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## The Use of Storytelling in Children's STEAM Education

Wykorzystanie storytellingu w edukacji STEAM-owej dzieci

*Narrative is not just a form of communication –  
it is a way of thinking and understanding the world.*

J. Bruner

### KEYWORDS

education, future  
competences,  
STEAM,  
storytelling,  
storytelling in  
education

### ABSTRACT

The aim of this paper is to show the potential of using storytelling in children's STEAM education. The article is both a review and a practical study. The methodological framework of the study is based on an analysis of scientific literature and a review of previous research. The theoretical section discusses issues related to storytelling, including the key elements of a narrative: character, structure, emotions, moral, and conciseness. It also presents the concept of STEAM in education, its assumptions, stages of implementation, and the educational benefits resulting from the application of this approach. In the practical part, a descriptive approach was adopted, focusing on presenting ways of using storytelling in STEAM education. The example presented illustrates how narrative can support the learning process by engaging emotions, contextualizing content, and creating coherent, interdisciplinary educational experiences. The article makes a significant contribution to the educational literature by highlighting the potential of storytelling as a tool that supports teaching in the spirit of STEAM. It indicates that narrative can serve as an integrating element across different areas of knowledge, fostering the development of critical thinking, creativity, and students' communication skills.

**SŁOWA KLUCZE      ABSTRAKT**

edukacja,  
kompetencje  
przyszłości,  
STEAM,  
storytelling,  
storytelling  
w edukacji

Celem artykułu jest ukazanie możliwości wykorzystania storytellingu w edukacji STEAM-owej dzieci. Artykuł ma charakter zarówno przeglądowy, jak i praktyczny. Struktura metodologiczna opracowania opiera się na analizie literatury naukowej oraz przeglądzie dotychczasowych badań. W części teoretycznej omówiono zagadnienia dotyczące storytellingu. Opisano między innymi kluczowe elementy opowieści: bohatera, strukturę, emocje, morał i zwięzłość. Przedstawiono również koncepcję STEAM w edukacji, jej założenia, etapy realizacji oraz korzyści dydaktyczne wynikające z zastosowania tego podejścia. W części praktycznej przyjęto podejście opisowe, koncentrujące się na przedstawieniu sposobu wykorzystania storytellingu w edukacji STEAM. Zaprezentowany przykład pokazuje, jak narracja może wspierać proces uczenia się poprzez angażowanie emocji, kontekstualizowanie treści oraz tworzenie spójnych, interdyscyplinarnych doświadczeń edukacyjnych. Artykuł wnosi istotny wkład do literatury pedagogicznej, ukazując potencjał storytellingu jako narzędzia wspierającego nauczanie w duchu STEAM. Wskazuje, że narracja może pełnić funkcję integrującą różne dziedziny wiedzy, sprzyjać rozwojowi myślenia krytycznego, kreatywności oraz kompetencji komunikacyjnych uczniów.

## Introduction

Modern education poses many challenges for teachers. One of these is, among other things, to develop the competences of the future that are necessary in a dynamically changing reality. As Marlena Plebańska notes: “the world needs new competencies that cannot be developed in students through a conventional approach based on the traditional classroom-lesson model of education, which relies on a rigid division into subject groups and is equipped with standardized testing systems” (2018, p. 2).

UNESCO’s recommendations in *Education for Sustainable Development: A Roadmap* (2020) highlight the key role of developing and implementing interdisciplinary projects in schools. Among other things, three dimensions of education were identified:

- cognitive dimension: understanding and helping students to comprehend sustainability challenges and their complex interrelationships, exploring and critically evaluating existing and alternative solutions;
- socio-emotional dimension: shaping values and attitudes related to sustainable development, developing empathy and concern for other people and the planet, and motivating students to initiate change;

- behavioural dimension: encouraging practical steps towards sustainable change in personal life and beyond (UNESCO, 2020, p. 23).

Competences for sustainable development, in turn, are defined and presented in the UNESCO document *Education for Sustainable Development Goals: Learning Objectives* (2017). The aspect of value formation, the application of environmental, natural science and interdisciplinary knowledge, as well as the development of critical thinking and other skills aimed at enabling individuals to make responsible decisions and take action, are highlighted here. These goals can be achieved by implementing, among other things, STEAM concepts, considered today to be the most innovative and effective in the teaching and learning process (Plebańska, 2018, p. 87).

