. Participants: Express the mood and characters of a fairy tale through artistic creation. Combine colours, shapes, and materials. Read or listen to fairy tales, develop imagination and language skills. Reflect on artistic activities, identify their feelings and the meaning of their creations.

M (mathematics)	Measurement, proportions, understanding of scale. Participants: Measure their height and calculate how many times taller they are than *Thumbelina*. Apply the principles of proportion calculation and scale. Apply units of measurement and tools. Are able to draw conclusions from calculations and apply them in their work.
Competencies developed in participants *(underline the competency and its structure or structures)*	Communication competence (message creation, message delivery and communication interaction, message analysis and interpretation)
	Cultural competence (cultural awareness, cultural expression, cultural awareness)
	Creativity competence (exploration, generation, creation, evaluation, and reflection)
	Digital competence (digital content, digital communication, digital safety, problem solving)
	Cognitive competence (subject knowledge and skills, critical thinking, problem solving, learning to learn)
	Civic competence (civic identity and civic power, living in a community to create a democratic society, respect for human rights and freedoms state building and strengthening statehood in the international community
	Social, emotional, and healthy lifestyle skills, self-awareness and self-control skills, empathy, social awareness and building positive relationships, responsible decision-making and behaviour when assessing consequences, caring for health
Objective	By exploring H.C. Andersen's fairy tale " *Thumbelina"* to develop participants' ability to apply knowledge of scale, proportion, and measurement, to plan and create a small model (a house or a boat), and to justify decisions with arguments from natural sciences, engineering, and art, using appropriate technologies to document and present their work.
Activity objectives	• Read an excerpt from the fairy tale and identify 2-3 situations in which mathematics or science can be applied (scale, buoyancy, stability). • Calculate their ratio with *Thumbelina* (10 cm) and adjust the scale to compare 3 selected objects; fill in a short table. • Based on the chosen scale, plan a sketch and create a prototype – *Thumbelina* 's house or boat; name 1–2 stability solutions (e.g., supports, weight distribution). • When creating the structure, use measuring tools and justify at least two selected calculations (length, height, proportion).
Activity methods and strategies	Research, problem-based learning, creative expression, discussion, reflection, storytelling methods. Experiential learning, problem solving, creative and collaborative strategies.
Activity tools and equipment.	Hans Christian Andersen's fairy tale *" Thumbelina "* Illustrations or colouring sheets with images of Little Match Girl Paper, coloured paper, cardboard Pencils, markers, paints, brushes Scissors, glue, adhesive tape Walnut shells (halves) Straws, thread, pieces of fabric

	Natural materials (leaves, grass, flowers, stones) Napkins, aprons, tablecloths Stickers or small cards for reflection Rulers, measuring tapes Calculators Water container (for the floating experiment) Tablets or phones (for photos, filming, presentations) Projector or screen (for showing stories or illustrations, if possible)	
Additional resources needed to carry out the activity	Audio recording or video clip of the story. Background music to create atmosphere. Camera, tablet, or phone for recording results A4 or A3 sheets of paper for group work, descriptions, drawings Protective equipment (aprons, table covers, paper towels)	
Activity content		
Stages	Educator's activities	Participants' activities
Before the activity	Reads or listens to Hans Christian Andersen's fairy tale *" Thumbelina"* (or an excerpt from it) so that he/she could expressively retell or read it to the participants. Selects a short excerpt from the fairy tale (2-3 minutes to read) – for example, the episode where Thumbelina is born in a flower bud or floats down the river on a lily pad. Familiarizes him/herself with the main concepts that will be presented to the participants: scale, proportions, measurement, sustainability, natural materials. Prepares an illustration or visual aid – can use a line drawing picture for the participants to colour or an image of Thumbelina. Prepares and divides the tools into groups (for 4–6 participants): rulers, measuring tapes; paper, straws, glue, scissors, thread; walnut shells (cleaned, halved); natural materials (leaves, flowers, grass); colouring agents. Prepares a container of water for the experiment "Does a nut shell float?" Creates a sample prototype—a small Thumbelina's house or boat—to provide visual inspiration for participants. Selects a space with tables for creative work. Creates a "fairy tale corner" – a place where reading and discussion of the fairy tale will take place (this can include cushions, table decorations with flowers or natural elements). If possible, provides a projector or tablet to show Thumbelina's illustrations or a short video.	
Introduction, motivating participants, finding out about their experience, discussing the task *(15 min.)*	The educator welcomes the participants, creating a cozy and fairy-tale atmosphere: flowers, natural elements, or pictures of Thumbelina are placed on the table. Calm music is playing. A brief introduction to Hans Christian Andersen's fairy tale "Thumbelina " – about a little girl	Immerse themselves in the world of fairy tales: • Participants enter a prepared space where music is playing and they see flowers, elements of nature, and Thumbelina's illustrations. • Sit comfortably in a circle or at a table, observe their surroundings, and guess what the activity will be

	named Thumbelina, born from a beautiful flower. The educator reads or tells a short excerpt from the fairy tale (e.g., about Thumbelina 's birth in a flower or her journey down the river on a lily pad). Then asks: *"Who among you has heard or read "* Thumbelina*"?* *What do you remember about her world?* *What do you think your room would look like if you were the same height as* Thumbelina*?"* The educator seeks to find out what the participants already know about: • measurement and proportions (have they used a ruler, measured objects, compared sizes); • natural materials (what a nut shell is, what it is made of, whether it floats in water); • fairy tales and creativity (how fairy tales can be related to science or mathematics). A short interactive task can be performed: Participants choose one small object (e.g., a pencil, an eraser, a pebble) and guess what it would be in Thumbelina's world—would it become her chair, bed, or even a table? This task helps to connect the participants' existing experience with the new topic. The educator presents the goal and tasks of the activity in simple language that is understandable to the participants: *"Today we will become little explorers in* Thumbelina*'s world. We will measure how many times we are bigger than her, learn how the sizes of objects change, and build* Thumbelina*'s house out of a walnut shell."*	about. • Listen to the educator's story or an excerpt from the fairy tale " Thumbelina". • Observe the illustrations or line drawings presented, discuss what they see, what they feel, and what mood the fairy tale evokes. Discussion after reading: • Answer to questions: *– Who has heard the fairy tale "* Thumbelina *"?* *– What do you remember about her world or adventures?* *– What would their room or surroundings look like if they were the same height as* Thumbelina*?* • Share thoughts on how Thumbelina 's world differs from their own. • Use their imagination to create short examples ("my pencil would be Thumbelina‘s table"). Clarification of experience and knowledge: • Participants discuss what they already know about measuring, comparing objects, and proportions. • Based on their memories, they say whether they have used a ruler or measured objects. • They talk about what materials objects are made of (e.g., nut shells, wood, paper) and how they behave in water. • Participants understand that their experience will be useful in further activities. Interactive task – " The World in Thumbelina’s Scale " • Each participant takes a small object (e.g., a pencil, eraser, pebble, toy). • Thinks about and says what this object could be in Thumbelina 's world (e.g., a bed, a table, a boat, a pole). • Shares his/her thoughts with the group, learning to compare sizes

	Discussion: Why is it important to know how to measure and compare? How can mathematics and engineering help even fairy tale characters? What can we learn from nature as seen through Thumbelina's eyes? The educator emphasizes: This activity will help us understand that mathematics, nature, and creativity are interrelated—just as everything in Thumbelina's world fits together in small proportions.	and change their perspective. • Discusses what it means to be "ten times smaller" – applying his/her imagination and logic. Understanding the purpose and objectives of the activity: • Participants listen to the educator's presentation about the purpose of the activity. • Learn that during the activity they will: – measure and compare objects; – find out how many times larger they are than Thumbelina; – build a small model – Thumbelina's house or boat. • Participants can say what they expect from the activity ("I want to find out if a nut floats," "I want to make a boat"). Discussion and questions • Participants discuss why it is important to know how to measure, count, and compare. • Consider how mathematics or engineering can be useful even to fairy tale characters. • Discuss what can be learned from nature by looking through Thumbelina's eyes.
Practical activity – experimentation ***(30 min.)***	Explains that participants will form teams of little engineers who will help Thumbelina build a house or a boat from a Greek nut shell. Reminds them of the task: *"Let's try to find out if the walnut shell would keep* Thumbelina *afloat, and let's build her a stable, comfortable house or boat."* Shows an example (in the form of a model or illustration created by the teacher). Introduces the tools and reminds participants of safety rules (be careful with scissors, glue, hot glue gun, if used).	Participants listen to the educator's explanation of the goal of the activity—they will become "little engineers" who will help to build the Thumbelina's house or a boat from a Greek nut shell. They look at the example provided by the educator (a model or illustration) and discuss what they see: what shape it is, what materials it is made of, whether it looks sturdy, whether it could float. Listen to the safety rules and agree to work carefully and neatly with the tools. Stage I – *"Scale calculation":*

	The educator assists participants in the following stages: In stage I, "Scale calculation," the educator helps participants figure out: How tall they are and how many times taller they are than Thumbelina (e.g., 130 cm / 10 cm = 13 times). What the scale ratio would be (1:13, 1:14). Suggests comparing simple objects: a pencil, a cup, a book – how big would they be in Thumbelina's world? Helps them record the results on a table or piece of paper. In stage II, "Does a nut float?", the educator demonstrates an experiment with a container of water: Places an empty nut shell in the water. Discusses with the participants whether it floats or sinks. Why? Considers how to strengthen the shell so that it stays afloat better? Helps participants try it out for themselves and observe the results. The educator explains the principle of buoyancy (air in the shell, volume, and mass). Stage II: "Creating a Thumbelina's house or boat": Encourages participants to use their creativity and make the Thumbelina's house or boat from a nut shell. Asks questions that encourage engineering thinking: How can you make the house sturdy? What materials will help keep it dry? How can we decorate the house to make it look like something out of a fairy tale? Encourages cooperation within the group and helps those who need assistance.	• Each participant finds out their height (e.g., 130 cm) and, with the help of the educator, calculates how many times taller they are than Thumbelina (10 cm). • Participants in groups calculate the scale ratio (e.g., 1:13 or 1:14). • Compare everyday objects (a pencil, a cup, a book, a phone) and determine what size they would be in Thumbelina's world. • For example: "My pencil would be as long as a tree in Thumbelina's world." • Write down the results on a table or piece of paper, noting the calculations and interesting observations. • The group briefly discusses: *"Would* Thumbelina*'s world be comfortable for us if all objects were ten times smaller?"* Stage II – "*Does a nut float?"*: • Participants formulate a hypothesis: "I think that a nut shell will float/sink because...". • Watch the experiment with a container of water demonstrated by the educator, and then try it themselves by placing a nut shell in the water. • Observe and record the results: whether the shell floats or sinks, how long it stays afloat, whether it depends on its shape. • Perform several tests: they change the half of the shell, add small objects (a leaf, a straw) and observe how the floating changes. • Discuss in a group what determines buoyancy (air bubbles in the shell, volume, mass, density of the material). • Express ideas on how to strengthen the shell so that it floats better on water. Stage III – *"Creating* Thumbelina*'s house or boat"*: The participants in a group choose what to create – Thumbelina's house or boat.

