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OUTSTE(A)M

Discover, Think, Play: OUTSTE(A)M Guidelines for Educators

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Acknowledgements

These Guidelines for Educators were written by Daniel Benavides and Margaret Kernan, International Child Development Initiatives, Leiden to accompany the OUTSTE(A)M Toolkit. We gratefully acknowledge the input and feedback received from all the OUTSTE(A)M partners on earlier drafts: Luisa Tesch (ICDI), Miriam Molina Ascanio (EUN), Nikolaos Tezas (EUN), Brenda Lattimore (DCU), Córa Gillic (DCU), Sandra O'Neill (DCU), Pablo Busó (AIJU) and Ana Mata (AIJU). We also acknowledge with gratitude the useful feedback from the members of the OUTSTE(A)M Validation Group: Dr. Hanno van Keulen, Professor for Science & Engineering Education, Delft University of Technology, The Netherlands and Sol Martire, Academia de Inventores, Spain.

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Recommended citation: OUTSTE(A)M Consortium (2025) *Discover, Think, Play: OUTSTE(A)M Guidelines for Educators*. Leiden, ICDI.

Table of Contents

Table of Tables

Table of Figures

Welcome!

Welcome to **OUTSTE(A)M**! This European project aims to inspire you to embed integrated STEM experiences into your daily routines with young children. OUTSTE(A)M offers a unique outdoor perspective on STEM.

Why *OUT* STE(A)M?

STE(A)M stands for: Science, Technology, Engineering, All subjects and Mathematics.

OUT (or Outdoors) has been combined with STE(A)M because of the added value for children's learning of combining 'hands on' STEAM with outdoor play in real-world contexts.

If you are an educator of young children (2 to 9 years) interested in exploring the potential of outdoor play to teach science, technology, engineering or mathematics in early childhood education and care (ECEC) settings or in primary schools, then the OUTSTE(A)M resources are for you.

These Guidelines for Educators are designed to help you navigate the **OUTSTE(A)M Toolkit.** The Toolkit contains:

- customizable activities and learning scenarios
- videos featuring real scientists talking about their work
- curated STEM-related games and toys suitable for children aged 2 to 9 years

All components of the Toolkit have benefitted from testing with children and their educators in France, Ireland and Spain and from written feedback from the 258 educators in 14 countries who completed a survey about the Toolkit.

About OUTSTE(A)M

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Funded by the European Union's (EU) Erasmus+ programme (Grant Agreement 101133868) and coordinated by European Schoolnet (EUN), a network of 30+ ministries of education, OUTSTE(A)M aims to help teachers and educators promote high-quality outdoor integrated STEM learning. This initiative addresses the lack of focus on STEM education in early childhood education and care (ECEC) settings and primary schools.

Website: https://www.scientix.eu/community/partner-projects/outsteam

How to use the Guidelines

The Guidelines are split into three parts:

- **Part 1, "The OUTSTE(A)M Framework".** This section summarizes essential concepts and research findings about integrated STEM and outdoor play. It also provides accessible and practical strategies to engage children of different ages with STEM. Throughout Part 1 you will find reflective questions ('Think Abouts') that will challenge your own understanding and will make your learning more active. Being more knowledgeable about how children benefit from STEM outdoors will help you use the Toolkit more effectively.
- **Part 2, "Using the Toolkit".** Here you will find guidance about how to use and adapt the different components of the Toolkit. You will also be inspired by the experiences of teachers and early childhood educators who have tested the OUTSTE(A)M toolkit.
- **Part 3, "Extra Resources".** Do you want to learn more about STEM outdoors? "Extra Resources" contains a curated list of commercial STEM toys and games; more information about the OUTSTE(A)M MOOC and the Review of the Literature that supported the development of these guidelines (http://files.eun.org/scientix/OUTSTE(A)M-Literature-Review.pdf). Part 3 also contains information about other educational projects and resources about integrated STEM education for children aged 2 to 9 years.

Notes on terminology

The term *I-STEM* denotes integrated **s**cience, **t**echnology, **e**ngineering and **m**athematics. I-STEM is both a curriculum (what to teach) and a pedagogy (how to teach it). I-STEM and STEM are used interchangeably. When we are referring specifically to the Project, the term *OUTSTE(A)M* is used.

We refer to education professionals working in early childhood education and care settings (ECEC) as *educators* or *early childhood educators* and professionals working in primary schools as *teachers*. Sometimes the term '*educators'* is used interchangeably to refer to both categories of education professionals. The terms children and pupils are also used interchangeably. When the term pupils are used, it generally refers to children attending primary school.

A glossary of key STEM-related terminology is provided for easy reference. Terms that are explained in the glossary appear in *italics* in the text.

Remember: It is up to you to decide how you want to use the Guidelines and the Toolkit in your work. Feel free to explore each part independently by clicking the hyperlinks below or just follow the Guidelines in order.

OUTSTE(A)M Glossary[1]

Intentionality: intentionality means educators are purposeful, deliberate, and thoughtful in their decisions and actions when planning for children's learning and development. Intentionality also comprises applying a child-centred approach that encourages children's exploration.

STE(A)M: within the OUTSTE(A)M project, STE(A)M stands for Science, Technology, Engineering, All subjects and Mathematics.

STEAM: an extension of STEM incorporating the Arts as a fifth discipline. STEAM focuses on approaches to learning rather than solely on disciplinary knowledge.

STEM: an acronym for Science, Technology, Engineering and Mathematics. It may refer to learning within one or across multiple STEM disciplines, often implying integration to create knowledge.

STEM curriculum and pedagogy in ECEC: in early childhood education and care (ECEC), STEM and STEAM foster creativity, critical thinking and collaborative problem-solving. Science stimulates inquiry and exploration of the natural world; Technology enhances digital literacy and engagement; Engineering introduces practical problem-solving, creativity, and teamwork; Mathematics develops counting, measurement, and spatial reasoning skills.

STEM curriculum in Primary Education: may include subject knowledge, scientific literacy, the role of science in responding to local/global issues, and preparation for future careers. Also focuses on skills such as questioning, problem-solving, critical/creative thinking, inquiry processes, and values/attitudes in science.

STEM pedagogy in Primary Education: may include scientific inquiry, engineering design/make processes, constructivist principles, hands-on practical activities, problem-based learning, research, coding, and computational thinking.

Integrated STEM (I-STEM): meaning any instructional blending of two or more of the four disciplines. I-STEM is both a curriculum (what to teach) and a pedagogy (how to teach it).

Learning story: a narrative assessment tool used in early childhood education and care (ECEC) that documents a child's significant learning moments through structured observation and interpretation. It tells a story about what an educator observes, hears, and interprets about a child's abilities, strengths, and dispositions, to highlight their competencies. Learning stories are often created with the child and family's perspective in mind, focusing on what the child can do and serving as a foundation for future planning.

[1] *Definitions have been adapted from the OUTSTE(A)M Literature Review and the literature referred to in development of these Guidelines (see Part 3: Extra Resources).*

Learning zones: also called 'centres of interest', learning zones are intentionally designed and delimited spaces to promote a specific type of play and learning experience.

Loose parts: materials or elements in the environment that can be moved, manipulated, and combined in a variety of ways by children during free play or adult-guided learning sessions.

Risky play: thrilling or exciting forms of physical play that involve uncertainty and risk of injury. It is not about exposing children to unnecessary hazards or unencouraging unsafe behaviour such as broken equipment, sharp objects, or unmonitored activities in dangerous environments.

Technology: in STEM, technology is a tool for learning and play, encouraging children to be creators rather than passive consumers. Types of technology:

- Analogue: binoculars, thermometers, manual water pumps, cameras.
- Digital: timer, weighing scales, digital cameras.
- Internet-enabled: tablet, PC/laptop, smartphone, smartboard.
- Unplugged: props, games, analogue tools.

Stages of technology use:

1. Learning how to use technology: children explore and choose technology through playful and social interactions (e.g., operating a digital camera).
2. Learning with technology: technology is used as a learning tool across STEM disciplines (e.g., using a balance scale to explore weight and balance).
3. Learning about technology: children become creators, engaging in coding, computational thinking, and hands-on activities (e.g., assembling gear systems).

Part 1: The OUTSTE(A)M Framework

If you are curious about the ideas underpinning *integrated STEM (I-STEM)* education, this part of the Guidelines is for you.

You will find background information about the principles and concepts underpinning the OUTSTE(A)M project. You will consider whether access to I-*STEM* learning is equitable. You will explore how outdoor play and *risky play* relate to I-*STEM* and find practical tips about how to use outdoor environments to promote *STEM* learning. You will also learn about the importance of being flexible and adaptive in the time allotted for *integrated STEM* activities.

The final section summarises basic principles about how young children learn across three age groups (2-3 years, 4-6 years, 7-9 years). Here you will also find suggestions for activities for each age group that integrate at least two of the *STEM* disciplines: science, *technology*, engineering and mathematics.

All sections include **Think Abouts** (questions and ideas to reflect on) and **Top Tips** that will deepen your own understanding of *I-STEM* and make your learning more active. We have also highlighted suggested **Adaptations** to activities that educators can make (or have made) so that activities better match children's age, interests, abilities or curriculum requirements.

Think Abouts **Top Tips** **Adaptations**

1.1 A Knowledge Check about I-STEM Education

Think About

To effectively implement I-STEM education, it is essential to first reflect on your own preconceptions about it. Use the following self-reflection resource to explore them. This can be done individually or in a small group with colleagues.

	Question	True	False
1	*I-STEM* education is more suitable for older children in primary education, as younger learners lack the capacity to engage with its concepts meaningfully.		
2	Promoting *I-STEM* skill development is as simple as allowing children to explore the world through open-ended, hands-on experiences.		
3	You should have thorough *I-STEM* preparation and aim to know the answers for most of the potential children's questions in advance.		
4	High-tech equipment is not essential for successful implementation of *I-STEM* projects in early education and primary school settings.		
5	A key goal of *I-STEM* education is to nurture children's curiosity, as it is the foundation of *I-STEM* competencies.		
6	*Technology* should be avoided in early education environments due to its potential health risks, as supported by scientific evidence.		
7	Indoor play offers the same developmental benefits as outdoor activities, and similar milestones can be achieved in either setting.		
8	Best practices in *I-STEM* education involve avoiding *risky play* because there are safer alternatives for skill development.		
9	*I-STEM* learning is best delivered through structured, formal instruction using numerous examples, pictures, and diagrams.		
10	*I-STEM* education is not just about preparing children for careers in science and engineering fields.		
11	*I-STEM* education emphasizes coding and robotics, with limited attention given to arts and creativity.		