In the Council Recommendations of 22 May 2018 on key competences for life-long learning, we read:

[...] in order to encourage more young people to choose science, technology, engineering and mathematics (STEM) careers, initiatives across Europe have begun to link science education more closely with the arts and other disciplines, using a pedagogy based on self-exploration and involving a wide range of social actors and industries. Although the definition of these competencies has not changed much over the years, supporting the development of competencies in STEM has become increasingly important, which should be reflected in this recommendation.

And it goes on to read: member states should support the development of key competences, paying particular attention to “supporting the acquisition of competences in science, technology, engineering and mathematics (STEM), taking into account their link to the arts, creativity and innovation, and encouraging more young people, especially girls and young women, to choose careers in STEM fields” (Council..., 2018).

In the words of Martyna Szczotka and Katarzyna Szewczuk, the school is “an ideal space to develop the concept of STEAM and education for sustainable development, also referred to as education for the future” (2024, p. 7). Both approaches are developing rapidly and are considered the future of 21st century education.

The role of the modern school, therefore, is first and foremost to offer the contemporary child the ability to learn independently, to learn through discovery, to explore reality, through multisensory experience of the world, teaching critical appraisal, selecting available information, creative problem-solving, asking questions, testing hypotheses, formulating conclusions, and cooperating and communicating with others i.e. developing future competence. These competences include: critical thinking, problem-solving, cooperation and creativity.

Critical thinking, as Iwona Czaja-Chudyba puts it, is “the initial phase of the active search for and construction of knowledge”. The basis for activating such a process,

is “uncertainty, ambiguity, contradiction – only these effectively motivate the effort to create one’s own interpretations. A critique of the existing state of knowledge, solutions, meanings can allow the transfer of colloquial knowledge (extremely valuable, but with limited, narrow adaptive qualities) into scientific knowledge (objectified, generalized, at the same time connected to the context of personal and social experience)” (Czaja-Chudyba, 2013, p. 11).

Critical thinking is the process of posing questions that stimulate curiosity, which is recognized as a natural, biologically determined state that motivates the acquisition of knowledge needed for problem-solving (Czaja-Chudyba, 2013, p. 83). Problem-solving is intrinsically linked to problem thinking, which provides the basis for identifying, analysing and finding effective strategies for action.

Dorota Zdybel proposes the following sequence of questions to guide problem thinking: from posing a problem (What happens if...?), to formulating hypotheses (What do you think? Who has another idea?), designing experiments and conducting research (How do we test this? What can we do?) through to formulating conclusions (What have we observed? What happened and why? How to explain this? Why do you think so, what evidence do we have?). Repeatedly repeating such a sequence of questions, framed as a project activity, fosters, according to the researcher, the activation of reflection on one’s own thinking (metacognitive reflection), which is widely seen as the core of any learning, determining its quality and outcomes (Zdybel, 2021, p. 64).

Rudolph Schaffer emphasizes that in co-operation, children are able to solve cognitive problems much more effectively. “Through active discussion, joint discovery and exchange of ideas, the children validate their ideas. Together they arrive at a solution that they would not have found on their own” (Schaffer, 2013, p. 139). So the use of group work in education, has the potential to create a favourable environment for cognitive problem-solving. Working cooperatively enables active discussion between students. Children can exchange ideas, ask questions and develop their own concepts in interaction with others. Group assignments allow knowledge to be explored together. By exploring and investigating topics together with their peers, students can better understand certain assumptions and can share different perspectives, experiences and strategies, leading to a richer understanding of the issues (Musiał, 2024, p. 76). When developing the competences of the future, the competences of the 21st century, it is particularly important to select and deliberately use a variety of methods and ways of working, and to use different situations or to consciously create situations.

## STEAM in Early Childhood Education

STEAM is a world-renowned way of education. In recent years, we can see the growth of various STEAM initiatives in Poland as well. Projects such as: "Kitchen Lab 4 Kids" (Zdybel, 2021), "Steer to STEAM" (Bilewicz, 2025) or the PAKT Active Technology Use Workshop project (2022).

It focuses on meeting the real needs of the 21st century economy by developing the competences of the future. The school, as an institution responsible for the future of the young generations, plays a significant role in creating the right conditions for the acquisition of 21st century competences.