	The educator summarizes the activities and invites each group to present their creation and briefly explain: What they learned about scale and proportions. How their creation maintains balance or floats. What was the most difficult/interesting part of the creative process. Summarizes: *"Mathematics and science helped us create something beautiful from the world of fairy tales.* Thumbelina*'s world teaches us that even small ideas can be big when we apply them creatively."*	Based on their calculations and the test they did, they plan what materials they would use (nut shells, straw, leaves, thread, paper). Create a sketch – briefly draw the shape of the future model and mark the main dimensions (height, length). Use measuring tools (a ruler, measuring tape). Measure the length of the materials to maintain proportions. Work together to find solutions to ensure stability, support, and balance. Decorate the creation – adapt colours, shapes, and natural details so that the house or boat looks like something out of a fairy tale. During the activity, they cooperate in a group, share responsibilities, and help each other (e.g., some measure, others glue, others decorate).
Presentation of activity results ***(10 min.)***	The educator invites participants to prepare a presentation of their creation – the Thumbelina's house or boat made from a walnut shell. Reminds participants of questions that will help them present their creations: • *What did you create and why did you choose this solution?* • *How did you calculate the scale or proportions?* • *What in your model reflects* Thumbelina*'s world?* • *What was the most interesting part of this work?*	Each group presents their model – a house or a boat. They explain what they created and what scale they used, how the creation maintained balance or floats; what was the most difficult and what was the most interesting part of the creative process. Participants demonstrate their creations and can show whether their boat actually floats. Discuss what they have learned about scale, proportions, and the laws of nature.
Reflection ***(5 min.)***	The educator invites participants to briefly share their thoughts by asking 2-3 questions: • *What new things have you learned today?* • *What did you like most about the activity?* • *What was the most difficult?* • *Where did you apply mathematics or science today?* • *What do you think* Thumbelina *would say about your creation?*	The participants briefly discuss: • What did they learn from this activity? • What was their favourite moment? • What would they like to try next time? • Each participant can write one word that describes their activity (e.g., *"fun," "creativity," "science," "friendship"*) on a sticker or piece of paper and stick it on the " Thumbelina's World" poster.

	The discussion takes place in a circle – each participant says one sentence or one word describing their experience. The educator emphasizes that each participant was a creator, thinker, and inventor – *"* Thumbelina*'s world showed that even the smallest ideas can be big. The most important thing is to see the world with curious eyes."*	
Assessment of achievements Self-assessment	When participants reflect on their activities individually or in groups, the educator: • Creates a calm and safe atmosphere for reflection. Stops the activity and asks everyone to sit in a circle or at tables. • Clearly explains the self-assessment task. Reminds participants what they need to identify: what they learned; what went best; what they would change next time. • Helps children reflect more deeply: • "*What stuck with you most during the creative process?"* • *"How was your model similar to* Thumbelina*'s world?"* • *"What decision would you make differently next time?"* • *"What helped your team the most?"*	Participants, either individually or in groups: • reflect on how they did; • identify at least one new thing they learned; • name one thing that went best; • name one thing they would like to improve.
Recommendations	The educator prepares all the materials in advance and sorts them according to the groups so that participants can independently take the necessary tools during the activity. The space is divided into zones: • A corner for reading and discussing fairy tales – with a cozy atmosphere (music, illustrations, fairy tale decorations). • Experimentation and creativity zone – tables with tools, protective equipment, and measuring instruments. • Reflection zone – a board, poster, or place for presenting and discussing creations.	
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Video resources	Audio fairy tale: H.CH.Andersen's "The Little Match Girl." See https://youtu.be/21fPjbdEt0I?si=syO2CIcOhq2GqwPr

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STEAM EDUCATION ACTIVITY DESCRIPTION "BASICS OF PROGRAMMING USING THE AVOGADRO PROGRAM"

Topic	Basics of programming using the Avogadro program
Duration	60 min
Abstract	In this educational activity, participants explore molecular structures using the STEAM methodology and modern digital tools. During the activity, they create and analyse 3D models of selected molecules in the Avogadro program, and then construct a real physical model of the molecule from simple materials based on the digital drawing. The activity integrates science, technology, engineering, art, and mathematics, encouraging participants' creativity, problem-solving skills, and spatial thinking. The activity ends with a mini molecule exhibition and reflection, helping participants to evaluate their achievements and better understand the learning process.
Areas of achievement and expected outcomes	
S (natural sciences)	Participants understand that materials are made up of atoms and molecules, are able to recognize the structures of simple molecules (H_2O, CO_2, CH_4, etc.), understand the relationship between bond types and molecular shape, and explain why molecules can be bent, straight, or tetrahedral.
T (technology)	Participants are able to use the basic functions of the *Avogadro* program: create simple molecules, view their 3D structure, change the colours of atoms, save and print the image needed for the model; understand how digital modelling helps scientific research.
E (engineering)	Participants are able to construct a stable physical model of a molecule based on a digital drawing, using materials (sticks, balls, markers) appropriately, solve engineering challenges—how to reinforce the structure, maintain angles and proportions—and understand the connection between the real model and the digital version. markers), solve engineering challenges—such as how to reinforce the structure, maintain angles and proportions—and understand the connection between the real model and the digital version.
A (arts, other subjects)	Participants creatively present their molecule model: create a visually clear label, color legend, and aesthetically present the model in a mini exhibition; they are able to combine scientific information with creative visualization.
M (mathematics)	Participants count the number of atoms in the molecule, identify the quantities of different atoms, name the number of bonds, and more advanced participants are able to calculate the scale of the model and understand the importance of proportions in both digital and physical modeling.
Competencies developed in children *(underline the competency and its structure or structures)*	Communication competence (message creation, message delivery and communication interaction, message analysis and interpretation)
	Cultural competence (cultural awareness, cultural expression, cultural awareness)
	Creativity competence (exploration, generation, creation, evaluation, and reflection)
	Digital competence (digital content, digital communication, digital safety, problem solving)
	Cognitive competence (subject knowledge and skills, critical thinking, problem solving, learning to learn)

	Civic competence (civic identity and civic power, living in a community to create a democratic society, respect for human rights and freedoms, building a state and strengthening statehood in the international community)	
	Social, emotional, and healthy lifestyle competence, self-awareness and self-control skills, empathy, social awareness and the creation of positive interpersonal relationships, responsible decision-making and behaviour when assessing consequences, caring for health	
Objective	To provide participants with the opportunity to explore molecular structures in a practical and creative way, applying scientific knowledge, digital tools, and engineering solutions, while developing the ability to link digital and physical modelling, understand the interrelationships between STEAM fields, and independently assess their learning achievements.	
Activity objectives	• To familiarize participants with the structures of simple molecules, chemical bonds, and molecular geometry by applying scientific knowledge in a practical context. • Teach participants to use the Avogadro program to create, analyse, and visually process 3D models of molecules, change the colours of atoms, and generate images for the model. • Enable participants to create a physical model of a molecule using construction materials and following a digital drawing, thus developing engineering skills and spatial thinking. • Encourage creativity and aesthetic perception by creating a label for the molecule, a visual legend, and presenting the model in a mini exhibition. • Develop mathematical skills by counting the number of atoms and bonds, analysing the proportions of the molecule, and determining the scale of the model if necessary.	
Activity methods and strategies	Research, problem-based learning, creative expression, discussion, reflection, storytelling methods. Experiential learning, problem solving, creative and collaborative strategies.	
Activity tools and equipment.	Digital tools: – Computers or tablets with *Avogadro* software installed; – Mice (for easier control of 3D models); – Printer and paper for printing molecular drawings. Construction materials for physical models: – Wooden sticks or toothpicks; – Plasticine or foam balls for atoms; – Coloured markers or paints for marking atoms; – Trays or bases for placing models. Creative tools and exhibition supplies: – Label sheets for describing molecules; – Pens, markers, A4 sheets for mini posters; – Table or shelf for displaying work. Organizational tools: – Camera or phone for recording work.	
Additional tools needed to carry out the activity	– Projector; – Prepared sample molecule models; – Napkins or cleaning supplies for hands.	
Activity content		
Stages	Educator's activities	Participants' activities
Before the activity	The educator must prepare computers or tablets with the Avogadro program installed, check that the mouse is working, ensure that a printer with paper is available and working properly, and test the Avogadro functions – adding atoms, optimizing the structure, colour change, and screen image saving.	