All the above statements are ***false*** except statements 4 and 10 which are true. Do you want to know the reasons? See feedback below.

1.1.1 Feedback

	Question	Feedback
1	*I-STEM* education is more suitable for older children in primary education, as younger learners lack the capacity to engage with its concepts meaningfully.	Early childhood is the foundation for *I-STEM* competences. Children as young as babies and toddlers explore their world through curiosity, hypothesis-building, and experimentation, forming the basis of scientific thinking.
2	Promoting *I-STEM* skill development is as simple as allowing children to explore the world through open-ended, hands-on experiences.	Experience alone is not sufficient. Adults must guide children by noticing, naming, and scaffolding their learning to help them understand the language of *I-STEM*.
3	You should have a thorough *I-STEM* preparation and aim to know the answers for most of the potential children's questions in advance.	*I-STEM* education values exploration over definitive answers. Adults should model curiosity and encourage children to explore answers collaboratively
4	High-tech equipment is not essential for successful implementation of *I-STEM* projects in early education and primary school settings.	*Technology* includes everyday tools like pencils or baskets. *I-STEM* learning thrives in environments using simple, accessible materials.
5	A key goal of *I-STEM* education is nurture children's curiosity, as it is the foundation of I-STEM competencies.	Curiosity can be nurtured by introducing new topics and teaching children to ask testable questions. Curiosity should be deliberately cultivated.
6	*Technology* should be avoided in early education environments due to its potential health risks, as supported by scientific evidence.	Thoughtfully used *technology* enhances learning by extending human capabilities and includes tools as simple as blocks or crayons (see glossary definition of *technology*).
7	Indoor play offers the same developmental benefits as outdoor activities, and similar milestones can be achieved in either setting.	Outdoor play provides unique, whole-body, multi-sensory experiences, including contact with nature, which are vital for all round development.
8	Best practices in *I-STEM* education involve avoiding *risky play* because there are safer alternatives for skill development.	*Risky play* under safe conditions is crucial for development, building resilience, motor skills, and risk assessment abilities
9	*I-STEM* learning is best delivered through structured, formal instruction using numerous examples, pictures, and diagrams.	*I-STEM* is best explored through hands-on, inquiry-based learning, allowing children to actively construct their understanding.
10	*I-STEM* education is not just about preparing children for careers in science and engineering fields.	The purpose of *I-STEM* is to develop critical thinking, creativity, and problem-solving skills, which are applicable to all aspects of life.
11	*I-STEM* education emphasizes coding and robotics, with limited attention given to arts and creativity.	*I-STEM* integrates arts to foster creativity and expression, essential components of scientific and engineering problem-solving.

1.2 Equitable Access to I-STEM Learning

Early *STEM* exposure boosts confidence and fosters belonging, participation and interest in science. However, equitable access to *STEM* learning cannot be taken for granted, especially for girls and minority groups. Gender gaps in *STEM* begin in early childhood. Contributing factors include a lack of exposure to diverse role models, fixed mindsets about personal abilities (e.g., "I'm just not good at maths"), biased media and actors (e.g., books that primarily depict male astronauts, or parents who reinforce those beliefs), and limited access to engaging *STEM* experiences from an early age.

OUTSTE(A)M's focus is on *integrated STEM(I-STEM)* learning outdoors. However, due to structural and cultural barriers children from low-income families, minority ethnic backgrounds, refugee families and children with disabilities are less likely to have access to green spaces and nature-based learning experiences.

As an *I-STEM* educator, the first step in addressing these gaps and inequalities is to become aware of unconscious stereotypes you may hold.

Think About

Consider these statements. Do you identify with any of them:

Do you believe any of the following?	
"Some children are naturally more talented in science or math than others."	
"Certain activities in my lesson plans are more suitable or interesting for boys than for girls."	
"Girls are generally less interested in *technology* and engineering."	
"Boys are naturally better at building and tinkering."	
"Some subjects are too difficult, especially for girls."	

If these beliefs resonate with you, there are practical strategies to counteract them in the classroom:

- Use **gender-neutral and balanced educational materials**. Choose books and resources that depict women in *STEM* roles and provide diverse examples.
- When introducing activities, **focus on process rather than identity** i.e. say, 'let's do science' rather than 'let's be scientists'.[2]

[2] *An article that appeared in the July/August 2025 edition of Scientific American, describes how language cues children hear from parents, the media and school curricula may contribute to reducing their curiosity about world*

- **Focus feedback on the process rather than assumed "natural talent."**
    - For example, instead of saying, "*You're so smart at building towers,*" try, "*That tower has strong foundations, which helps it stay balanced!*" This also models *STEM*-related language.
- Introduce **female role models**, such as the job profiles in the OUTSTE(A)M Toolkit.
- Ensure all children **have access to and feel welcome in all learning areas outdoors and indoors** without reinforcing or suggesting children to attend a specific area because of their gender, background or ability.
- Provide children **with hands-on activities that connect them directly to nature** and the **environmental issues** that are important in their communities.
- All *STEM* experiences **should be thoughtfully adapted** to ensure meaningful participation and engagement for every child, regardless of ability or background.

Remember: Promoting inclusivity in *I-STEM* education begins **with meeting each child where they are at**—considering their individual interests, strengths, and current stage of development across social, emotional, physical, and cognitive domains.

around them. Focusing on science as an identity i.e. being a scientist, rather than a process can be demotivating. One study referred to in the article showed that girls (not but boys) as young as four persisted longer when their cue to participate in science activities was 'let's do science' rather than 'let's be scientists'.

Adaptation

Practice example

The following is an example of how a boat making activity (see Part 2, Section 2.1) can be adapted and modified to suit all children – meeting them where they are. This *learning story*, described by an early year educator in Ireland, depicts a pre-verbal four-and-a-half-year-old boy with Down syndrome and a query of autistic spectrum disorder.

'Today, we were making our boats from recycled materials and launching them into the water to test their durability.

I know how much you love your dinosaurs, and even though you were not interested in making a boat, I thought we could use your love of dinosaurs to entice you into this play. I offered a container of water and a selection of tubs. I modelled placing a dinosaur into a tub and floating it on the water. You were immediately drawn in, and it was joyful to see the expression of wonder and delight on your face. I watched as you removed the dinosaur from the tub and replaced it with another – you tracked the tub's movement as it bobbed across the surface of the water. You kept changing the dinosaurs, even adding two at a time – clapping your hands excitedly with each change. This play lasted over half an hour, showing me how interested you were in this activity. I will offer this to you again tomorrow and observe your interactions.'

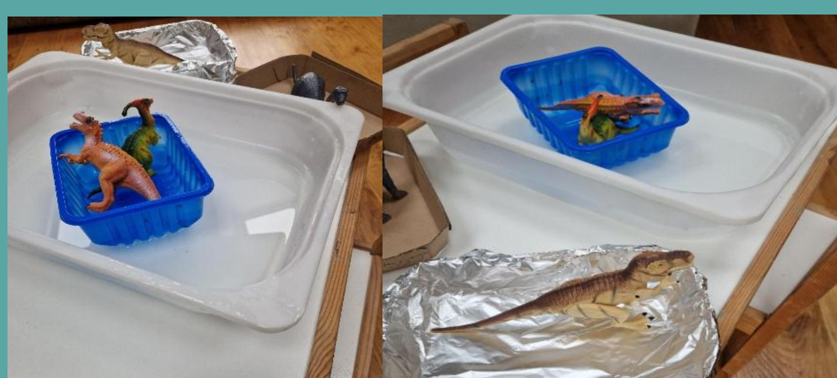


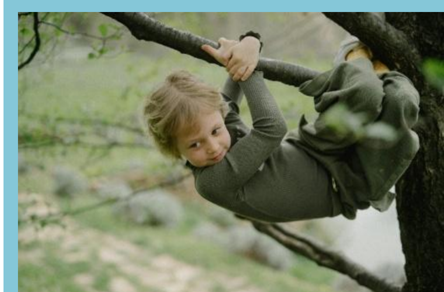
Figure 1: Adapting a boat making activity[3]

[3] *Figure 1: Adapting a boat making activity. Photographed by DCU colleagues. Reproduced with permission and explicit approval from the authors.*

1.3 How Outdoor Play and I-STEM Support Each Other

Do you remember building forts out of blankets, racing bikes down the street, or digging holes in the backyard just to see how deep you could go? Maybe you recall the thrill of climbing a tree with friends, discovering bugs under rocks, or splashing in puddles after the rain. Moments like these may have shaped some of your most cherished childhood memories.

These moments of connection aren't just fun for children; they are essential for laying the groundwork of children's cognitive systems. These whole-body multi-sensory experiences are the foundations for language development and scientific thinking. Outdoor play brings countless opportunities for developing solid cognitive development. For instance, when children:



Climb, they embody physics concepts like gravity and balance

Build dens, they apply engineering principles, testing materials and structures

Jump from different heights, they explore mathematical notions like measurement and estimation as they compare distances and test their landing strategies

Figure 2, 3, 4: Whole body outdoor play experiences[4]

Outdoor play can have many benefits for children beyond cognitive development.

[4] *Figure 2, 3 and 4: Whole body outdoor play experiences. Source pexels.com. Open access. All photos and videos on Pexels can be downloaded and used for free. Read here for more information:* [*https://www.pexels.com/license/*](https://www.pexels.com/license/)

Think About

In your opinion, which of the following are positive outcomes of playing outdoors?