The acronym STEAM is an approach to learning that is based on five disciplines:

- Science – exploration of the natural world through observation and experimentation; topics in biology, chemistry, physics, geography;
- Technology – (the digital world), refers to the use of digital tools to, for example, document work, visualize, experiment or analyse information;
- Engineering – learning by doing, i.e. designing, tinkering, building, creating structures or objects;
- Arts – using imagination and creativity to create a variety of artistic works: visual arts, theatre, multimedia; and
- Mathematics – which can become a common denominator for activities – e.g. counting, analysing data (More on this STEAM topic in: Scientix, 2018).

Although each discipline is different, they form a unified whole.

STEAM is aimed at educating students who, as a result of STEAM projects, are able to think innovatively, think outside the box, take prudent risks, engage in experimental learning, creative problem-solving, collaborate and actively participate in creative processes (Plebańska, 2018, p. 4).

In STEAM classes, the priority is on the real problem and its solution. In such learning five stages are distinguished:

- engagement – the teacher arranges a problem situation to stimulate the children's curiosity and get them to ask a research question;
- exploration – children formulate hypotheses and carry out experiments to verify them and gain a better understanding of the phenomena under investigation;
- explanation – children draw their own conclusions, learn to justify them and assimilate new terminology;
- elaboration – acquired knowledge is applied in new contexts, leading to deeper understanding and consolidation;
- evaluation – children assess their progress, identify areas of knowledge and ignorance and plan for further learning (Zdybel, 2021, p. 63). Through this, children learn through discovery.

According to Katarzyna Trojańska STEAM lessons:

- allow us to see educational issues holistically and to see the problem as embedded in the real world, at the borderline of many scientific disciplines, rather than as belonging to a particular subject, isolated;
- combine theoretical and practical knowledge;
- limit the delivery methods in favour of active pupil action;
- replace reproductive activity and schematic solutions with creative activity;
- develop creativity and creative thinking, inspire and encourage the search for new solutions;
- by transferring control of the educational process from the teacher to the student, they teach responsibility and develop educational awareness. The students themselves realize the path to the goal, with the teacher playing a supporting role;
- they take into account the neurobiological conditions of the learning process and, through polysensory interaction, create favourable conditions for memorization;
- create an atmosphere of safety and acceptance, in which making a mistake is treated as the next and even indispensable step in the search for an effective solution to a problem, rather than as a sign of ignorance;
- motivate, inspire and teach perseverance in achieving goals;
- allow individualization of the learning process and follow the student, his/her ideas, train of thought, action;
- diminish rivalry in favour of cooperation and empathetic communication (Trojańska, 2018, p. 14).

STEAM education gives freedom to both children and teachers. Traditional classes are being replaced by experiments, research carried out in laboratories, outdoors or museums. Such experiences, experiments or explorations attract children's attention. During the experiments, children develop thinking skills, learn to solve problems, discuss, make decisions, make mistakes, focus their attention and hone their basic senses such as sight, touch, hearing and smell. In addition, they boost self-confidence. The projects carried out are holistic, interdisciplinary projects.

## Storytelling in Teaching

The term storytelling originates from the English language and translated means "storytelling". As Peter Brooks wrote, "our lives are ceaselessly interwoven with narrative, with the stories that we tell, all of which are reworked in that story of our own lives that we narrate to ourselves" (quoted by Wyrwas, 2014, p. 12).

Contemporary education is also increasingly turning to narrative strategies as a way of deepening student engagement and fostering all-round development. A method

that can help to teach children about the world around them in an inspiring way is storytelling. Stories have long been a familiar tool in the teaching and learning process. They date back to a time when the alphabet did not yet exist and word-of-mouth stories were the only means of conveying information. Storytelling can make a teacher's job easier and help students better absorb sometimes difficult and complex topics. It can inspire them to explore the subject further, encourage reflection, aid memory retention, and thus support the learning process. Storytelling helps students to gain knowledge, develop their imagination and develop critical thinking skills.

The use of storytelling for educational purposes can become an effective teaching strategy. This is because stories introduce pupils to the world of imagination.

With an interesting narrative and an emotional message, we can influence the listener, change their way of thinking, provoke them into action. The advantage of storytelling is that it is safe and interesting for the audience. This is because children like to listen to stories.