	He should prepare materials for the production of physical molecules: sticks or toothpicks for connections, plasticine or foam balls for atoms, coloured markers for labelling atoms, trays for placing models, and, if necessary, pre-printed labels or blank sheets of paper for participants' notes. Various molecule kits can be used instead of these materials. The educator should also prepare examples of several simple molecules (e.g., H_2O, CO_2, CH_4, NH_3), prepare a short introduction to molecules, bonds, and their forms, and, if necessary, slides or posters to facilitate the teaching part. Before the activity, it is necessary to arrange the space: set up the tables so that participants have enough space to work on the computer and construct physical models, prepare a separate area for the molecule exhibition, and provide space for photography. In addition, the educator should prepare several pre-modelled examples of molecules and a few spare printed structures in case participants run out of time or encounter technical difficulties. Finally, the educator should refresh their knowledge of molecular geometry, types of bonds, and the standard atomic colour scheme, and think about simple explanations for children or beginners about why atoms bond, what determines the shapes of molecules, and how real molecules differ from educational models.	
Introduction, motivating participants, clarifying their experience, discussing the task *(10 min.)*	The educator greets the participants and establishes a connection with them: "*Hello, today we will dive into the world of molecules and create both digital and real models of them. We will work like real STEAM researchers—combining science, technology, engineering, art, and mathematics."* Motivates the participants: *"You may have seen drawings of molecules in textbooks, but today you will have the opportunity to see them in a different way—in 3D format, in a digital program, and we will also make physical models. This will allow you to understand what water, carbon dioxide, or methane really look like — how they connect, what their shapes look like, and why they are the way they are."* The educator can ask a few short questions to find out about the participants' experience: • *"Have you ever modelled anything on a computer?"* • *"Do you know what a molecule is?"* • *"Has anyone worked with 3D models or constructed structures from sticks, Lego, or puzzles?"* • *"What molecules do you know from everyday life?"* The educator presents the goal of the activity and links it to the purpose, theme, and outcome of the activity: *"What you already know, or even if you don't know anything yet, will be very useful to us today—we will start with*	• Listen to the educator's presentation and familiarize themselves with the theme and objectives of the activity. • Answer short questions about their experience: what they know about molecules, whether they have worked with 3D models, whether they have constructed structures. • Share their knowledge or examples they know from everyday life (e.g., water, CO_2, smells, food molecules). • Engage in a short discussion: what interests them, what they would like to learn, what activities they find interesting. • Familiarize themselves with the work process and prepare to move on to the practical part. • Become psychologically and emotionally involved – begin to be curious, observe what awaits them, look at sample photos of molecules or real models, if the educator shows them. • Listen to instructions on how the activity will proceed, what their task will be, and what results will be sought.

	simple examples and move step by step to creating our own model." *"The goal of this educational activity is to show how science and technology can help us understand the world we live in. In the Avogadro program, we will create a simple molecule, colour it, print its drawing, and then, based on it, create a real, three-dimensional model from simple materials."* *„At the end of our activity, you will have two results of your work: a digital version of the molecule on the computer and a real, handmade model. We will put them all together in a mini exhibition to see how diverse the geometry of molecules can be".*	
Practical activity – experimentation ***(30 min.)***	During the practical activity, the educator first explains the scientific part: clearly and comprehensively presents what molecules are, what the main chemical bonds are, how molecular geometry is formed, and why molecules such as H_2O, CO_2, CH_4, or NH_3 have different shapes, angles, and structures; shows examples of these molecules and emphasizes how their shape is related to the arrangement of atoms. Moving on to the technological part, the educator helps participants at select or create a molecule in the Avogadro program, explains how to rotate the 3D model, how to enable bond or atom visualizations, how to change the colours of atoms, and supervises the participants as they explore the structure on their own. He assists those who have difficulty using the program, reminds them how to save and print the image, and ensures that each participant has his/her own molecule drawing to construct a physical model. Once the engineering part begins, the educator distributes construction materials—sticks, plasticine or foam balls, and markers— explains how to create a three-dimensional model based on the printed Avogadro diagram, advises on how to replicate the colours of the atoms, how to connect the bonds accurately, and how to strengthen the structure so that the model is stable. He walks around the group, helping those who are having difficulty and asking questions that encourage engineering	*At the beginning of the practical activity, in the scientific part, students listen to the educator's explanations about molecules, chemical bonds, and molecular geometry, look at the examples of H_2O, CO_2, CH_4, and NH_3, and compare their shapes, angles, and structures. they ask questions, share their observations, and begin to understand why molecules are straight, bent, or tetrahedral.* In the technological part, students work on computers: they select or create their own molecule in the Avogadro program, explore its 3D structure, rotate the image, zoom in, enable bond display, change the colours of atoms, experiment with various functions, and then save and print an image of their molecule, which will be needed for further work. In the engineering part, students receive materials—sticks, plasticine or foam balls, and markers—and, based on the printed Avogadro diagram, build a real, three-dimensional model of their chosen molecules. They discuss among themselves how best to connect the atoms, how long the "bonds" should be, how to replicate the colours, and how to make the model stand and be stable, applying creative and engineering thinking. In the artistic part, students create a short label for their model—indicating the name of the molecule, the meanings of the colours, and the type of shape—and aesthetically arrange their model

	thinking *("How can you prevent the model from collapsing?", "How can you ensure that the angles are similar to the digital version?").* During the artistic part, the educator helps participants create molecule labels—explains what needs to be included on them (name, color legend, shape type) and encouraging them to creatively arrange the molecule models into an aesthetic mini-exhibition. If necessary, he offers ideas on how to present the work in a more attractive way. During the math part, the educator helps participants count the number of atoms in a molecule, identify different types of atoms, name the number of bonds, and, if the group is more advanced, explains how to calculate the scale of the model by comparing real molecules with their enlarged representation.	among the others, creating a small exhibition composition. and, if they wish, they can additionally decorate, draw, or stylize the image of the molecule. In the math part, they perform short calculations: they count how many atoms are in their molecule, how many different types of atoms there are, how many bonds connect the structure, and, if age and time allow, they calculate how many times their physical model is enlarged compared to the real molecular structure. Finally, at the end of the exhibition, the students place their molecules on a common table, examine the models created by others, discuss the shapes and differences, compare which ones turned out best, and take a group photo of the exhibition and to celebrate the results of their practical work.
Presentation of activity results ***(10 min.)***	The teacher asks the students to place their molecule models in the common exhibition space, helps them arrange them so that all the works are visible, and encourages the students to briefly present the molecule they have created, explaining its name, shape, number of atoms, and bond structure. The teacher asks questions to help students reflect on their experience, notice the differences between digital and physical models, identify what was easiest or most difficult, and emphasizes how this activity combined science, technology, engineering, art, and mathematics.	Students place their molecule models in a shared exhibition space, look at the work of other participants, and compare how different molecules look. They briefly present their molecule, say its name, explain how many atoms and bonds it has, what its shape is (straight, bent, tetrahedral, or other), and what decisions they have made when creating both the digital and physical models.
Reflection ***(10 min.)***	The educator summarizes the results of the lesson, identifies what the students have learned, praises their creativity and efforts, and, if necessary, helps to photograph the exhibition so that the students can preserve their impressions of their work.	Students share their experiences—what was easiest, what was most difficult, what surprised or interested them—and engage in a joint reflection by answering the educator's questions and discussing how this activity helped them better understand molecular structures and how STEAM areas were applied.
Achievement assessment and self-assessment	During the self-assessment of achievements, the educator guides the reflection process and helps participants to systematically apply the *"what worked – what was difficult – what I have learned"* method. He begins with a brief explanation of how the self-assessment works and provide clear instructions so	During the achievement assessment, participants focus on a brief reflection and, guided by the educator, apply a simple "three-step" method: first, they identify what went well, i.e., which parts of the activity they did best—whether it was creating a molecule model in Avogadro, the stability of the

	that students can reflect on their activities in a structured way. The educator asks specific, open-ended questions that correspond to each step of the reflection: first, invites students to share what they did best, encourages them to recall moments of success in technology, engineering, or creativity, and helps identify them. The educator then moves on to the second step and asks students to reflect on what they found difficult, encouraging them to talk about challenges such as the difficulty of controlling Avogadro, the repetition of molecular angles, or the stability of the structure. If students hesitate, the educator helps by providing examples or asking additional questions so that each participant can clearly identify their challenges. Finally, the educator moves on to the third step and helps students identify what they have learned: he directs their thoughts to scientific discoveries and the like. The educator summarizes the students' statements, emphasizes their progress and efforts, and helps them understand the value of this activity and the achievements that have been made.	physical structure, or the creative part of the label. Then the participants think about and share what was difficult: perhaps they had challenges managing the 3D model, connecting the atoms correctly, choosing the proportions, or understanding the shape of the molecule. Finally, students discuss what they have learned—what new knowledge they have gained about molecular structures, bonds, and geometry, what technological or engineering skills they have acquired, and how the STEAM components of helped them understand this topic from different perspectives. Through reflection, students actively evaluate their work process, recognize their progress, and consider what they would like to improve in the future.
Recommendations	Briefly show participants 1-2 examples – Avogadro's screen image, a physical model of a molecule, and a simple label – so that participants understand the task more clearly, feel more confident, and start working faster. Remind participants to handle the sticks with care (do not stab or put them in your mouth), ensure they sit correctly when working at the computer, and encourage them to get up from their chairs at least once during the activity, for example, when setting up the exhibition. Strengthen the connection with everyday life by choosing molecules that are familiar to participants (e.g., water, carbon dioxide, oxygen, ethanol) and briefly explaining where they are found in everyday life—in smells, food, air, or household chemicals.	
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Molecule table