	Playing outdoors fosters or is positively correlated with…	Benefit	Not a benefit	Not sure
1	Positive emotions: Children enjoy the excitement and sense of expectation of exploring risks and embracing adventure			
2	Autonomy and confidence: They develop self-determination by choosing activities that match their personal interests and current needs			
3	Problem solving: Children learn to address challenges and navigate risks on their own and collaboratively			
4	Compassion: Children have direct contact with plants, animals and earth elements (air, soil, water) and other human beings, creating a sense of connectedness and spirituality			
5	Physical development: Movement and gross motor coordination are enhanced through active, outdoor play			
6	Physiological rhythm: Regular exercise and fresh air help support healthy sleep-wake cycles			
7	Achievement and accomplishment: Children gain a sense of fulfilment by overcoming obstacles and solving problems			

All statements are benefits that have been scientifically proven![5]

Outdoor settings offer unique affordances (e.g. scale, materials, natural variation, emergent phenomena) that indoor environments cannot replicate; embedding I-STEM outdoors allows children to engage in real-world investigation, design, and play.

[5] *Adapted from: Literature review to support the updating of Aistear, the Early Childhood Curriculum Framework Commissioned by the National Council for Curriculum and Assessment, Ireland. September 2022.*

1.4 Outdoor Risky Play and I-STEM

Think About

Play experiences such as climbing, building dens and jumping from different heights are more likely to happen in outdoor settings and include some degree of risk. However, opportunities for children to engage in outdoor play and learning are being curtailed due to obstacles such as lack of teacher knowledge, confidence and expertise in teaching and learning outdoors. Do you experience such barriers? Read more about outdoor risky play and I-STEM and think about the first next step you can take to address these or other barriers if they exist for you?

Risky play researcher Ellen-Beate Sandseter has defined *risky play* as thrilling or exciting forms of physical play that involve uncertainty and risk of injury. She categorised children's *risky play* as follows: Play involving great heights; high speed; dangerous tools; dangerous elements; rough and tumble; disappearing/getting lost (see Part 3).

Risky play is about providing children with situations where they can encounter manageable challenges and difficulties. It is not about exposing children to unnecessary hazards or encouraging unsafe behaviour such as broken equipment, sharp objects, or unmonitored activities in dangerous environments.

Incorporating *risky play* into the curriculum provides varied and engaging opportunities for *STEM* integration. It also builds children's confidence, supports the development of problem-solving skills and ability to assess risk, all of which are important for *I-STEM* learning.

Figure 5: Outdoor risky play[6]

[6] *Figure 5: Outdoor risky play. Photographed by Brenda Lattimore (DCU). Reproduced with permission and explicit approval from the author.*

OUTSTE(A)M parter Brenda Lattimore (DCU) proposes that we should reframe the narrative about risky play in ECEC as 'Pedagogical Risk' whereby play is positioned not as a hazard, "but as a deliberate, developmental opportunity — where educators balance freedom with foresight, and there is consideration and planning for reasonable and appropriate pedagogical risk" (personal communication, Brenda Lattimore, 6 November 2025).

The key approach is to proactively manage hazards and plan for reasonable risk rather than eliminate risks.

Here are some suggestions to proactively manage hazards when incorporating *risky play* into the curriculum in ECEC and primary school settings:

- Control the environment by ensuring climbing structures are well-maintained while allowing children the freedom to test their limits and learn through trial and error.
- Communicate openly with parents and colleagues about how *risky play* fosters motor skills, autonomy, emotional resilience, decision-making, and problem-solving (*STEM* skills).
- Schedule routine outdoor activities adjusted to weather conditions.
- Introduce safety signs (e.g., "No Swimming," "Danger: Electric Shock") and discuss their meaning with children to increase awareness of safety.
- Use physical elements like bushes or shrubs to naturally delimit spaces in outdoor settings to support children to choose different kinds of play.

Top Tip

Actively involve children in evaluating risks. Ask guiding questions like, "What do you think will happen if you try this?" When children experience small failures, such as falling while trying to balance, guide them to learn from the experience rather than avoid similar challenges in the future by asking, "How can you position your body to create more balance?"

1.5 I-STEM Learning Environments

Since 2020 there has been an increase in scientific publications that have connected learning outdoors with *STEM* outcomes for young children. In this section you will find some practical tips and planning strategies to incorporate *STEM* experiences across the curriculum whether you are in an ECEC setting or in primary school.

To create *STEM* experiences outdoors, your role is like an architect i.e. designing learning environments that prompt children to engage in multi-sensorial experiences. Sometimes you will take children to nearby nature such as beach, lake, pond, woodland. Sometime the *STEM* experiences will take place in the ECEC outdoor area or school yard. The way to nurture *STEM* attitudes and skills is by making sure that children have access to supportive and stimulating (outdoor) spaces that spark children's curiosity and respond to their wide interests, whilst keeping in mind equitable access to *STEM* learning (see Section 1.2).

Designing *I-STEM* learning environments, whether in the school yard or in the classroom involves four actions:

1. Arranging appropriate ***learning zones*** and providing **open-ended materials and *loose parts*** that promote hands-on and open-ended multisensory experiences
2. Viewing ***technology*** as a tool to support children's learning
3. Being flexible and adaptive **in the time** allotted for *I-STEM* activities
4. **Modelling *I-STEM* language and attitudes** in a variety of contexts: story, free play, guided learning.

Explore practical recommendations for each component below.

1.5.1 Learning zones

Place matters: their conditions may have a detrimental or beneficial impact on children's development. *Learning zones*, also called centres of interest, are intentionally designed and delimited spaces to promote a specific type of experience outdoors or indoors. The elements and boundaries of each zone invite children to engage in a specific kind of activity in a self-determined way.

Look at the examples below: one an ECEC setting, one a primary school classroom and one a woodland.

For a space to be called a learning zone, it should:

- Promote a specific set of age-appropriate **learning objectives**

- Have clear **boundaries** or delimitations to guide behaviour while allowing exploration and creative freedom
- Include visual cues for **entries** and **exits** to ensure smooth transitions and minimize disruptions
- Support a wide range of **hands-on activities** by providing varied materials.

Outdoor areas or *learning zones* that can facilitate *I-STEM* learning may be:

- water areas
- tunnels
- garden plots
- sand areas
- natural shade (awning or trees)
- slopes and steps.

Top Tip

Encourage children to take responsibility for their spaces and materials. Allocating time before lunch or at the end of the day for cleaning and organizing ensures that the space is well-maintained.

1.5.2 Loose parts

A useful tip to set up learning scenarios, outdoors or indoors, is to use *loose parts*. ***Loose parts*** are open-ended materials or elements in the environment that facilitate creativity and problem-solving. Playing and learning with loose-parts are a great opportunity for developing *I-STEM* skills.

Loose parts can be moved, manipulated, and combined in a variety of ways by children during free play or during adult-guided play and learning sessions. For instance, a large cardboard box can be transformed into a fort, a tunnel, or a ramp!

Adaptation

In the example below primary school children created foxes' dens using boxes and recycled packaging. This is part of the **Foxes and Boxes Learning Scenario** (see Part 2 of the Guidelines). English is the second language for these children. The teacher purposely selected a scenario for younger children to facilitate active participation and inclusion of second language learners.

Figure 6: Children using loose parts in I-STEM activities[7].

Additional ideas for *loose parts* in outdoor settings that promote exploration and testing behaviours that are central to *I-STEM* learning are:

- natural materials like sticks, leaves, cones, sand, soil
- found objects such as cardboard boxes, egg cartons, old tyres or wheels, bottles
- water play materials like plastic pipes or tubes, buckets, funnels
- building materials such as rope, strings, stones, bricks, wood discs
- soil, plants, and tools.

Many materials needed for *I-STEM* learning are low-cost or no-cost. Using found and recycled materials in *I-STEM* activities provides an opportunity to reinforce

[7] *Figure 6: Children using loose parts in I-STEM activities. Photographed by DCU colleagues. Reproduced with permission and explicit approval from the authors.*

sustainable environment behaviours with children. The Toolkit lists free or cheap alternatives to materials needed for the sample Learning Scenarios (see Guidelines Part 2).

Figure 7: Example of free or cheap alternatives to materials needed for I-STEM activities[8].

Top Tip

For large class sizes consider organizing *I-STEM* activities as small group activities or in stations, where different groups are using different materials

1.5.3 I-STEM outdoors in the community

There are many non-formal education spaces in the community such as children's farms, nature education centres, allotments and botanical gardens where young children can engage in I-STEM learning. Many have education and outreach programmes.

One example is Hortus botanicus in the city of Leiden, which is the oldest botanical gardens in The Netherlands and is part of University of Leiden. In November 2025, the OUTSTE(A)M parters were fortunate to visit Hortus and meet with its education officer, Maxime Boersma. She brought us on a guided tour and told us about the many

[8] *Figure 7: Children exploring I-STEM activities using free or cheap alternatives to STEM materials. Photographed by DCU colleagues. Reproduced with permission and explicit approval from the authors.*

events and programmes [Hortus Botanicus offer to ECEC settings, primary schools and to families with young children]. Maxime studied museum studies and cultural heritage. The child-centred pedagogical approach that she brings to her work embodies the integrated STEM and outdoor focus of OUTSTE(A)M. As we walked around the gardens we stopped to look and wonder at plant fossils intertwined in the stone bridge; ancient soft mosses; magical yellow *Gingko* trees; Poison dart frogs and Wobbly harvestman spiders. Maxime explained how she follows the children's lead and draws on story, dance, creativity and sensory experiences to stimulate their understanding of the natural world.

Figure 8: Ginko tree, Poison dart frog, and fossil[9]

[9] *Figure 8: Ginko tree,* Poison dart *frog,* and *fossil. Photographed by OUTSTE(A)M partners. Reproduced with permission and explicit approval from the authors.*

Think About

What nonformal STEM focussed spaces and amenities are available in your community? Find out what kind of accessible education programmes for early childhood and primary aged children they offer. As well as inviting visits of groups of children to gardens or museums, sometimes education officers bring discovery and creative activities to the children.

1.5.4 Technology outdoors

The T (Technology) in *STEM* is about the things, tools, and instruments we use to do the activities such as observing, (de)constructing, transporting, preserving, measuring, counting, recording, etc. Tools support young children's play and learning when they engage in these activities. What you need for building a tree house (hammer, rope) is very different from what is needed to investigate microscopic life in the ditch (magnifying glass, sieve), so you need an array of things.