Storytelling is a method by which the child learns, emotionally engaging with the story, and develops their imagination. The student also enters into a dialogue with the teacher, making it easier to remember content. As shown by the research conducted by Rebecca Isbell, Joseph Sobol, Liane Lindauer and April Lowrance, students who listen to stories understand the narrated text better than the read text. According to these researchers, the teacher tends to use more repetitions of certain phrases, gestures, and voice modulations than a person who only reads the story. They also argue that listening to stories requires the listener to use their visual imagination more than when listening to a read text. They believe that storytelling is a more personal experience because the listener has more eye contact with the storyteller than with the person reading the story. Research authors argue that storytelling is an effective method for developing listening skills and sustaining student engagement (Isbell et al., 2004). Therefore, stories are more easily remembered because they are communicated in a way that is natural to our way of processing and remembering information.

We create stories not just to tell something, but to understand ourselves and the world.

From early childhood, we explain to the child why and how certain natural processes occur, how a chemical reaction takes place and where it can be used in everyday life. Storytelling in education can become a tool that transforms the way students learn and assimilate knowledge. The use of history in lessons can influence:

- greater student engagement: stories can make the material more interesting and accessible to students;
- easier memorization: stories are easier to remember than dry facts, which helps students learn the material better;

- development of critical thinking skills: analysis of history, context etc. can develop critical thinking skills in students;
- building empathy and understanding: stories allow students to see the world from different perspectives, develop empathy, and facilitate understanding of other cultures and experiences.

Storytelling can be used in early childhood education in a number of ways, depending on the objective to be achieved, the age of the students, the level of proficiency and the creativity of the teacher. When organizing activities based on storytelling, the teacher uses the story as the context in which the whole learning process will take place. As in any properly constructed story, key ingredients should also appear in storytelling. It is suggested to include the following:

**Hero.** It is the central figure of the story, around which the whole story is built. A story can feature multiple protagonists on different levels. When creating the protagonist of a narrative, one should remember to: show his/her main character traits, advantages or disadvantages (a villain can also be the protagonist of a story); the protagonist should not be one-dimensional, i.e. only good or only bad (after all, there are no perfect people), everyone can have stumbling blocks or difficult situations which, as a consequence, lead to a certain transformation which the protagonist experiences at the end of the story; it is important for the protagonist to have a goal they are trying to achieve or a dream they want to fulfill; there should be elements in the story that stimulate the protagonist to act; the protagonist should be the guide of the plot, they see, feel, build a certain vision of the world in which the story is set; they should also have a name.

**Structure.** Most of the story structures are derived from the classical concept of Aristotle's drama, according to which every story has: a beginning, a development and an ending. When constructing their stories, the teacher can use other story structures, for example: Gustav Freytag's pyramid, Joseph Campbell's hero's journey, the structure of a fairy tale, the story according to Studio Pixar, or the Storyboard Story Seekers (a detailed description of each structure can be found in: Petryniak et al., 2023; Malinowski, 2018; Tkaczyk, 2017). An interesting storytelling suggestion was offered by Mike Bosworth for building stories in situations where we want to interest the listener, persuade them to change their behaviour or explain complicated things. The structure consists of the following elements: introduction, adversity, turning point, conclusion and moral.

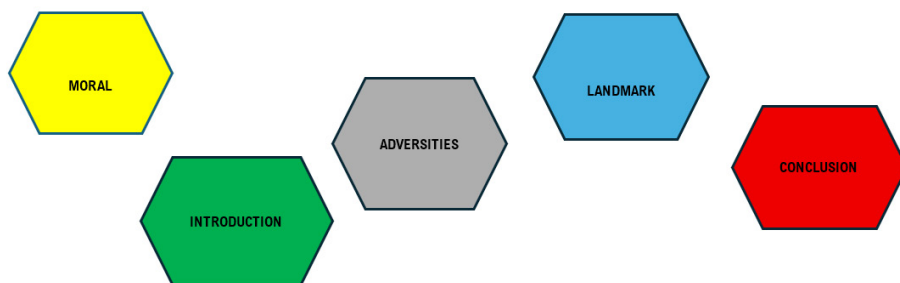
The story begins with an introduction in which we get to know the main character, his dreams, the world around him and the initial situation he finds himself in. The protagonist faces various challenges, adversities and problems on his way to achieving his goal. The breaking point of the story is when the protagonist receives support (usually new knowledge, someone's help or an event that changes the perception of



a particular problematic situation). The breaking point strengthens the protagonist, it is a kind of impulse to reach a goal, to solve problems, to fulfil dreams. At the end of the journey, the protagonist is different than at the beginning of the story, he has undergone a transformation, changed, enriched with new knowledge. There is always a moral/learning or message from a story set up in this way.