Molecule	**Chemical formula**	**Geometry**	**What does it look like in Avogadro's model?**	**Areas of use/appearance**
Methane	**CH_4**	Tetrahedral	Highly symmetrical and clearly defined shape.	Gas deposits, natural gas, energy.
Ammonia	**NH**	Triangular pyramid	Space is formed by clear, contrasting geometry.	Fertilizers, biological processes, household.
Water	**H_2O**	Curved	A gentle, easily recognizable shape.	Food, biology, air, all vital processes.
Carbon dioxide	**CO**	Straight	Symmetrical, double bonds are clearly visible.	Air, breathing, plant photosynthesis, bubbles in drinks.
Boron trifluoride	**BF_3**	Flat triangle	Extremely modern, regular structure.	Industry, chemical synthesis (not in everyday life).
Methanal (formaldehyde)	**HCHO**	Flat	Clear plane and bonds.	Biology, material production (high educational potential).
Nitrate ion	**NO_3^-**	Flat triangle	Resonance structures look interesting.	Fertilizers, soil, water cycles, biology.
Benzene	**C_6H_6**	Cyclic (aromatic)	Highly symmetrical, attractive structure.	Chemical industry, organic chemistry, fragrance mixtures.
Ethane	**C_2H_6**	Two tetrahedral parts	Perceived as a "moving" structure.	Gas, fuel, organic materials.
Ethanol	**C_2H_5OH**	Three-dimensional fragments	Functional group clearly visible and aesthetic.	Food, beverages, disinfection, biological processes.
Menthol	**$C_{10}H_{20}O$**	Complex three-dimensional	Natural-looking spatial structure.	Fragrances, mint aroma, hygiene products.
Vanillin	**$C_8H_8O_3$**	Aromatic + functional groups	Aesthetic, cyclic with side groups.	Food, aromas, confectionery, fragrances.

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DESCRIPTION OF STEAM EDUCATION ACTIVITY "MUSIC AND SOUND ENGINEERING"

Topic	Music and sound engineering
Duration	60 min.
Abstract	During the activity, participants explore how instruments made of different materials and shapes produce sound, test the effects of vibrations, create rhythms, and discover their connection to mathematical repetition. The activity combines STEAM principles: scientific exploration, observation of engineering solutions, creative expression, and collaboration. Participants play individually and in groups, create a joint "sound orchestra," learn to listen and respond to the sounds of others, and at the end of the activity, reflect on their experience, identify discoveries, and evaluate their progress. This is an engaging, sensory, and emotionally enriching educational experience suitable for children of all ages, including those with special needs.
Areas of achievement and expected outcomes	
S (natural sciences)	Participants explore how sound is produced by vibration, how it travels in waves, and how different materials and surfaces change the properties of sound (pitch, duration, timbre).
T (technology)	Participants explore musical instruments as tools of sound technology, test their operating principles, and understand that different designs create different sound functions.
E (engineering)	Participants explore how the shape, structure, and materials of instruments determine the sound result and experiment with different playing techniques to achieve the desired sound.
A (arts, other subjects)	Participants explore forms of creative expression—creating rhythms, improvising, combining sounds in a group, and discovering how sound can convey moods, stories, or emotions.
M (mathematics)	Participants explore the structure of rhythms, count beats, recognize patterns of repetition, and understand the relationship between rhythm, tempo, and the measurement of time.
Competencies developed in participants *(underline the competency and its structure or structures)*	Communication competence (message creation, message transmission and communication interaction, message analysis and interpretation)
	Cultural competence (cultural awareness, cultural expression, cultural awareness)
	Creativity competence (exploration, generation, creation, evaluation, and reflection)
	Digital competence (digital content, digital communication, digital safety, problem solving)
	Cognitive competence (subject knowledge and skills, critical thinking, problem solving, learning to learn)

	Civic competence (civic identity and civic power, living in a community while building a democratic society, respect for human rights and freedoms) Building the state and strengthening statehood in the international community	
	Social, emotional, and healthy lifestyle skills, self-awareness and self-control skills, empathy, social awareness and building positive relationships, responsible decision-making and behavior when assessing consequences, caring for health	
Goal of the activity	To familiarize participants with the principles of sound phenomena, encourage practical exploration of the sounds produced by percussion instruments, and reveal their connection to STEAM elements.	
Activity objectives	• Explore the sounds produced by various percussion instruments, their characteristics, and the effect of vibrations on sound production. • Create and recognize rhythms, learn to count beats, and understand the connection between rhythm repetition and mathematics. • Develop creativity and collaboration skills by playing in a group, combining sounds, and creating a joint "sound orchestra." • Reflect on their experience and evaluate the knowledge the participants have learned about sound, how instruments work, rhythm, and STEAM elements.	
Activity methods and strategies	Research, problem-based learning, creative expression, discussion, reflection, storytelling methods. Experiential learning, problem solving, creative and collaborative strategies.	
Activity tools and equipment.	A tambourine with a stretched membrane, a tambourine, two hand rattles, five triangles, two maracas, two castanets, a rattle, two wooden sticks, and various other rattles and shakers. Also—a rain stick, ocean drum, drum, wind chimes, etc.	
Additional materials needed for the activity	• Rhythm and sound cards • Color codes or pictograms (for easier communication) • Large sheet of paper or poster board • Markers, crayons, or pencils • Sticky notes or emotion cards for self-assessment	
Activity content		
Stages	Educator's activities	Participants' activities
Before the activity	The educator prepares the activity space, arranges the percussion instruments and visual aids so that participants can easily reach and explore them. He thinks through the introductory part, prepares a motivating phrase to present the activity, questions to find out about the participants' experience, and a clear explanation of the activity's objective. The educator checks the suitability of the instruments, prepares rhythm and listening cards, plans how to create a safe, friendly atmosphere and how to start the activity in an engaging way so that participants are ready for exploration, creativity, and active participation from the very first minutes.	
Introduction, motivating participants, clarifying their	Welcomes the participants and briefly introduces the activity, sparking their curiosity:	Participants calmly sit down in a circle and listen to the educator's presentation, familiarizing themselves with the upcoming task and the idea behind the activity.

experience, discussing the task *(15 min.)*	*"Today, we will become sound explorers and find out how music can become science."* Creates a safe and friendly atmosphere, encouraging participants that anyone can play—no musical skills are required. Asks simple questions to find out about the participants' experience and expectations: • *"Have you ever played an instrument?"* • *"What kind of sounds do you like?"* • *"Do you know where sound comes from?"* Summarizes the answers and links them to the goal of the activity. Clearly states the goal of the activity: *"Today we will learn how sound travels, how we can create it with instruments, and how rhythm is related to mathematics."*	They participate in a conversation, answering the educator's questions about their experiences: they talk about whether they have played instruments, what sounds they like, and how they imagine sound is created. Participants engage in discussion verbally or with gestures, expressing their expectations and curiosity. Listening to the educator's explanation, they accept the goal of the activity and prepare themselves for exploration, creative experimentation, and active participation in future musical experiments.
Practical activity – experimentation *(30 min.)*	Introduces participants to different percussion instruments and shows how they produce sound: by striking, shaking, rubbing, or touching. Explains that this part of the activity is dedicated to exploring sounds, and that each participant is a "sound scientist." Suggests conducting several sound experiments: how the sound changes when played louder/softer, how the sound changes when the instrument is made of different materials (metal, wood, leather), how the sound sounds fast/slow, how a short long sound sounds. Encourages participants to compare sounds and notice sound characteristics (pitch, length, vibration, timbre). Works with the group in stages: first, everyone explores individually, then in small groups, and finally, all together. Demonstrates examples of rhythm, leads rhythmic exercises, and helps participants repeat them.	Select a percussion instrument and independently explore the sounds it produces. Experiment: play instruments with varying intensity and speed, try different techniques (striking, shaking, stroking), listen to how the sound changes with the intensity of the movement or the material. Compare different instruments: metal, wooden, rattling, or vibrating. Participate in short experiments: • Which sounds the quietest? • Which sounds the longest? • Which sound is the highest? • Which is the lowest? Learn to create a rhythm and repeat it: count beats, recognize repetition, play rhythmic patterns. Participate in group activities – "sound orchestra" rehearsals, where each group plays according to the educator's cues.

	Encourages active and creative participation, helping participants hold or play instruments as needed. Helps participants discover the connection between sound, vibration, and mathematical rhythm repetition.	Observe how sounds change when several instruments play together and how rhythms blend. Unleash creativity: create short rhythms and try to match them with other participants. Understand that rhythm is a pattern and sound travels in waves of vibration.
Presentation of activity results *(10 min.)*	Invites participants to return to the circle and briefly reminds them what they did during the educational activity: *"We explored sounds and rhythms and created our own orchestra. Now we will see what we have managed to create."* Explains the presentation task: • each group of participants or individual participant presents a sound, rhythm, or short improvisation that they created during the experiment; • participants also discuss what they noticed or learned (e.g., which sound was the longest, which was the lowest). Organizes a demonstration of the results: • one group plays its rhythm, • another imitates the sounds of nature (rain, wind, footsteps), • a third demonstrates the characteristics of an instrument (e.g., vibration, length of sound). Encourages reflection with questions: • *"How is your sound different from the others?"* • *"How did you create your rhythm?"* • *"What did you discover about sound today?"* Provides positive feedback and helps participants identify STEAM elements: • physics (sound = vibration), • mathematics (rhythm repetition),	Sit calmly in a circle and present the results of your work: • play the rhythm you have created, • demonstrate how the sound of the instrument changes, • perform a short musical improvisation, • present the sound characteristics you have noticed (length, pitch, timbre). Explain how they created their sound or rhythm. Listen to the presentations of other participants and notice the differences between the sounds. Participate in a group discussion and name what they have learned: • how sound travels, • the difference between high and low tones, • how to count rhythmic sequences, • how instruments sound together. • Share their experiences: • *"I liked..."* • *"I was surprised by..."* • *"I would like to try..."* Participants feel that they have created a shared result and experienced a musical achievement.