Tools can be analogue or digital, such as a thermometer, electrical or manual, such as a saw, traditional or sophisticated (children can take notes with paper and pencil or with a tablet). More important is that tools should be safe, sturdy, easy to use, and affordable.

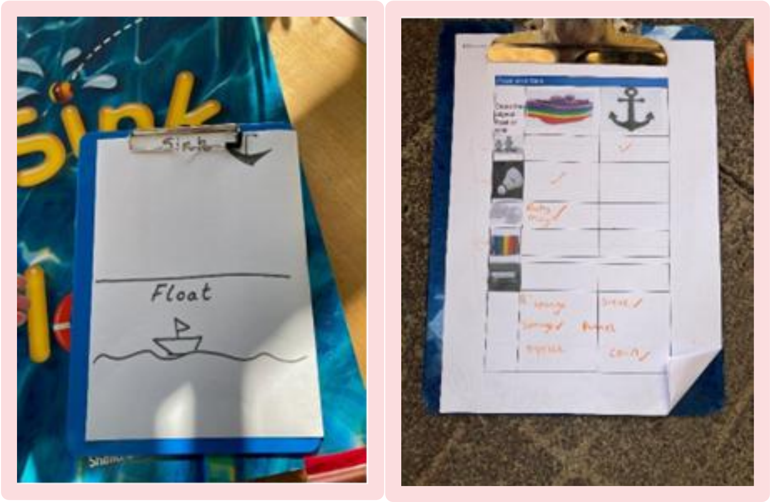


Figure 9: Examples of more traditional forms of technology during I-STEM activities[10].

In the OUTSTE(A)M toolkit you will see how educators are encouraged to incorporate both traditional (clipboards) and digital *technology* (iPads, cameras) in I-*STEM*.

[10] *Figure 9: Examples of more traditional forms of technology during STE(A)M activities. Photographed by DCU colleagues. Reproduced with permission and explicit approval from the authors.*

Figure 10: Examples of use of digital technology during I-STEM activities[11].

What counts as technology?

In essence, all technology is an extension of ourselves, of our bodies. A hammer is a fist, but stronger. A smartphone is your voice, carried over long distance. To children, it is important to develop this sense of familiarity with technology through direct experience and to appreciate how ingenious everyday tools are, such as a needle, a wheelbarrow, a winch, a pair of sunglasses, or a syphon.

Make sure you have a wide variety of tools and instruments relating to the weather, food, clothes, health, housing, transportation, building, and collecting. In the table below you will find items that can be used in *STEM* learning activities categorized according to functions that make sense to children. You are encouraged to develop your own set of tools and instruments that suit your indoor and outdoor opportunities!

[11] *Figure 10: Examples of use of digital technology during STE(A)M activities. Photographed by AIJU colleagues. Reproduced with permission and explicit approval from the authors.*

Table 1: Tools and instruments for STEM learning activities[12]

Observing and measuring	Collecting and preserving	Design and building	Recording and presenting
Magnifying glass	Scoop	Wood	Camera
Thermometer	Sieve	Rope	Audio recorder
Rain gauge	Bucket	Canvas	Sketch- and notebook
Measuring stick and tape	Net	Hammer and nails	Computer, tablet or smartphone
Weighing scales	Jar	Saw	Markers
Timer	Press	Scissors	Labels

1.5.5 Time matters

A key insight of the testing phase of the OUTSTE(A)M toolkit was that it was beneficial for children's *STEM* learning when teachers and educators planned multiple activities on the same topic such as floating over extended periods of time i.e. 2 to 6 weeks. This approach is seen in *Project-based Learning*, where children are facilitated to investigate a particular problem, question or challenge for a sustained period.

By slowing down and revisiting lessons as well as providing open-ended and creative materials (*loose parts*), and other visual aids, children are enabled to deepen their knowledge and understanding over time. Children learning a language for the first time, for example migrants, also benefit from returning to topics and frequent opportunities to practice newly learned vocabulary (see Section1.2. Equitable Access to *I-STEM* Learning).

1.5.6 Language matters

I-STEM activities provide rich opportunities for introducing language in a meaningful way.

[12]Adapted from: Keulen, H. (2024). A Philosophy for the Place of Technology in STEM. In W. Fox-Turnbull & P. J. Williams (Eds.), Locating Technology Education in STEM Teaching and Learning: What does the 'T' Mean in STEM? (pp. 7-16). Springer.

Hands-on, open-ended activities should be combined with meaningful interactions with educators that include modelling and encouraging children to use *STEM* language, ask questions, and solve problems.

While free play is part of the day in ECEC and primary school settings, *STEM* skills and understanding are more likely to develop when educators are actively involved. Using appropriate language cues, with learning outcomes in mind are a big part of the educators' role.

Suppose children are playing with blocks. You can boost that exploratory behaviour by following these steps:

1. **Noticing**: Be present as an observer while children interact physically with objects and socially with others. Ask yourself: What *I-STEM* phenomena are implied in this situation?
2. **Naming**: Label their behaviour using accurate words such as "balance," "stability," and "structure."
3. **Asking questions**:
    a. Encourage them to **test hypothesis**: What do you think will happen if you move the lowest block? Try it!
    b. Invite them to solve **problems**: "How can we make the tower taller without it falling?"
    c. Prompt them to ask their own questions: "What questions do you have?"

Here is another example of noticing, naming and asking questions to enrich children's learning while they are experimenting with magnets.

Noticing	Pay attention when they move magnets to attract or repel objects.
Naming	Label their actions using terms like "magnetic force," "attraction," and "polarity."
Asking questions	Encourage them to reflect on inquiries such as "What do you think will happen if we use a bigger magnet?" Prompt them to explore further by asking, "What other materials do you think a magnet will stick to?"

Top Tip

Connect the language to children's bodily experiences and what they are observing. This creates foundations for abstract thinking about the phenomena they are exploring.

Figure 11: Cloud experiment in an ECEC setting[13]

Adaptation

Figure 11 shows the cloud experiment in an Early Years setting in Ireland. This is part of the Water Cycle Learning Scenario (see Part 2). An alternative story called 'The Little Rain Drop' was used very successfully to consolidate the language and concepts at the heart of the Water Cycle. Educators printed and laminated images from the book and the children dramatized the story.

Top Tip

As a STEM educator, think of your role as a dance or 'choreography with children'. Learning unfolders with you and the children together in which language, story and embodiment all have a role.

Visual displays further enhance *STEM* related discussion and understanding.

[13] *Figure 11:* Cloud experiment in an ECEC setting. *Photographed by DCU colleagues. Reproduced with permission and explicit approval from the authors.*

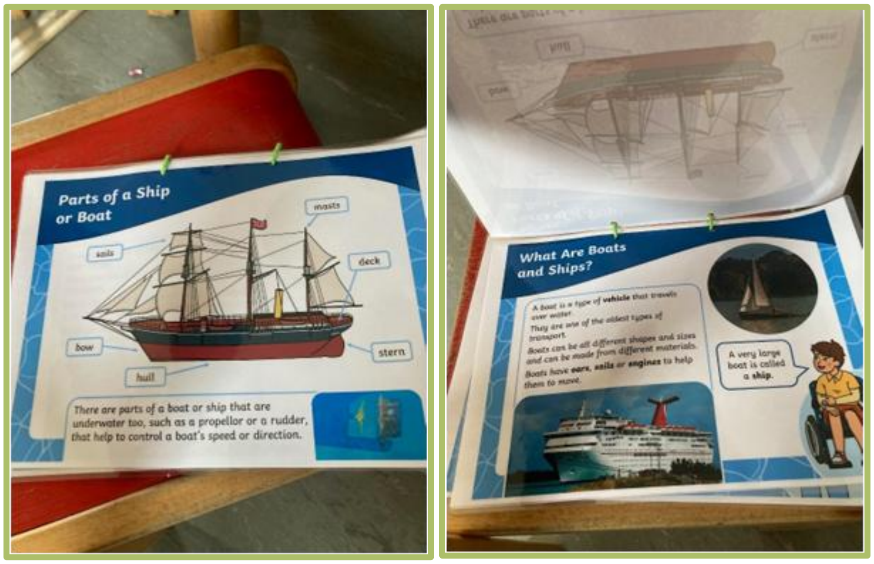


Figure 12: Materials available to children to support design and building of boats[14].

Sometimes educators and teachers also need prompts and memory aids before and during learning scenarios. Consider making **language support sheets/word banks** for different themes or projects and displaying them in the classroom where both children and adults can see them. These can also be a handy prompt during children's free play.

Figure 13: Language prompts displayed in preschool classroom during OUTSTE(A)M pilot[15].

The OUTSTE(A)M Toolkit provides lists of key vocabulary for each of the suggested Learning Scenarios and activities (see Part 2)

[14] *Figure 12: Materials available to children to support design and building of boats. Photographed by DCU colleagues. Reproduced with permission and explicit approval from the authors.*
[15] *Figure 13: Language prompts displayed in preschool classroom during OUTSTE(A)M pilot. Photographed by DCU colleagues. Reproduced with permission and explicit approval from the authors.*

Remember, even if you do not know the answers or the correct word for a phenomenon, you can investigate together to find the answers!

Language, *intentionality* and story

Everything said here about the importance of language and *STEM* learning relates to *intentionality*. Educators act with *intentionality* in *STEM* learning when they:

1. Extend children's learning using intentional teaching strategies, such as asking questions, explaining, modelling, speculating, inquiring and demonstrating. This extends children's knowledge, skills, and enjoyment in thinking and learning.
2. Sustain, extend, challenge, and deepen children's ideas and skills through shared thinking and scaffolding learning.

In Part 3 of the Guidelines you will find more information about the work of Professor Laureate Professor Marilyn Fleer and Conceptual PlayWorlds, an evidence-based model that uses imaginary scenarios, **often inspired by a storybook**, to intentionally guide children in problem-solving.

Some of the most successful *STEM* experiences facilitated by educators during the OUTSTE(A)M pilot were preceded by a well-chosen story.