The graphic below shows a diagram of such a storyboard.

Diagram 1. Storyboard Story (Petryniak et al., 2023, p. 28)



The diagram is a fairly simple and straightforward tool that will work well in a classroom lesson, and by using coloured cards on which the successive parts of the story are written, it is easy for the teacher to see what stage of the narrative they are at.

Emotion – this is another important element of storytelling. The stories told can evoke different emotions, build empathy and change beliefs. Research shows that stories are better remembered than dry facts. The emotional aspect of the stories ensures that listeners not only understand them, but also feel them, which greatly increases their engagement.

Moral. The first step in using storytelling is to identify the goal we want to achieve through the story, and the moral is the conclusion/punchline we are aiming for when telling the story.

Brevity. In the stories used in lessons, brevity is particularly important. Michał Larek emphasizes that we live in an attentionalist culture in which attention is the most important commodity, and today attention is gained through appropriately constructed stories or micro-stories (Larek, 2019). For this reason, stories aimed at pupils – especially at younger school ages – should take the form of short stories. This is due to the fact that children can only maintain auditory concentration for a few minutes. The micro-story is characterized by condensed action – events are presented quickly, without unnecessary digressions or side plots. The economy of words is also important: each sentence here has a specific function, and the text is devoid of elaborate descriptions and long-winded dialogues (Petryniak et al., 2023, pp. 37–47).

Storytelling can gain particular relevance in the context of STEAM education, where complex and interdisciplinary content requires accessible forms of delivery that are set in a real-world context and close to students' experiences.

Here is an example of the use of STEAM with storytelling. A central motif could be, for example, the story of Bronka the Ladybug, who sets off on a journey through a spring meadow, encountering various inhabitants representing different fields of science.

### “The Adventures of Bronka the Ladybird” – STEAM story

“One spring morning little ladybird Bronka woke up on a clover leaf. She noticed that something strange was happening to the plants – some were wilted and others had strange marks on their leaves. She decided to investigate what was happening in the meadow...”

So Ladybug embarks on a journey during which she meets insect friends who show her the world of science, technology, engineering, art and mathematics...

Table 1. Getting to Know the Ecosystem of a Spring Meadow With the Ladybird Bronka

Component STEAM	Story element	Forms of activity
S – Science	Ladybird examines wilted plants...	Observation of plants, life cycle of insects, role of pollinators; life cycle of ladybird, children study plants, role of pollinating insects, meadow ecosystem.
T – Technology	Meeting the bee: “Basia meets Maya the bee, who showed her how honeycomb cells are built. – It’s like designing houses! – enthused Basia...”	Educational film about bees, microscope photos, honey plants
E – Engineering	Construction of “houses” for insects	Children construct hexagonal cells from paper, sticks or LEGO bricks.
A – Art	Meeting the butterfly: “Then Bronka met Arthur the butterfly, who was painting the wings of other insects! He showed her how colours can be used for camouflage and warning...”	Children create insect wings and learn about symmetry, colour mixing and art techniques; experimenting with colours.

Component STEAM	Story element	Forms of activity
M – Math	Meeting the ant: “At the end, Basia met an ant who was keeping an eye on the order and counting the supplies. She asked Basia to help count the grains and organize them by size.”	Counting, sorting grains, introduction to the concept of measure and order; measurements (e.g. length of paths, size of leaves), object classification, counting, mathematical operations.

The story consists of five parts, which can be implemented at certain intervals (e.g. one STEAM component and one part of the story in one day). This will enable the teacher to address many other issues related to the topic and introduce a variety of STEAM activities. One piece of storytelling can contain several STEAM components.

The creative process can continue – children can invent new adventures and make them more interesting with experiments, experiences and building structures. They can, for example:

- develop your own stories with new characters;
- build a model/diorama of a meadow;
- draw a map of the meadow with the places visited by the ladybird;
- create their own characters and their stories (using drama and storytelling);
- make a class lapbook entitled: “Bronka the ladybird meets STEAM”;
- draw a comic with the adventures of the Ladybird.