	• engineering (the structure of the instrument helps to create a certain sound).	
Reflection ***(10 min.)***	Invites participants to finish the activity in a quiet circle and reminds them that this part is for reflecting on the experience. Propose a reflection task: choose one of the ways to express your experience-verbally, through movement, drawing, or sound imitation. Ask open-ended questions that help connect the activity to STEAM principles: • *"What surprised you the most today?"* • *"Which sound was the most interesting to you and why?"* • *"What did you learn about how sound travels?"* • *"How is rhythm related to numbers?"* • *Encourages participants to name not only their knowledge but also their emotions:* • *"How did you feel playing together with others?"* • *"When was it easy, and when was it difficult?"* Helps participants relate their observations to scientific phenomena (vibration, waves, tempo changes, rhythm structure). Provides a brief summary and thanks everyone for participating.	They calmly sit down in a circle and share their experiences in one of the following ways: verbally (they describe what they liked most), through drawing (they draw what their sound "looks like"), through sound improvisation (they demonstrate a short sound or rhythm), through movement (they show how their sound feels—high, low, soft). Answer the educator's questions and name: • which sound they will remember best, • what they learned about sound waves and vibrations, • how they understood the repetition of rhythm or changes in tempo. Listen to the reflections of other participants and notice that everyone experienced the sound differently. Describe their feelings: the joy, curiosity, and surprise that the musical experiments evoked. Feel a sense of achievement – that they were able to create sound and rhythm and participate in a joint orchestra.
Assessment of achievements Self-assessment	Introduces participants to the self-assessment task and explains that there are no right or wrong answers—the most important thing is to describe their experiences. Provides a simple, easy-to-understand assessment form (according to the age and needs of the participants): • emotional face cards ☺ 😐 ☹ • color scale (green – I understood, yellow – I am still learning, red – it was difficult) • finger scale (1–5)	Choose a method of self-assessment (smiley card, color, number of fingers, sound gesture) and show how they assess themselves. Name what they have learned: • *"I learned that sound is vibration."* • *"I learned how to create a rhythm and repeat it."* • *"I discovered that metal sounds longer than wood."* Name what they did best:

	• sound gesture (quiet sound = I understood less, loud sound = I understood a lot) Encourages participants to evaluate: • what they learned about sound, vibration, and rhythm; • how they did in the rhythmic games; • whether they felt confident playing the instrument; • how they did in working together as a group.	• playing rhythm, listening to others, creating a sound experiment, improvising. Express what was most difficult (if they want, they can show it with a color or gesture). Share how they felt during the activity (calm, brave, curious, happy). Name one thing they would like to try next time (e.g., another instrument, another rhythm).
Recommendations	It is recommended to organize activities in small groups (up to 12–15 participants) so that everyone has the opportunity to actively explore the instruments, express themselves, and participate in the creation of a joint "sound orchestra." When planning the composition of participants, it is worth taking into account the age and special needs of the children – for more sensitive participants, it is advisable to select instruments with a softer sound in advance (rain sticks, wind chimes, kalimbas) and to provide a "quieter zone" for a brief retreat from the sounds. It is recommended to clearly agree on "volume rules" in advance and use visual signals (color cards, gestures) to regulate the sound and transitions between moments of silence and playing. In order to strengthen the STEAM aspect, it is worth consciously identifying when we are talking about science (vibration, waves), when about mathematics (rhythm repetition, counting), and when about art and creativity (creating moods and stories with sounds). It is advisable to leave some flexibility in the activity time: if the group is very engaged in practical experimentation or rhythm creation, the presentation of results or reflection can be shortened, but do not forget to include at least a brief discussion and evaluation. It is useful to write down brief notes after the activity (what worked, what was difficult, what adaptations were needed) so that next time it will be easier to adjust the course of the activity, the tools, and the tasks to the needs of the specific group.	
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DESCRIPTION OF STEAM EDUCATION ACTIVITY "MAKE YOUR OWN WIND MILL!"

Topic	**Make your own windmill!**
Duration	60 min.
Abstract	During the activity, participants explore how wind moves and what it can do, and use creativity and engineering solutions to build their own colorful windmill. Through experimentation, they observe how air currents cause movement, learn to draw simple conclusions, and experience the power of wind. The practical activity takes place in the library—participants touch, blow, observe, listen, and learn to understand natural phenomena through their senses. To make learning engaging and playful, the activity features a character named Cheerful Wind, which invites participants to explore air movement, race windmills, and discover how wind generates energy. The plot of the activity revolves around the participants' journey through the world of wind power, colors, movement, and creativity. The activity encourages the development of participants' cognitive, creative, and communication skills through play, senses, and experimentation.
STEAM educational achievement areas and developed skills	
S (natural sciences)	Skills developed: observation, exploration, understanding of cause and effect, scientific curiosity. Participants: • Learn what wind is and that it is moving air that has force. • Observe how wind causes movement – a windmill turns when air blows into it. • Understand the relationship between cause and effect: if the wind blows → the windmill moves. • Notice that the strength of the wind (blowing stronger or weaker) changes the speed of rotation. • Experiment and form hypotheses: what will happen if we change the shape or size of the blades?
T (technology)	Skills developed: familiarity with technological processes, safe use of tools, understanding of technological creativity. Participants: • Learn about the operating principles of simple mechanisms – the axis of rotation, the effect of air. • Use tools and materials (scissors, glue, pins, straw) safely and purposefully. • Observe how a fan or hair dryer creates wind – this is an example of technology that helps to explore natural phenomena.

	• Can compare: how people use wind in technology (e.g., in wind turbines to generate electricity).
E (engineering)	Skills developed: problem solving, creative thinking, engineering design, perseverance. Participants: • Design and construct their own windmill from simple materials. • Learn to plan their actions step by step (cutting, bending, fastening). • Improve the design during testing – if it doesn't work, they look for the reason (e.g., the axle is too tight). • Experience a sense of success – the object they have created moves and works!
A (arts, other subjects)	Skills developed: creativity, self-expression, emotional intelligence, aesthetic perception. Participants: • Choose colours and patterns and decorate the windmill according to their taste. • Develop aesthetic perception—what is beautiful, what goes well together, how to express themselves through colors and shapes. • When creating in a group, they develop communication skills and a sense of pride in their work. • They learn that science and art can go hand in hand – a technical object can also be beautiful.
M (mathematics)	Skills developed: spatial awareness, shape recognition, counting skills, logical thinking. Participants: • Use geometric shapes (squares, triangles) to construct a windmill. • Learn about symmetry – all blades must be bent equally for the windmill to turn. • Count, compare, and measure: how many angles, how many times it turned, which windmill is faster. • Notice the importance of proportions – larger blades = more wind power.
Competencies developed in participants *(underline the competency and its structure or structures)*	Communication skills (message creation, message transmission and communication interaction, message analysis and interpretation)
	Cultural competence (cultural awareness, cultural expression, cultural consciousness)
	Creativity skills (exploration, generation, creation, evaluation, and reflection)
	Cognitive competence (subject knowledge and skills, critical thinking, problem solving, learning to learn)
	Social, emotional, and healthy lifestyle skills, self-awareness and self-control skills, empathy, social awareness and building positive relationships, responsible decision-making and behavior when assessing consequences, caring for health.
Goal of the activity	Encourage participants' curiosity and interest in natural phenomena by helping them understand the impact and application of wind power, and develop their ability to explore, create, and experiment using STEAM principles—science, technology, engineering, art, and mathematics.

Activity objectives	• Introduce participants to the phenomenon of wind – how air moves, what force it has, and how people can use it. • Encourage exploration and experimentation – allow participants to test how air currents cause the windmill to move, observe differences, and draw simple conclusions. • Develop creativity and fine motor skills – by creating, decorating, and constructing their own windmill from simple materials. • Develop cooperation and communication skills – by working in pairs or small groups, sharing ideas, and helping each other. • Encourage reflection and self-esteem growth – help participants identify what they have learned.	
Activity methods	Research, problem-based learning, demonstration, creative expression, discussion, reflection, storytelling methods.	
Activity strategies	Experiential learning, problem solving, creative, collaborative, inclusive education strategies.	
Activity tools and equipment.	Colored paper (thicker A4) Scissors (with rounded tips) Glue/adhesive tape Pins or small tacks Pencils/straws Stickers, markers, glitter (for decoration) Small fans or a hair dryer or fan (to simulate a wind source)	
Additional materials needed for the activity	• A container with stones or other material for grinding. • Plastic caps or sticks if you want more durable axles. • Mini vertical wind turbine generator, wind turbine kit, educational model.	
Activity content		
Stages	Educator's activities	Participants' activities
Before the activity	Preparation of the space and environment • Selects a quiet, noise-free space in the library where participants can work without distraction. • Arranges tables and chairs so that it is convenient to move around, pass by, and work in pairs or small groups. • If there are participants with mobility difficulties in the group, ensures that they can comfortably access the space and reach the materials. • Ensures that the space is bright, cozy, and has minimal distractions (no flashing lights or strong smells). • Writes the name of the activity on a board or poster: "Make your own windmill!" (this helps to visually understand what we will be doing today). Preparation of materials. The educator prepares in advance: • Colored paper squares (diagonals can be cut out in advance for weaker participants). • Scissors (safe, with rounded ends). • Pins, straws, or pencils – one set for each participant. • Glue/adhesive tape/stickers for decoration. • Additional sensory materials: glitter, felt, colored ribbons. • A device to imitate wind – a small fan, hair dryer, or even a paper fan. • One sample windmill – to show the result. Arranges the materials on tables in separate boxes or envelopes – this will make it easier for participants to find their way around.	