1.6 How Young Children Learn

Even very young children are interested in *STEM* topics and materials and can explore and engage with *STEM* content and processes. In this section, we will explore how children of different ages learn by answering simple questions so you can plan age and ability-appropriate *STEM* experiences. The examples provided are intended as inspiration and illustration of **integrated *STEM* activities** and will complement the learning scenarios in the Toolkit.

The section is divided into three age groups: toddlers (2-3 years), pre-schoolers (4-6 years), and primary aged children/pupils (7-9 years)[16], each with tailored insights and examples to support effective planning and teaching.

The letter labels *S, T, E, A, M* in each activity denote the main *STEAM* disciplines involved in the activity: science, *technology*, engineering, arts, mathematics.

Remember: Developmental milestones in early childhood are representative of that age and are not strict boundaries. Differences in rates of development and learning occur due to individual (biological), environmental, and cultural factors.

1.6.1 How toddlers learn (2-3 years)

Think About

Which of the following are distinctive characteristics of how 2- to 3-year-olds learn?

Two- and three-year-old children:

1) Play collaboratively through games with certain rules to achieve goals
2) Learn about the world by engaging their senses and moving their bodies
3) Use objects as symbolic representation of something else which enables them to engage in imaginative play
4) Rely on repeated trial-error experiments to discover how things work

The only **false** statement from the list is **the first one**! At this age, children do not typically engage in play activities that require cooperation with others and following rules to pursue specific objectives.

Below in Table 2, you will see a list of features describing how 2–3-year-old children learn, matched with specific examples on how to apply these in *I-STEM* experiences:

[16] *It is acknowledged that learning begins at birth. However, since the focus age range of the OUTSTE(A)M Project is 2 to 9 years, the primary focus of the Guidelines and the OUTSTE(A)M Toolkit is children aged 2 to 9 years.*

Table 2: Features describing how 2–3-year-old children learn matched with specific examples of I-STEM experiences.

<table>
<tr><th></th><th>2–3-year-old children learn by[17]</th><th colspan="3">Inspiring Examples
(S: Science, T: Technology, E: Engineering, A: Arts, M: Mathematics)</th></tr>
<tr><td>1</td><td>Primarily exploring and understanding their surroundings by engaging their senses and moving their bodies</td><td>S+M: Collecting and sorting leaves by size or colour</td><td colspan="2">E+T: Building simple structures using large wooden blocks</td></tr>
<tr><td>2</td><td>Using objects as symbols enables them to engage in imaginative play</td><td>M+S: Pretending that a pile of pebbles is "food" and sorting them into "big food" and "small food" categories.</td><td colspan="2">T+E: Turning a cardboard box into a "car" or "house" and arranging it with simple objects like cushions or bottles as "furniture"</td></tr>
<tr><td>3</td><td>Relying on repeated trial-error experiments to discover how things work: Repeating actions, observing results, and adjusting their behaviours</td><td>S+E: Collecting and dropping different-sized natural objects into water and observing which sink or float</td><td colspan="2">A+E: Exploring clay by shaping, squishing, and rolling it to see what forms they can make</td></tr>
<tr><td>4</td><td>Exploring the relationship between parts and wholes: Discovering how components fit together and contribute to the function of an entire object</td><td>S+A: Talking about books with adults that show different kinds of plants, animals and machines or stories about life cycle (e.g. The Very Hungry Caterpillar.)</td><td colspan="2">T+E: Disassembling small appliances with simple, safe tools to explore how they work</td></tr>
<tr><td>5</td><td>Actively observing and celebrating their growth through self-reflection and discussions with caregivers</td><td>A+T: Creating a simple 2D self-portrait using crayons or finger paints to draw their face, or shaping a basic 3D version of their face with soft, child-safe modelling clay</td><td colspan="2">E+T: Building a tower with blocks, then comparing the height of the tower to the child's height. You can prompt them by saying: "Build a tower as high as you."</td></tr>
<tr><td>6</td><td>Replicating objects, they observe through drawing and sculpting, sparking curiosity about details.</td><td>E+T: Using wooden blocks or LEGO blocks to replicate the shape of a house they observed</td><td>A+T: Using firm modelling clay and simple tools like sticks or rollers to create</td><td>T+A: Taking photos of their models to celebrate</td></tr>
</table>

[17] *Principles 3-4 were mainly inspired and adapted from: https://extension.psu.edu/programs/betterkidcare/early-care/tip-pages/all/mathematical-scientific-thinking-in-three-and-four-year-olds*

	2–3-year-old children learn by[17]	Inspiring Examples (S: Science, T: *Technology*, E: Engineering, A: Arts, M: Mathematics)		
			detailed sculptures of fruits.	their creations.
7	Understanding that a written numeral represents a specific quantity and corresponds to the spoken word for that number	**M+S**: Including counting, verbal labels, and written symbols during daily routines, like counting steps while climbing stairs or identifying numbers on signs		

1.6.2 How 4-6 years old children learn

Think About

Which of the following are distinctive characteristics of how 4-6-year-old children learn?

1)While younger children primarily learn through sensory and motor exploration, 4-6-year-olds begin to exhibit more interaction through their enhanced language development.

2)4-6-year-old children start to ask universal questions, such as why the sun is yellow (is it?) or what happens when we die. This language development correlates with greater curiosity about the world and more sustained attention.

Both characteristics are generally true about this age group. This period is perfect to support children's interest in any science domain that they are interested in by encouraging them to interact with books and other *technology*: Dinosaurs, water, insects, stones or whatever topic that sparks their attention.

Table 3 below lists features describing how 4 to 6-year-old children learn matched with a few examples of how to incorporate these features into *I-STEM* experiences:

Table 3: Features describing how 4–6-year-old children learn matched with specific examples of I-STEM experiences.

	4-6 children learn by…	Inspiring Examples (S: Science, T: *Technology*, E: Engineering, A: Arts, M: Mathematics)
1	Engaging in active observation and asking thoughtful questions about the physical world	**S**: Taking children outside to observe insects in their natural habitat and encouraging them to ask questions like, "Why do ants walk in a line?" or "What do bees collect from flowers?"

	4-6 children learn by…	Inspiring Examples (S: Science, T: *Technology*, E: Engineering, A: Arts, M: Mathematics)	
2	Observing and categorizing objects based on detailed characteristics such as size, shape, colour, and function.	**S+M**: Sorting objects like blocks or leaves into groups by size, shape, or colour and counting each group.	**A+T**: Creating a collage by categorizing magazine cutouts or coloured paper by shades or shapes.
3	Engaging more with literature through active listening, discussing plotlines and characters, and connecting stories to personal experiences.	**S**: Reading stories about animals and encouraging them to ask questions about how they adapt to their environment.	**A+T**: Acting out scenes from a story with costumes or puppets to bring the plot to life.
4	Documenting observations through drawings, symbols, or simple data charts	**S+M**: Observing weather daily and creating a chart to track sunny, rainy, or cloudy days.	**E+M**: Guiding children in creating a "growth tracker" for a classroom plant by drawing lines on paper to mark the plant's height each week. Add dates or simple symbols to show changes over time.
5	Distinguishing time more accurately, including parts of the day, seasons, days of the week, and measuring time in hours and minutes	**A+S**: Creating a seasonal wheel using paper and markers, dividing it into four sections (spring, summer, fall, winter). They can decorate each section with drawings of activities or weather typical for that season.	**E+M**: Constructing a simple paper clock with movable hands to help children understand hours and minutes.
6	Formulating predictions and testing them through structured experimentation (*)	**S+E**: Predicting which objects will sink or float and testing the predictions in water.	**E+T**: Designing boats from cork or foil to see how they float and hold weight.
7	Solving real-world problems using measurements and quantifying sets of ~ 10	**M+S**: Counting and organizing 10 chairs for a class activity and discussing how to share them equally.	**M+S**: Arranging a pretend picnic and ask children to count how many plates, cups, and napkins are needed for a group of 10 people. Encourage them to verify their count by matching one item per person.
8	Exploring the interactions between living things and their environment	**A+S**: Depicting an ecosystem (with animals, plants and water), such as a pond or forest, using paper, clay, and natural materials.	**E+T**: Guiding children in building a simple bird feeder using recycled materials, such as a plastic bottle or a milk carton.
9	Drawing representations of people with at least three distinguishable body parts	**M+S**: Using geometric shapes to form people, counting the number of shapes used for body parts.	
10	Recalling specific details from stories and narrating extended storylines	**A+S**: Creating storyboards with drawings to retell the sequence of events of a memorable moment of their holidays, how they imagine the earth was created or how their pets have grown.	

Remember: It is possible to have the same learning principle for different age groups but matched with more elaborate/challenging activities for older ages.

1.6.3 How 7-9 years old children learn

Think About

Which of the following are distinctive characteristics of how 7-9 year-olds learn?

1. Engaging in games with defined rules and goals
2. Expanding their vocabulary through reading
3. Visualizing objects before constructing them and following plans to bring their ideas to life
4. Generating hypotheses and visualizing what-if scenarios
5. Understanding symbols and imagining realities that are not present (e.g., pretending to feed a toy bear with a stick as though it were a spoon.)

The only characteristic that is not typical of 7- to 9-year-old children is the last one as toddlers can already engage in this type of *pretend play* using symbols. Table 4 below lists features describing how 7 to 9-year-old children learn matched with examples of how to incorporate these features into integrated *STEM* learning experiences:

Table 4: Features describing how 7–9-year-old children learn matched with specific examples of I-STEM experiences.