Over the course of the narrative another component comes into play: Literacy – children are included in the creation of the story. This increases their engagement and activity related to what is happening in class.

### The Role of the Teacher

An important role in the process of creating and carrying out activities is attributed to the teacher.

A very important role in storytelling is attributed to the teacher. His tasks include partnering with students in solving the problems that arise and guiding them on the right track of thinking by leading discussions, which he initiates with questions. It is worth emphasizing that the facilitator here ceases to be a person giving instructions and becomes a researcher who learns together with the children – taking on the role of a so-called facilitator. The teacher’s focus should be on ensuring that students learn “how to learn”. It is therefore important to create the right conditions and atmosphere for them to acquire these skills.

The author, Lilian G. Katz, claims that young children should frequently have the following experiences:

- being intellectually engaged and absorber;
- being intellectually challenger;
- being engaged in extended interactions (e.g., conversations, discussions, exchanges of views, arguments, participation in planning of work);
- being involved in sustained investigations of aspects of their own environment and experiences worthy of their interest, knowledge, and understanding;
- taking initiative in a range of activities and accepting responsibility for what is accomplished;
- experiencing the satisfaction that can come from overcoming obstacles and setbacks and solving problems;
- having confidence in their own intellectual powers and their own questions;
- helping others to find out things and to understand them better;
- making suggestions to others and expressing appreciation of others' efforts and accomplishments;
- applying their developing basic literacy and numeracy skills in purposeful ways;
- feeling that they belong to a group of their peers (Katz, 2010).

To effectively implement STEAM education Margaret Honey, Greg Pearson and Heidi Schweingruber (2014) point to three key principles for successful integration of STEAM components:

- integration has to be purposeful and explicit – students do not spontaneously combine content from different disciplines, so it is necessary to consciously design integrated learning experiences;
- students' knowledge of particular disciplines should be supported – students need help in applying their knowledge of, for example, mathematics or science in contexts such as engineering, technology or relating to the arts;
- more is not better – STEAM integration should be thoughtful and strategic so as not to overload students and disrupt learning.

The example shows how the use of stories can engage children in learning, support their cognitive development and create a space for interdisciplinary project work, which promotes deeper learning.

By taking on the role of a scientist, technician, engineer or artist, students have the opportunity to 'step into the world of science' and the narrative can facilitate their understanding of complex issues by setting them in a familiar and safe context (e.g. a spring meadow). Furthermore, the story being told:

- develops language, creativity and collaboration skills (pupils co-create the story);
- activates all senses and learning styles (movement, image, sound, action).

During such activities, children can experience many positive emotions: curiosity, wonder, a desire to discover, joy at the results achieved or a sense of community, which will encourage them to take an even greater interest in the world around them, ask questions and share their impressions and observations. Children's critical and creative thinking or problem-solving skills are also strengthened.

Integrating STEAM activities into the storytelling process helps to develop children's skills not only in language, but also in their ability to understand and express emotions, develops critical and creative thinking skills and creates the conditions for acquiring problem-solving skills.

## Summary

Stories structure experiences, make sense of them and allow them to build logical cause-and-effect sequences. In STEAM education, storytelling can act as a cognitive structure in which knowledge from different disciplines comes together to form a coherent whole – for example, through stories of characters solving technical or mathematical problems.

Storytelling has a strong emotional impact, which supports the process of remembering and understanding content. In early childhood education, where the child's intrinsic motivation is key, narrative can capture attention and encourage active participation in a STEAM lesson through identification with the protagonist, curiosity about the world presented and the need to explore.

STEAM is based on integrating knowledge from different disciplines – and storytelling can foster just such a combination. A story set in the context of a problem (e.g. the design of a bridge by an animal engineer character) helps students to understand the relationship between science and technology, art and engineering. The story builds a natural 'framework' in which to embed new information and facilitate its transfer to other learning situations.

Through storytelling, students can not only acquire knowledge, but also develop 21st century competences, namely communication, collaboration, critical and creative thinking. As part of STEAM projects, they can, for example, create their own digital stories, design narrative educational games or construct technical models as 'hero problem solvers'. Such activities integrate a cognitive, artistic, technical and social component. Using stories and STEAM, we can facilitate students' understanding of complex concepts, enhance memory and engage emotionally and intellectually. Stories can help students learn better by contextualizing knowledge and making it more relatable.

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