Introduction, motivating participants, clarifying their experience, discussing the task ***(15 min.)***	Creates a cozy and safe atmosphere: • Welcomes participants warmly, greeting them by name. • Seats them in a circle or at tables so that everyone can see each other. • Uses a short emotional exercise or greeting game *("Show me what kind of wind you feel today – calm or strong?").* • Explains that today there will be a fun creative activity about the wind. • Introduces the topic – what is wind? Asks the participants simple, engaging questions: • *"Who among you has felt the wind?"* • *"What can the wind do?"* • *"Where can we see how the wind moves?"* • Shows pictures or a short film clip about wind, windmills, and sailboats. Lets the participants feel the wind: uses a fan or a hand fan and asks: • *"What do you feel on your face? Does the wind have power?"* • *Briefly explain that "Wind is moving air. It can make things spin. Today we will find out how this happens!"* Finds out what experience the participants have: • Encourages them to share their personal observations: *"Have you ever seen a windmill?", "What does the wind do when it blows strongly?", "How do you think people use the wind?"* • Allows participants to show what they know through gestures or drawings (this is especially helpful for nonverbal or quieter participants). • The educator listens actively and praises each answer *("Great!", "Yes, the wind can really turn a windmill!").* Motivates and engages: • Takes out a model windmill, allows participants to touch it, blow on it, and watch it spin. Asks the question: *"What do you think makes it spin?"* • *"Would you like to make your own windmill that spins in the wind?"* Creates intrigue: • *"Today we will be inventors – engineers and artists!"* Presents the task (3 min.) • Clearly and simply explains the goal of the activity: *"Our task is to make a windmill that will turn in the wind. Each of you will create your own, choosing the colors, shape, and decorations."* • Briefly shows the course of the activity visually (with cards or pictures). Emphasizes	Listen and participat in conversation: • Answer questions about wind, shares their experiences. • Look at pictures, watch a video or look at objects related to wind. • React to the sensation of wind (from a fan or hand fan). Express their experiences and emotions: • Tell or show with gestures, facial expressions, or drawings what they know or remember about wind. • Share their thoughts or memories: *"I like it when the wind blows bubbles!"* Engage in the motivational moment • Observe, touch, blow on the model windmill. • Express interest and curiosity *("I want one too!"*). Understand the task • Together with the educator, name what they will do *("We will make a windmill that spins").* • Prepare to begin the creative part, promise to work calmly and amicably.

	that *"The most important thing is to try and enjoy your creation. Each windmill will be unique!"*	
Practical activity – experimentation ***(30 min.)***	Start of activity (5 min.): • Briefly explains what the participants are going to do: *"Now we are going to become engineers and try to build a windmill that will turn in the wind."* • Shows a sample windmill and demonstrates the steps slowly and clearly: 1. Cut out a square. 2. Cut diagonal lines to the center. 3. Fold the corners inward. 4. Pin it to the straw with a pin. 5. Test by blowing on it. • Uses visual cards for each step (for participants with language or attention difficulties). • Emphasizes safety: cut carefully with scissors, only adults should hand out pins. Windmill construction (10–12 min.): • The educator goes around the groups, helping each participant, holding or preparing parts if necessary. • Encourages independence: *"Great, try bending another corner yourself."* • Encourages: *"Every windmill will be different and they will all be wonderful!"* • If a participant has difficulty connecting the pieces, can give them a simpler option (a ready-made square or adhesive tape instead of a pin). • Monitors whether participants are following the process and helps them to orient themselves. • Occasionally explains in simple scientific terms: *"When the wind blows, it pushes the blades of the windmill. That's why they turn."* Experimenting with wind (10–12 min.): • The educator prepares wind sources: a small fan, a hair dryer, or simply lets the participants blow. • Explains what they are going to do: *"Now we will test how our windmills react to the wind. Which one will spin faster? How will it change if the wind is stronger?"* Encourages exploration and observation: o *"What have you noticed?"* o *"What happened when the wind was stronger?"* o *"Which windmill spins slower?"* Can write the participants' answers on the board or use drawings to show "slow – fast."	Construction • Select paper of the desired color. • Perform actions according to the educator's example and visual cards. • Cut, bend, glue, and attach blades. • Decorate their windmill with stickers, patterns, or colors. • If necessary, ask for help – work together with a friend or educator. Testing: • Blow into their windmill and observe how it moves. • Experiment with different distances from the fan and different blowing strengths. • Notice how the force of the wind affect the speed of rotation. • Are happy with the result, share it with friends *("My windmill spins very fast!").* Observations and conclusions: • Talk to the educator, answer questions. • Understand that wind causes movement. • Everyone chooses what they want to keep or show (e.g., create a "wind exhibition" on the table).

	Helps the participants try several distances from the fan to see how distance affects movement.	
Presentation of activity results ***(5 min.)***	Creates a joyful, festive atmosphere: · Announces: *"Now it's time to present our creations – little wind wonders!"* Prepares a "wind exhibition" – a table or shelf where participants can place their windmills. Plays calm, pleasant background music to create a festive mood. Encourages the presentation: • Invites participants to show their windmills one by one or in pairs. • Asks simple, encouraging questions (so that everyone can answer according to their abilities): o *"What color is your windmill?"* o *"How does it spin when the wind blows?"* o *"What did you like most about making it?"* • Praises each participant specifically: *"Very nice colors!"* • *"Your windmill spins fast-great engineering work!"* Encourages friends to get involved: • Invites participants to applaud each other or give a "thumbs up." • Uses emotion cards – participants can show how they feel. Summarizes the results: • Helps participants summarize in simple words: *"Today we learned that wind has power, and we created windmills that demonstrate this power."* • *"Each of your creations spins differently – just as you are all different, but special!"* • If possible, creates a short "wind show" together with the participants – everyone blows their windmills together. Can hand out a symbolic "wind creator" sticker or certificate. Captures the moment: • Suggests taking a group photo with all the windmills. • Suggests that the windmills could be left in the library exhibition or taken home to show to the family.	Present their work: • Show the windmill to the group. • Briefly describe (or show with gestures) what they liked, what colors they used, how it spins. • Are happy with their work and observe their friends' creations. Evaluate and support friends: • Express approval by clapping, showing emotion cards, or giving a thumbs up. • Learn to listen respectfully to others. Participate in summarizing: • Answer the questions: *"What new things have you learned today?" "What would you like to repeat mostt?"* • Show emotion *("I'm happy," "It was fun," "I did it").* End the activity joyfully: • Participate in a joint "wind show" – everyone blows their pinwheels together. • Can receive a symbolic "wind creator" sticker or certificate.
Reflection ***(10 min.)***	Invites participants to share their observations: *"What helped the windmill spin faster?"* *"Did all the windmills spin at the same speed?"* Summarizes the conclusions in simple words: *"Wind has power. When the wind is stronger, the windmill spins faster."* *"If there is no wind, it stands still."* Praises everyone for their efforts: "You are true explorers and creators!"	Participants observe their own and their friends' windmills, compare whether they spin at the same speed, and, to check, blow on them briefly to see the differences. They express their conclusions in simple words or

		gestures, sometimes imitating the movement or stopping of the wind with their hands.
Assessment of achievements Self-assessment	• After presenting the works, the educator says: *"You were all true creators today! Now let's think about how we did and what we learned."* • Reminds the participants that the most important thing is not the result, but the effort and experience. Provides a simple (visual) self-assessment method. Pictures, emoticons, or symbols are used so that participants can choose according to their abilities. Discusses achievements in STEAM areas: • The educator briefly reflects with the participants: • *"What have the scientists done today?"* (They observed how air moves) • *"What did the engineers do?"* (They built a windmill) • *"What did the artists do?"* (They decorated and colored) • *"What was the most interesting?"* • *"What would you like to do differently next time?"* This helps participants understand that they participated in science, technology, engineering, art, and mathematics activities, even if they did not name them directly.	Participants: • Choose an emoji/thumb/color that shows how they did. • Answer the following questions briefly: *"What was the most fun today?", "What was the hardest?", "What would I like to try again?"* • Show or tell what they are proud of *("I managed to bend all the spoons," "My windmill spins fast!").* • Support each other – applaud and rejoice in their friends' achievements.
Recommendations	• Create a themed installation. You can attach a card to each windmill with the participant's name and a short sentence: *"My windmill spins with the wind of joy!"* or *"When the wind blows, my colors dance!"* • Organize an exhibition or photo shoot. Take a photo of the entire "wind park" and create a collage or virtual exhibition on the library's website or social media. • Use wind sources of varying strengths. You can have several fans or even have the participants blow as a game: *"Who can spin their windmill the fastest?"* • Add sounds and music. Soft music with the sounds of wind, birds, or nature enhances the sensory experience and creates a calm, creative atmosphere. • Decorate the exhibition space with nature elements. Add green plants, grasses, cotton clouds, or paper suns to create the impression that the windmills are spinning in a "windy meadow." • Involve parents or library visitors. You can ask them to choose the "most spinning," "most colorful," or "most fun" windmill – not for a competition, but for the joy of sharing. • Create a windmill exhibition by preparing a large foam or cardboard board on which participants can stick their windmills. Use a small fan to make all the windmills spin together. This is very visually impressive – like a mini wind farm in the library!	

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Recommended tools	Mini vertical wind turbine generator, wind turbine kit, training model. Fans.