	7-9 children learn by…	Inspiring Examples (S: Science, T: *Technology*, E: Engineering, A: Arts, M: Mathematics)		
1	Observing and analysing multiple aspects of the same phenomenon simultaneously	**S**: Journaling how water, soil type, and sunlight impact plant growth	**A+S**: Sketching landscapes and analysing light, shadow, and texture simultaneously	**E+T**: Building a bridge using multiple materials, balancing strength and weigh
2	Creating simple plans to organize their actions before executing them	**S+A**: Drawing the steps to build a terrarium	**A:** Outlining painting design phases before applying colours to the canvas	**E+T**: Sketching a plan in a storyboard before assembling a LEGO tower
3	Exploring how actions lead to specific outcomes, recognizing the relationship between cause and effect	**S+E**: Mixing baking soda and vinegar (or soil and water) and observing the resulting reaction	**E+T**: Adjusting the angle of a ramp to see how it changes the speed or distance a toy car travels, illustrating how slope affects motion	

4	Generating hypotheses and visualizing what-if scenarios	**S+E**: Predicting how different liquids will affect seed germination and testing the hypothesis	**A+S**: Proposing a few theatre characters with their own facial expression, and predict the possible audience reactions	
5	Understanding the concept of sequences and durations, which helps them structure events in time and recognize patterns like days and weeks	**M+S**: Creating a timeline of activities or charting weather patterns over a week	**Arts+S**: Designing a sequential comic strip with events flowing logically	
6	Engaging in games with defined rules and goals	**M**: Playing a board game where players roll dice, calculate totals, and move pieces based on the sum	**E+T**: Building the tallest tower possible using only pebbles and sand within a set time frame	
7	Applying basic mathematical operations (like addition and subtraction) for simple problems	**M+S**: Calculating the total cost of previously connected natural items (leaves, stones, branches, pinecones, acorns, and flowers) in a pretend store/shop	**A+S**: Measuring and dividing a piece of paper to create symmetrical origami shapes	**E+T**: Adjusting dimensions of blocks to ensure symmetry in a simple model design	
8	Grasping money and its relative value (e.g., exchanging objects of varying value using play money.)	**M+A**: Exchanging natural objects of varying value using play money to understand equivalence	**A+T**: Designing artwork depicting different coins and their values.	
9	Visualizing objects before constructing them and following plans to bring their ideas to life	**S+A**: Drawing a diagram of a plant's structure before building a 3D model with playdough	**A+E**: Sculpting a clay model of a castle based on a drawn sketch	**E+T**: Sketching a diagram of a new bridge for any zone of the school outdoor playground	
10	Incorporating internal or unseen elements into their representations, such as when illustrating layered objects	**S**: Drawing a cross-section of a previously chosen nearby tree showing its internal layers (e.g., bark, cambium, growth rings)	**A+E**: Creating a drawing of the building with visible rooms, outdoor spaces and furniture inside	**E+T**: Designing a transparent model of a skateboard with its internal parts.	
11	Expanding their vocabulary through reading and applying new terms in various contexts.	(Any activity that involves language and communication!)			
12	Expressing themselves more clearly and engaging in longer, more meaningful conversations with others.	**E+A**: Explaining the features of a toy car's personal design to the class.			

Seven Key Takeaways from Part 1:

1. **Young children are ready for *I-STEM*—guided by educators' *intentionality*, not worksheets.**

   Children aged 2–9 year naturally investigate, hypothesise, and test ideas; educators add value by *intentionally* noticing, naming, questioning, and scaffolding inquiry (not by pre-teaching all answers). Hands-on, inquiry-based learning beats formal instruction for building I-*STEM* thinking.

2. **OUTSTE(A)M = I-*STEM* outdoors with purpose.**

   Outdoor play offers unique, whole-body, multi-sensory experiences that stimulate language, scientific thinking, and problem-solving (e.g., balance, estimation, engineering in dens, climbing, jumping). Using nearby nature and school yards as "living labs" is central to the approach.

3. ***Risky play*—managed, not eliminated—powers *I-STEM* learning.**

   When hazards are *proactively managed* (not removed), age-appropriate *risky play* builds autonomy, resilience, problem-solving and risk assessment—core *STEM* capacities. Engage families and involve children in judging risks.

4. **Design the environment for *I-STEM* outdoors: think *learning zones* + *loose parts* + tech as a tool.**

   Create clearly bounded *learning zones*, stock *loose parts* (natural, recycled, water/building materials), and treat *technology* (can be low-tech: clipboards, scales, timers) as a support for planning, recording, and modelling.

5. **Time and talk matter: revisit topics and model *STEM* language.**

   Deepen understanding by returning to the same big idea over weeks (e.g., floating/sinking projects), combining open-ended materials with sustained dialogue. Use story, "notice–name–question" and visual supports to boost prediction, reasoning, and vocabulary.

6. **Equity first—especially for outdoor *STEM*.**

   Gender and access gaps begin early and are worsened by unequal access to green spaces. Counter bias (materials, language, role models), ensure every child is welcome across all areas (indoor/outdoor), and adapt activities so all can participate meaningfully.

7. **Match pedagogy to development across 2–3, 4–6, and 7–9 age groups.**

   Plan integrated activities that fit how children learn at each stage (from sensory/motor and trial-and-error, to categorising, documenting, predicting, and then planning, hypothesizing, and analysing). Keep integration across *STE(A)M* domains genuine (S-T-E-A-M) while honouring each domain's practices.

This brings you to the end of the OUTSTE(A)M Framework. **Part 2 of the Guidelines** explains how you can use and adapt the OUTSTE(A)M Toolkit.

Part 2: The Toolkit

This part of the Guidelines provides you with guidance about how to use the OUTSTE(A)M Toolkit and how to incorporate the activities in your curriculum.

Find the toolkit here:	Or scan the QR code:
https://files.eun.org/scientix/OUTSTE(A)M-Toolkit.zip	

The OUTSTE(A)M toolkit has four components that you may **use flexibly and in combination to plan** and facilitate *STEM* learning. The main goal of the toolkit is to inspire and provide you with a variety of ideas and resources to incorporate *I-STEM* experiences in your daily planning, preferably in outdoor settings. Each of the components are explained in the sections below.

You can adapt the toolkit to the children in your group's interests and needs. Be inspired by how the educators in the pilot used the Toolkit. You will find direct quotations 'In educators' own words' in this part of the Guidelines to give you confidence.

2.1 Learning Scenarios (LSs)

Learning Scenarios (LSs) are your source of inspiration. Whilst they *may be* used as ready-to-use lesson plans to create *integrated STEM (I-STEM)* experiences outdoors and indoors – it is preferable to view the Learning Scenarios as a framework for planning *I-STEM* in both ECEC or primary school settings. **You are free and encouraged to select or adapt the Learning Scenarios for your context.**

They were co-designed and piloted by early childhood educators and teachers to ensure their suitability for diverse groups of children between ages of 2 and 9 years.

The toolkit contains three LSs, one for each age group. Two additional LS for 6 to 9 year-olds which were developed by the OUTSTE(A)M project in collaboration with TIMKEN can be found in Part 3. Table 5 below provides an overview of the LSs created for the OUTSTE(A)M toolkit.

Table 5: Overview of the LSs created by the OUTSTE(A)M project as part of the OUTSTE(A)M toolkit.

	Boxes and Foxes	Let's Sail off the Island!	The Wonderful World of Water
Link	Click here	Click here	Click here
Barcode			
Description	Fosters spatial awareness by playing with objects and using prepositions of space.	Promotes inquiry about natural materials' properties.	Explores the water cycle, states and properties, and solutions for water pollution.
Age group	2-3 years old	4-6 years old	6-9 years old
Time to prepare	2 hours	6 activities, 15 min each	4 hours
Indicated Teaching time	2 hours	¬4 hours	8 hours
Delivery	PDF. They can be accessed on digital devices or printed for convenience.		

What you will find in each Learning Scenario (LS)

Each Learning Scenario contains a **summary page** that describes briefly what it is about; the ***key words*** that will be introduced; ***the aim*** (learning goals) of the learning scenario.

This is followed by an **Overview** page, which specifies:

- The approximate preparation time and teaching time
- The teaching materials needed for the component activities in the Learning Scenario the OUTSTE(A)M Job Profile that best suits the Learning Scenario,
- General guiding comments about adaptation, materials and resources and story
- Learning objectives

Each LS is divided into **several component activities.** The Guiding comments outline specific core activities and the complementary activities. For example, the Learning Scenario 'Let's sail off the island!' has 6 activities, 3 of which are identified as core activities.

Detailed **Lesson Plans** are then provided for each activity. These specify the activity's **duration** (in minutes) ***STEM* Strategy criteria**; **tips for adaptation** i.e. how the activity can be customised to be inclusive of all children and ensure equal access to STEM; suggestions for formative and summative **assessment**.

In educators' own words:

[This is] suitable for very young learners (2-3 years of age) as it combines storytelling, sensory play & fine motor skills development in a natural and engaging way. It also shows strong alignment with early I-STEM education principles. ***Survey respondent***

TOP TIP

You are strongly encouraged to adapt the learning scenarios based on children's interests, prior learning, previous activities or individual needs. This can be done by changing the story, changing the order of the activities, using different materials and resources etc.

Remember: whatever the activity, the educator's ***intentionality* is important** to ensure that learning takes place and is consolidated. You should be clear about the benefits of what is planned and what direction the session might take, the language whilst being open to adapt and modify where necessary.

The LSs are guided by four key guiding principles, which you are encouraged to follow in your own planning:

- Aim to **integrate at least two *STEM* disciplines** in a single activity, such as science and mathematics or arts and *technology*. It may be that children will engage deeply in one discipline (or domain) while drawing on insights from another.
- Promote active and hands-on activity within clear ***learning zones* outdoors and indoors,** ensuring a plentiful supply of ***loose parts* and materials**. This encourages observation, experimentation, and hands-on exploration.
- Minimize **screen interaction** and use *technology* to connect children with nature and the outdoors.
- Including activities that highlight diverse roles and use inclusive language to actively challenge **gender stereotypes** in *STEM* careers.

For a description of these principles, please see Part 1 of the Guidelines.

Top Tip

Start with a captivating "wow" moment to spark children's curiosity— be it a story, song, riddle, secret box, experiment, challenge, celebration, mystery, magic trick, or missing item. Educators involved in the testing of the Toolkit found **story a very effective entry point** and a way to set out a problem to be solved in *I-STEM* lessons.