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DESCRIPTION OF STEAM EDUCATION ACTIVITY "APPLICATION OF FAIRY TALE THEMES IN STEAM: THE UGLY DUCKLING"

Topic	**Application of fairy tale themes in STEAM: The Ugly Duckling**
Duration	60 min
Abstract	This educational activity is designed to help participants better understand their own uniqueness and that of others through Hans Christian Andersen's fairy tale "The Ugly Duckling," biographies of heroes in the STEAM fields and creative workshops. During the activity, participants explore famous scientists, artists, and inventors who achieved exceptional results despite difficulties, and whose "otherness" became their strength. Group activities, discussions, and practical research encourage empathy, critical thinking, cooperation, and self-esteem. In the creative part, participants create symbolic "wings" that reflect their personal strengths and dreams, and during reflection, they evaluate their experiences and discoveries. The activity helps to build self-confidence and promotes a positive attitude towards diversity.
Areas of achievement and expected outcomes	
S (natural sciences)	Participants observe and analyze how different wing shapes affect air resistance and flight, and understand that in nature, the structure of organisms is adapted to their way of life. See Recommendations.
T (technology)	Participants apply simple methods of information analysis and selection when exploring biography cards, recognize the role of technology in human achievements, and understand that technological solutions are created by people with different abilities.
E (engineering)	Participants design and test objects of different shapes, understanding that the performance of structures depends on their shape, material properties, and function. See Recommendations.
A (arts, other subjects)	Participants creatively express their strengths and individuality by decorating symbolic wings using colours, shapes, and visual symbols.
M (mathematics)	Participants compare, group, and systematize biographical data (challenge–strength–achievement), recognize logical connections, and observe how mathematical thinking has helped people achieve results in different STEAM fields.
Competencies developed in participants *(underline the competency and its structure or structures)*	Communication competence (message creation, message delivery and communication interaction, message analysis and interpretation)
	Cultural competence (cultural awareness, cultural expression, cultural awareness)
	Creativity competence (exploration, generation, creation, evaluation, and reflection)
	Digital competence (digital content, digital communication, digital safety, problem solving)

	Cognitive competence (subject knowledge and skills, critical thinking, problem solving, learning to learn)	
	Civic competence (civic identity and civic power, living in a community to create a democratic society, respect for human rights and freedoms building a state and strengthening statehood in the international community	
	Social, emotional, and healthy lifestyle competence, self-awareness and self-control skills, empathy, social awareness and the creation of positive interpersonal relationships, responsible decision-making and behavior when assessing consequences, caring for health	
Goal of the activity	To encourage participants to recognize and appreciate their own uniqueness and that of others through fairy tales, STEAM hero stories, and creative activities that foster empathy, self-esteem, critical thinking, and collaboration skills.	
Activity objectives	• To introduce participants to famous representatives of STEAM fields, highlighting the challenges they have faced, their strengths and achievements, and to show that "otherness" can become a strength. • To develop the ability to analyze information and work in a team by reading biographies in groups, identifying challenges, strengths, and achievements, and preparing short presentations. • Encourage creative self-expression and self-esteem by creating symbolic "wings" that reflect the talents, hobbies, dreams, and personal strengths of the participants. • Develop empathy and respect for diversity by comparing your strengths with those of other participants during the "Wings Gallery" and discussing similarities and differences.	
Activity methods and strategies	Research, problem-based learning, creative expression, discussion, reflection, storytelling methods. Experiential learning, problem solving, creative and collaborative strategies.	
Activity tools and equipment	Biography cards about famous people, reinforced with thicker cardboard if necessary, as well as writing tools—pencils, markers, and pens—and sheets of paper or cards for noting challenges, strengths, and achievements. For the mini-experiment, paper wings in three different shapes: narrow, round, and wide are needed. For the creative workshop, wing templates or white and colored paper for the wing silhouette, markers, felt-tip pens, stickers, glitter, and other decorations for decorating are used. Children's scissors so that participants can safely cut out their wings are also needed.	
Additional materials needed for the activity	Several additional elements are needed to help create a cozy, motivating atmosphere and prepare the space for the final gallery. Small prizes such as stickers or badges may be needed, which the educator can use to encourage participants for their efforts. If desired, calm background music can be played to help participants concentrate on their creative work. It is also necessary to prepare a large poster, stand, or wall space to serve as the "Wing Gallery," where the participants' creations will be displayed.	
Activity content		
Stages	Educator's activities	Participants' activities
Before the activity	The educator prepares the content, materials, and space. He reads and selects appropriate excerpts from The Ugly Duckling for the introduction. Prints out biography cards about famous people who have faced challenges	

	and, if necessary, attaches them to thicker cardboard. Prepares questions for discussion about the fairy tale, STEAM activities, and reflection. Before the activity, the educator prepares all the necessary materials: a book or text for reading the fairy tale, cards, writing materials, and tables for groups for the STEAM part, and colored paper, stencils, scissors, glue, stickers, and markers for creative activities. Also sets aside a place for the "Wing Gallery," where participants' work will be displayed. The educator arranges the space, dividing it into three zones: a discussion circle, STEAM research tables, and a creative workshop area. He checks that there is enough space for the participants and that everyone can hear the reading clearly. Finally, the educator plans the time according to the structure of the educational activity (10 + 15 + 20 + 10 + 5 min.), practises reading the excerpts and ensures that the activity runs smoothly. If desired, he can prepare calm music or small incentives for the participants.	
Introduction, motivating participants, clarifying their experience, discussing the task *(15 min.)*	Explains that the activity will focus on how each person can be special and how valuable our diversity is. Creates a safe atmosphere by saying that all participants can freely express their thoughts and that there are no "right" or "wrong" answers. The educator then asks simple, motivating questions to engage the participants: *"Have you ever felt different?"* *"What helps you feel good when you feel different from others?"* *"Do you think being different can be a strength? Why?"* Briefly discusses the participants' answers, encourages them, emphasizes that everyone's experience is important, and moves on to the theme of the story. The educator recalls "The Ugly Duckling," but does not retell the whole story—just asks: *"Who remembers why the duckling felt different?"* *"How did the other characters treat him, and how did that make him feel?"* *"Does the fairy tale have a message that could be important to us today?"* After this discussion, the educator clearly states the goal of the activity: *"Today, we will explore famous people who proved through their lives that being different is not a disadvantage, but an opportunity to find your own path. Our goal is to understand how each person can overcome difficulties, discover their strengths, and make an impact on the world."*	Participants sit in a circle and answer the educator's questions about whether they have ever felt different, what helps them in difficult moments, and how they understand "otherness." They share their thoughts as much as they feel comfortable. Participants recall the characters and events of the fairy tale and briefly describe in their own words: *why the duckling felt different;* *how the other characters treated him;* *what feelings this story evokes in them.* Participants name situations from their own lives (at school, in clubs, with friends) when they felt similar to the duckling—different, misunderstood, or out of place. They share what they felt at the time and what helped them. Participants discuss whether it is good to be different and express their opinions on what qualities can become a person's strength. Participants give examples from their environment (friends, family, characters from films or games). Participants listen to the educator's presentation about the task for the next activity and

	He explains that during the activity, participants will work in groups, read stories about people who have faced challenges, and ultimately create their own "wings" that reflect their uniqueness. The educator concludes the introduction with a motivational sentence that draws participants into the activity: *"Each of you has qualities that no one else has. Today, we will try to discover them and see how they can become your strengths."*	briefly say what they expect from the activity: what they would like to learn, what they expect from the stories of scientists and inventors, what strengths they would like to discover. Participants prepare to work in groups and explore the biographies provided. They agree on the rules of cooperation: listen to each other, work amicably, ask questions boldly, and share ideas.
Practical activity – experimentation ***(30 min.)***	The educator explains that this part of the activity will be devoted to a "discovery lab" in which participants will explore real people who have achieved a lot, even though they initially seemed "different." He briefly explains the task and reminds the participants of the rules of group work: listen to each other, divide roles, and record conclusions. The educator then forms groups of 3-4 participants and gives each group a biography card of a famous person. He explains that this card is their "experiment," which they must investigate like scientists. The educator gives the task: the groups must read the text provided, discuss its content, and identify three main categories from the card—challenge, strength, and achievement. He helps the participants by explaining where to find each piece of information: challenges at the beginning of the biography, strengths in the facts about abilities, and achievements in the description of what the person has done in their field. If necessary, the educator helps with reading or paraphrases more complex words. While the groups are working, the educator walks around the tables, asking additional questions that encourage thinking: *"How did this challenge affect the person's life?"*	Participants are divided into groups of 3-4 people. Each group receives a biography card of one famous person. Together, they read the text, help each other understand unfamiliar words, and discuss what they have learned about the person being presented. The groups analyze the information on the card, looking for three key elements: challenge, strength, and achievement. They decide together: what challenge the person faced, what strength they demonstrated, what achievement they made in their life or work. Participants write down their thoughts on the provided sheets of paper or cards. Participants share their thoughts on why they chose those particular characteristics. They discuss whether that person would have achieved everything if they had not been "different." Groups agree on which information is most important for their presentation. Participants conduct a "STEAM study" to identify

	"What strength do you notice first?" *"Do you think this strength could have been formed through hardship?"* *"What does this story say about diversity?"* He reminds them that STEAM stands for science, technology, engineering, art, and mathematics, and thus helps participants identify which of these fields the person being explored represents. If the group has difficulty finding a STEAM connection, the educator provides hints, such as: *"What did Tesla create?"* *"What did Ada Lovelace do?"* *"What field of research is Marie Curie associated with?"*	which STEAM field the person they are researching belongs to (science, technology, engineering, art, or mathematics). They discuss how the person's strengths helped them work in that particular field and what impact they had on the world. Participants prepare a short presentation of their findings. The groups divide up the roles: some participants read, others explain, and still others present the conclusion. They prepare a short verbal report in which they present: the person's challenge, his strength, their most important achievement, the STEAM field to which they belong. Participants learn to share responsibilities: some read the text, others write down their thoughts, and others help to discuss or prepare for the presentation. They listen to and respect each other's opinions and try to find a common solution. Participants not only read the card, but also generate hypotheses themselves, e.g.: "Could the challenge have turned into a strength?" "What would have happened if this person had given up?" "What strengths do we have that can turn into achievements?" This discussion helps them understand how the experiences of scientists and creators relate to their own lives.
Presentation of activity results *(10 min.)*	After the allotted time, the educator asks the groups to prepare a very brief presentation of their findings. He emphasizes that the most important thing is not to retell the whole story, but to	**Participants' activities** **1. Prepare to listen to and support other groups** Participants sit down together in the presentation area and