In educators' own words:

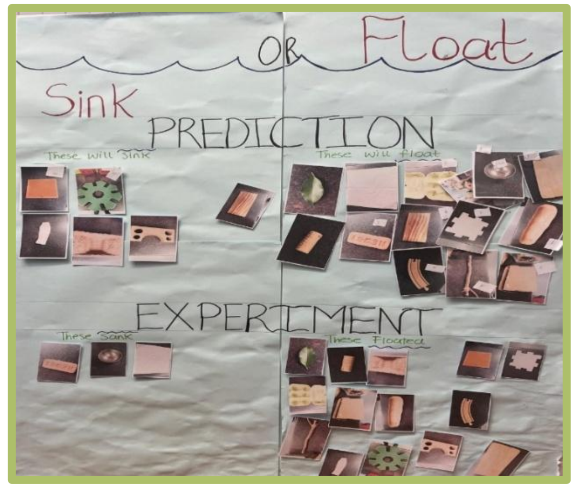
Well, I had the story. I knew what I was going to do and how I was going to start it, and then it just all kind of came together. Someone gave me a fox. I got the ears, that helped. But the story was a starting point, easier to follow for the children, rather than trying to find your way. **Educator, Pilot Ireland.**

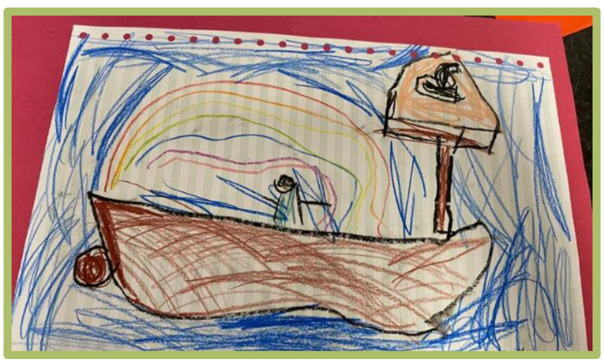
Adaptation

Practice Example:

Here is how one early childhood educator in Ireland adapted the Learning Scenario 'Let's Sail off the Island' for when working with 4- to 5-year-old children. Notice how the learning experience evolved over time and how it has been documented by both children and the educator.

The learning experience began with a story read to children about a marine biologist stranded on an island, which posed the problem of how she could get off the island. A few children mentioned a boat. This was acknowledged as an excellent suggestion, but before we made boats, we needed to consider the materials that would be suitable.





From this, the children were introduced to the concepts of sinking and floating, using a variety of everyday materials. Each child selected a different material from the learning environment and was encouraged to predict and then test whether the item would float, sink, or flip when placed in water. This hands-on investigation allowed children to engage in scientific thinking and hypothesis testing in an age-appropriate way.

Following this, the children were invited to design and construct their own boats using open-ended materials such as plastic, tinfoil, egg cartons, avocado peels, wood, cardboard boxes, tape, and paper—many of which were sourced from the art and construction corners. This element of the project encouraged creativity, problem-solving, and collaborative working as children shared ideas and tested different design features.

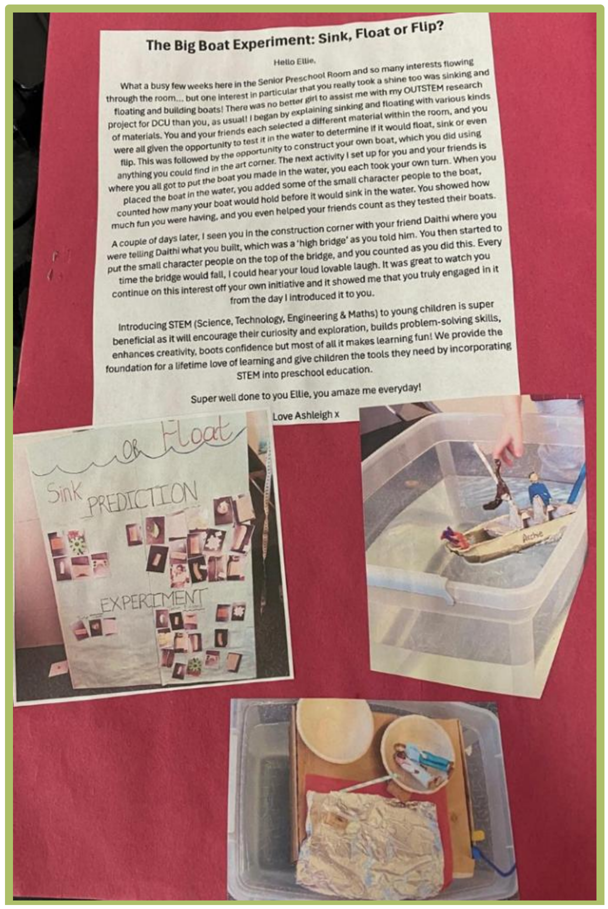
Figure 14, 15, 16: Examples of I-STEM activities in an ECEC setting[18].

[18] *Figures 14 -16: Examples of I-STEM activities in an ECEC setting. Photographed by DCU colleagues. Reproduced with permission and explicit approval from the authors.*

Once the boats were completed, each child had the opportunity to test their creation in water. They then experimented by placing small figurines onto their boats one at a time to determine how many their boat could hold before it began to sink or tip. This part of the activity encouraged mathematical thinking, particularly in counting and understanding weight distribution and balance. The room was filled with engagement, curiosity, and excitement as children observed the performance of each other's boats, noted the results, and offered explanations and predictions.

A follow-up discussion was held to reflect on the outcomes of the boat tests. Children considered which materials performed best and why certain boats remained afloat longer than others. These conversations prompted further exploration and critical thinking, supporting both language development and scientific reasoning.

In subsequent days, some children chose to extend this learning independently. For example, bridge construction activities emerged in the construction corner, where children applied their knowledge by creating structures and testing their strength with small figurines. These spontaneous extensions reflected genuine engagement and the development of key skills across the *STEM* domains.



The Big Boat Experiment: Sink, Float or Flip?

Hello Ellie,

What a busy few weeks here in the Senior Preschool Room and so many interests flowing
through the room... but one interest in particular that you really took a shine too was sinking and
floating and building boats! There was no better girl to assist me with my OUTSTEM research
project for DCU than you, as usual! I began by explaining sinking and floating with various kinds
of materials. You and your friends each selected a different material within the room, and you
were all given the opportunity to test it in the water to determine if it would float, sink or even
flip. This was followed by the opportunity to construct your own boat, which you did using
anything you could find in the art corner. The next activity I set up for you and your friends is
where you all got to put the boat you made in the water, you each took your own turn. When you
placed the boat in the water, you added some of the small character people to the boat,
counted how many your boat would hold before it would sink in the water. You showed how
much fun you were having, and you even helped your friends count as they tested their boats.

A couple of days later, I seen you in the construction corner with your friend Daithi where you
were telling Daithi what you built, which was a 'high bridge' as you told him. You then started to
put the small character people on the top of the bridge, and you counted as you did this. Every
time the bridge would fall, I could hear your loud lovable laugh. It was great to watch you
continue on this interest off your own initiative and it showed me that you truly engaged in it
from the day I introduced it to you.

Introducing STEM (Science, Technology, Engineering & Maths) to young children is super
beneficial as it will encourage their curiosity and exploration, builds problem-solving skills,
enhances creativity, boots confidence but most of all it makes learning fun! We provide the
foundation for a lifetime love of learning and give children the tools they need by incorporating
STEM into preschool education.

Super well done to you Ellie, you amaze me everyday!

Love Ashleigh x

Figure 17, 18, 19, 20: Examples of I-STEM activities in an ECEC setting[19]

[19] *Figures 17 - 20: Examples of I-STEM activities in an ECEC setting. Photographed by DCU colleagues. Reproduced with permission and explicit approval from the authors.*

During the piloting of the OUTSTE(A)M Toolkit many educators revisited the same activity multiple times and felt this was very beneficial for children.

In educators' own words:

I mean, we were getting endless time, like, much longer out of these activities than we would out of a normal curricular activity, like they were an hour and a half at water stations last Thursday without a single solitary complaint…. like, they were fully, fully engaged. Yes, loved it, yeah. **(Educator, pilot Ireland)**

And one parent actually had said to me that one little girl brought her boat to bed and she was so proud of it. **(Educator, pilot Ireland)**

2.2 Job Profiles

The OUTSTE(A)M toolkit also includes short video interviews with scientists discussing their jobs, paired with suggested activities for using the video interviews in lessons. Together, these form the toolkit's Job Profiles, which are meant to give children a first understanding *STEM* related jobs and careers.

There are two Job Profiles in the OUTSTE(A)M toolkit: a Marine Biologist and a Meteorologist. To broaden and deepen learning you are encouraged to use the Job Profiles in activities alongside the Learning Scenarios and the Games and Toys. For example, the exploration of what it means to be a Marine Biologist fits well with the 'Lets sail off the island!' Learning Scenario.

However, the Job Profiles can be used independently of the Learning Scenario and the rest of the toolkit's materials to enrich other *STEM* related activities in ECEC settings or in primary schools.

A nice idea to turn the Job Profiles to life is to invite actual *STEM* scientists into your class to talk about their work, the equipment and materials they use, and answer children's questions.

2.2.1 What you will find in each Job Profile

As discussed, each Job Profile consists of **a short, animated video interview** in which the scientist talks about their work.

You will also find **prompts for accompanying activities.** These tips and suggestions are adapted for different age-groups – 2- to 5-year-olds and 6- to 9-year-olds.

For example, one of the activity prompts for the Marine Biologist Job Profile video is to 'set up an ocean-themed sensory bin with blue-coloured water or rice, toy sea creatures, shells, and plants for hands-on exploration'.

There are also prompts and suggestions **for longer activities** that can be done either before or after watching the video interviews. Separate activities are suggested for 2 – 5-year-olds and for 6 – 9-year-olds.

Top Tip

Top Tip. As with the Learning Scenarios, the Job Profiles aim to challenge gender stereotypes, by featuring women working in *STEM* areas. A well-selected story book or non-fiction book or an actual visit of woman *STEM* scientist or a scientist who may be disabled or from a minority background can also a source of inspiration to children.