	clearly identify three elements: what challenge the person faced, what strength he/she revealed, and what achievement accomplished. The educator gives the floor to the first group and ensures that the presentations are conducted in an orderly and friendly manner and within the time limit. Helps with questions such as: *"What was his (her) biggest challenge?"* *"What strength helped the most?"* *"What is this person famous for and what have they given to the world?"* While listening to the presentations, the educator encourages the participants, praises them for their efforts, clarity, or insightful connections between human experience and the STEAM field. He also encourages mutual support among participants: after each presentation, he asks the groups to applaud or say one positive comment. When all the groups have presented their results, the educator briefly summarizes the essence of all the stories. He emphasizes that although each person faced different challenges, they were united by their persistence, curiosity, creativity, and courage to be themselves. The educator highlights the common message: most great achievements come from what makes us unique, and "otherness" often becomes a strength that helps change the world. Concluding the presentation part, the educator moves on to the next part of the activity, saying that now the participants will be able to apply the ideas they have heard to themselves and create their own symbolic wings that will reflect their abilities and qualities. The educator presents the task and explains that the wings created by each participant will symbolize their talents, dreams, and strengths. He shows an example or briefly demonstrates how to use the template, decorate the wings, and where to write the sentence "I am special because...". Before decorating the wings, the educator shows three different shapes of paper "wings" and drops them from the same	prepare to listen to the discoveries of other groups. They agree on a rule to support each other, applaud, praise, or say a kind word after each presentation. Each group takes turns presenting the person they researched on their biography card. Participants clearly state: what challenges the person faced, what strengths he demonstrated, what achievements he made, which STEAM field he belong to. The participants decide among themselves who will speak first, who will add to the presentation, and who will show the card. As they listen to the other presentations, participants notice how people's stories differ and how they are similar . They observe which challenges are repeated, which strengths helped achieve goals most often, and which STEAM areas are most reflected in the presentations. Participants can ask the presenting group short questions, such as: "What surprised you most about this story?" "Do you think the challenge has become a strength?" "Could this person be similar to the Ugly Duckling?" At the end of the presentations, participants briefly share which story they liked the most and why. They discuss what common ideas they take away: that being different is normal, that difficulties can build strength, and that everyone can find their own path.

	height. Participants observe which one flies the fastest, which one flies the slowest, and which one stays in the air the longest. The educator explains that different wing shapes perform differently due to air resistance and surface area—which is why birds in nature have wings adapted to their lifestyle. This serves as an introduction to the creative task in which participants will create their own symbolic "wings." The educator then distributes wing templates to the participants or helps them draw a silhouette on colored paper. He makes sure that everyone has the necessary tools: markers, stickers, scissors, glue, and decorations. If necessary, he explains how to use scissors or glue safely. While creating their wings, participants may have questions, so the educator walks among them, encourages them, and asks individual questions to help them recognize their strengths, e.g.: *"What are you really good at?"* *"What makes you unique?"* *"What dream would you like to see reflected in your wings?"* He helps participants who find it more difficult to identify their qualities by offering ideas or reminding them of what they mentioned in previous activities. The educator ensures that the environment remains safe and creative and that each participant's decisions are accepted without judgment. As the time comes to an end, the educator announces that there are only a few minutes left to finish the wings and prepares the participants for the transition to the next activity—the presentation or the creation of the "Wing Gallery."	Participants choose or receive a wing template and prepare to decorate it. They create and decorate the wings with colors, symbols, and stickers that reflect their talents, hobbies, and dreams. They write the sentence "*I am special because..."* naming their strength or characteristic. They finish their work and prepare to present their wings or hang them in the "Wing Gallery."
Reflection ***(10 min.)***	The educator invites the participants to stop or sit down at the "Wing Gallery" and directs their attention to the collective work. He helps the participants begin their reflection by asking clear, engaging questions: *"What does this gallery tell us about the strengths of our group?"*	Participants compare their wings with those created by others, answer the educator's questions, identify similarities or differences they have noticed, and talk about what inspired them or what new things they have learned about themselves. Participants can reflect by:

	"Do you notice any similarities between your wings and those of other participants?" *"What surprised you about yourself or others today?"* *"Which character or scientist's story inspired you the most? Why?"* The educator moderates the discussion, encourages participants, helps them express their thoughts in their own words, and ensures that everyone who wants to speak has the opportunity to do so.	*saying a few sentences,* *making a brief observation,* *or describing in one word the feeling that the gallery evokes in them (e.g., "joy," "pride," "inspiration").*
Assessment of achievements Self-assessment	The educator invites participants to briefly reflect on what they have learned and discovered about themselves during the activity. He asks simple questions that encourage self-assessment, such as "What did you do best today?" or "What strengths did you notice in yourself?" The educator helps participants identify their personal achievements and encourages them to see their progress. At the end, he summarizes that everyone's efforts and self-awareness are an important part of the learning process.	Participants briefly evaluate their work by saying what they did best, what they would have liked to do differently, and what strengths they recognized during the activity. They can name one specific achievement, such as a new idea, a moment of courage, or a newly discovered ability. Participants also share how they felt while creating and presenting their wings. During the evaluation, they learn to recognize their progress and rejoice in their results.
Recommendations	**Additional tasks to reinforce observation, exploration, and comparison:** **Task: "The secret of feathers."** Participants examine a photo of a bird feather or an artificial feather, discuss why it is light and fluffy, and how its structure aids flight. Achievement: understanding the connection between the structure of a feather and its function. **Task: "How do birds stay dry?"** Participants place a drop of water on a photograph or drawing of a feather and observe how it slides off—they discuss how feathers are often greasy. Achievement: understands the properties of surfaces and their importance in nature. **Task: "Bird adaptation."** Groups receive three photos of birds (swan, hawk, duck) and decide where each lives and how its wings are adapted to that environment. Achievement: able to recognize the connection between the environment and the structure of an organism. **Additional tasks to strengthen construction, prototyping, and testing skills:** **Task: "A nest for a duckling."** Participants use straws, paper rolls, or sticks to create a small "nest" structure that must hold a paper "egg." Participants test whether the nest collapses when lifted or touched. Achievement**:** understanding the principles of stability, support, and structural strength.	

	Task: "Bridge for a duckling to cross a swamp." Groups use straws, paper, or blocks to create a small bridge on which a picture or figurine of a duckling must stand stably. Participants check whether the bridge does not bend and if it can hold the load. Achievement: develops understanding of structural stability and problem-solving skills. **Task: "Raft for a running duckling."** Participants create mini rafts from corks, foil, plasticine, or paper and check which ones float best. They observe how different materials or shapes affect buoyancy. Achievement: understanding the properties of materials and their influence on buoyancy and structural stability. **Task: "Shelter for winter."** Participants construct a small shelter out of cardboard, fabric, or paper to protect a "duckling" from wind or "precipitation." The structure is tested by blowing air or dripping a few drops of water on it. Achievement: understanding the purpose of protective structures and their effectiveness.
Sources	
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BIOGRAPHY CARDS FOR EDUCATION
"THE UGLY DUCKLING: BEING DIFFERENT IS VALUABLE"

1. Albert Einstein – physicist
Challenge: slow to speak as a child, considered slower than others at school.
Strength: extraordinary curiosity, ability to imagine phenomena in his mind.
Achievement: created the theory of relativity, which changed the science of physics.
STEAM field: science (physics).
Interesting fact: Einstein enjoyed long walks because he said that was how he "came up with his best ideas."

2. Nikola Tesla – inventor, engineer
Challenge: suffered from severe migraines and was extremely sensitive to sounds and lights.
Strength: creative mind, able to come up with complex ideas without drawings.
Achievement: created the alternating current system – the electricity we still use today.
STEAM field: engineering, technology.
Interesting fact: Tesla sometimes "saw" inventions as holograms in his mind.

3. Frida Kahlo – artist
Challenge: suffered severe trauma and an illness that limited her movement.
Strength: emotional strength and unique creative style.
Achievement: became one of the most famous artists of the 20th century, expressing her personal experiences through art.
STEAM field: art.
Interesting fact: Frida often painted while lying in bed, attaching the canvas to a special frame.

4. Stephen Hawking – astrophysicist
Challenge: lost the ability to move and speak due to serious illness.
Strength: perseverance and extraordinary logical thinking.
Achievement: explained the workings of black holes and wrote popular science books.
STEAM field: space science, physics.
Interesting fact: Hawking's voice remained computer-generated even when new technologies became available – he chose to keep it that way.

5. Ada Lovelace – the first programmer
Challenge: in her day, it was difficult for women to pursue science.
Strength: the ability to see creativity and "the science of imagination" in mathematics.
Achievement: she wrote the first algorithm for a computer, even though computers did not yet exist!
STEAM field: technology, mathematics.
Interesting fact: she believed that machines would one day create music and paintings – and she was right.

6. Marie Curie – scientist
Challenge: She was not allowed to study at university in Poland because she was a woman.
Strength: extraordinary precision and diligence.
Achievement: discovered radium and polonium, won two Nobel Prizes.
STEAM field: chemistry, physics.
Interesting fact: her laboratory notes are still radioactive, so they are kept in special boxes!

7. Vincent van Gogh – painter
Challenge: struggled with mental health issues, his work was not appreciated during his lifetime.
Strength: emotional sensitivity and sense of color.
Achievement: his painting style became one of the most influential in the world.
STEAM field: art.
Interesting fact: he painted about 900 paintings in 10 years!

8. Katherine Johnson – NASA mathematician
Challenge: she was unable to study with others and worked in separate rooms because of her skin color.
Strength: extraordinary mathematical abilities and precision.
Achievement: her calculations helped make the first human flights into space possible.
STEAM field: mathematics, space, technology.
Interesting fact: astronauts trusted her calculations more than computers.

WING TEMPLATE EXAMPLE