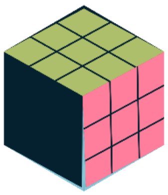
Each Job Profile is also accompanied by a list of Key Vocabulary associated with the job and used in the video. An exploration of the meaning of words such as: 'data' or 'observation' or 'research' in a meaningful context can be an activity itself –See *Part 1 Guidelines, Section 1.5.6 Language Matters.*

Job Profile	Ages	Link	Barcodes
Marine Biologist	2-5 years old	Click here	
Marine Biologist	5-9 years old	Click here	
Meteorologist	2-9 years old	Click here	
Accompanying Activities	2-9 years old	Click here	

In educators' own words:

I really loved the idea of the "Weather Wizard," where children can forecast the weather themselves. They can become "Weather Wizards" by simply looking out the window and identifying different weather phenomena. I also like how the activities encourage expanding children's vocabulary throughout the day by modelling and introducing new words. **Survey respondent**

2.3 Games & Toys



The Games & Toys section of the Toolkit includes three OUTSTE(A)M Project designed I-STEM educational games that you can incorporate in your daily routines with children in ECEC, in primary schools or informal and non-formal settings. Like the Learning Scenarios and Job Profiles, the Games have also been tested with children of different ages, their educators and parents.

The three games are:

- **Solar System Game (3-8 years)**: An outdoor educational game in which children explore the solar system by taking roles such as planets, the sun, or a comet, moving according to their characteristics and simulate orbits, alignments, and astronomical phenomena. Children learn basic astronomy such as the position of the planets, orbital movements, and the interaction between celestial bodies.

- **AREco Rescue (3-8 years)**: An outdoor educational game with augmented reality (AR), in which children become guardians of the planet. Their mission is to explore the real environment, collect virtual resources, clean up virtual polluted areas, and restore ecosystems, all while playfully learning about biodiversity, sustainability, and climate change outdoors.

- **Rain Explorers (3-8 years):** An outdoor educational game to play after the rain in which children become nature explorers. The objective is to gather as many points as possible by finding elements related to water and completing educational challenges about the water cycle, ultimately becoming the "Rain Explorer."

Figure 21: Children playing the Rain Explorers Game[20].

2.3.1 What you will find about each Game in the Toolkit

Each game has a **summary sheet** with short description of game and accompanying keywords (vocabulary).

The Games **overview page** provides information about age of pupils the game is suitable for; preparation time; teaching time and list of materials needed to play the game as well as *STEM* related topics included in the game.

Subjects	Natural Sciences, *Technology*, Engineering, Mathematics, Art, and Interdisciplinary Learning.
Topics	Solar system, planets, sun, comet, orbits, natural sciences.

[20] *Figure 21: Children playing the Rain Explorers Game. Photographed by AIJU colleagues. Reproduced with permission and explicit approval from the authors.*

Age of students	3-8 years
Preparation time	30 minutes
Teaching time	30–60 minutes
Materials	o Role cards (see annex) o 22 Velcro balls o 10 customized Velcro t-shirts (see annex) o Chalk or ropes to mark the orbits o Blindfold o Appropriate clothing and footwear to move freely o Cameras or mobile phones to document the movements or alignments of the planets (optional)

Figure 22: Children playing the Solar System Game[21].

Other background information about the Games provided is the **reasons why the game can be considered an *I-STEM* game.** Here is the explanation regarding the Solar System Game:

- **Science**: Learn concepts of astronomy and natural sciences, such as the structure of the solar system, orbits, the position of the planets, and phenomena like alignments and eclipses.

[21] *Figure 22: Children playing the Solar System Game. Photographed by AIJU colleagues. Reproduced with permission and explicit approval from the authors.*

- ***Technology*:** Using timers, markers, or apps to record scores and movements, integrating digital tools into practical learning.
- **Engineering:** Apply strategic thinking and planning by organizing the movements and alignments of planets and comets, solving spatial and coordination challenges.
- **Mathematics:** Work on counting skills, score calculation, turn-taking, and alignments, applying mathematical concepts within the game dynamics.
- **Art:** Dramatization of the planets and the comet through body movements and creative gestures allows children to represent abstract concepts in an artistic and expressive way.

You will also find an explanation of how playing the game **supports *STEM* learning outdoors and the benefits of children playing outdoors** and **the 21st century skills addressed** in the game.

The core part of the Games information for educators and families are:

- the **Game Plan** (Step by Step instructions to play the game)
- the **Variations and Adaptations** that can be made. This contain suggestions for how the game can be adapted for older children, if the game is played cooperatively rather than competitively, if the game is played indoors rather than outdoors.
- **Didactic Keys** (pedagogical guidance) for educators and families, before, during and after playing the game.
- Formative **assessment guidance** including suggestions for **post activity reflection questions with children.**
- **General comments** for educators about how to enrich game as an educational and playful experience.

OUTSTE(A)M Game and Toys	Ages	Link	Barcode
Solar System	3-8 years old	Click here	
AREcoRescue	3-8 years old	Click here	
Rain Explorers	3-8 years old	Click here	

The annexes section of the Games includes printable colour game materials.

Figure 23: Challenge cards for 3- to 5-year-olds for the Rain Explorers Game[22].

In educators' own words:

This [Rain Explorers Game] is a great game to cultivate students' curiosity, problem-solving skills, and creative expression. I would definitely use this game. It offers a wonderful balance between fun and education, encouraging exploration and active engagement with the natural environment. I believe it would be a valuable resource both inside and outside the classroom. **Survey respondent**

[22] *Figure 23: Challenge cards for 3- to 5-year-olds for the Rain Explorers Game. Photographed by AIJU colleagues. Reproduced with permission and explicit approval from the authors.*

Part 3: Extra Resources about I-STEM

In this part of the Guidelines you will find a range of additional resources about *I-STEM* outdoors such as a curated list of commercial *STEM* toys and games; information about the Learning Scenarios that were created by the OUTSTE(A)M project in collaboration with TIMKEN; the background academic and grey literature which informed the development of the OUTSTE(A)M toolkit and information about the OUTSTE(A)M MOOC. This part also contains information about other educational projects and resources about *STEM* education for children aged 2 to 9 years.

3.1 Curated I-STEM toys and games and posters

OUTSTE(A)M Spanish partner AIJU has produced a database of 95 commercially available toys and games which you can find here.

Each toy or game is described within a single slide, and provides information about the *STEAM* areas it stimulates, the age group it is suitable for, its purchase link and approximate price:

Figure 24: Example of I-STEM Games and Toys catalogue[23].

The toys and games can also inspire you to create your own I-STEM materials according to the age group you are working with and the children's interests.

Besides this catalogue, there is also a poster to support the Toolkit, which can be found here.

[23] *Figure 24: Example of STE(A)M Games and Toys catalogue. Photographed by AIJU colleagues. Reproduced with permission and explicit approval from the authors.*

3.2 The OUTSTE(A)M MOOC

Many of the concepts, strategies, and activities described in the *Toolkit* and *Guidelines* will also be explored in the MOOC **"OUTSTE(A)M in Action: Let's STE(A)M"**, supported by **Scientix®**, an initiative of the **European Schoolnet®**.

This MOOC will support you as an Early Childhood Education and Care (ECEC) and primary school educator to deepen your understanding of I-STEM education and enhance your teaching strategies! By exploring and using the OUTSTE(A)M toolkit in depth, you will learn to effectively integrate I-STEM concepts in your approaches both in indoor and outdoor settings and ultimately inspiring pupils to explore STEM skills and pursue STEM careers. This MOOC will also facilitate the creation of a community of educators from across Europe and beyond, encouraging networking, idea-sharing, and collaboration.

The MOOC launched on **Monday 12th January 2026**, on the **European Schoolnet Academy** platform.

It consists of **four modules**, released weekly (one every Monday). Each module includes interactive activities and valuable resources designed to support you in bringing innovative I-STEM education into your classroom and beyond.

The course is **asynchronous**, meaning you can complete it at your own pace. Each module provides around **5 hours of asynchronous learning** content and activities.

Participants who complete all activities by **Wednesday 18th February 2026**, will receive a **certificate of completion**. After this date, the MOOC remains available in **archive format** for anyone to access, though certificates will not be issued for late completion.

By participating in the MOOC, you will get to meet some educators who created the OUTSTE(A)M Learning Scenarios and the experts who led the creation of the OUTSTE(A)M toolkit.

MORE INFORMATION?

Click here if you would like to register for the OUTSTE(A)M MOOC and learn more about its modules.

3.3 Learning Scenarios

To show the importance and relevance of I-STEM in everyday life and strengthen its outreach, the OUTSTE(A)M project collaborated with TIMKEN for the development of two extra Learning Scenarios that focus on promoting STEM skills and careers.

This collaboration and the insights and creativity of two experienced primary school teachers gave way to the creation of the Learning Scenarios "Guardians of Tribology" and the "Let's Fix it!" for pupils in primary school between the ages of 6-9 years.

Table 6. Overview of the LS created by the OUTSTE(A)M project and TIMKEN as part of the OUTSTE(A)M toolkit.

	The Guardians of Tribology	Let's Fix it!
Link	Click here	Click here
Barcode		
Description	Builds foundational knowledge of friction, wear and lubrication, highlights Tribology's real-life applications, the importance of developing eco-friendly lubricants and introduces the STEM career of a Tribologist.	Encourages understanding of everyday machines, explores how simple and complex machines work and introduces the STEM career of a Service Engineer.
Age group	6-9 years old	6-9 years old
Time to prepare	4 hours	2 hours
Indicated Teaching time	4 hours	10 hours
Delivery	PDF. They can be accessed on digital devices or printed for convenience.	

These two LSs also reflect the four guiding principles and structural elements that the rest of the OUTSTE(A)M LSs have (section 2.1).

TOP TIP

Once again, you are strongly encouraged to use these LSs as a guide and a source of inspiration to create your own I-STEM activities. Alternatively, use them as they are by making the necessary adjustments so they can address both your own and your pupils' needs.

3.4 OUTSTE(A)M Policy Recommendations

It is very important that policy makers and curriculum framework developers, as well as early childhood educators and primary teachers are involved in integrating the OUTSTE(A)M toolkit in ECEC and primary school curricula. To this end the OUTSTE(A)M project will develop a set of Recommendations for National and EU Policymakers. These recommendations will also be useful for teacher trainers and representative bodies of ECEC educators, primary school principals and teachers and those who are responsible for school-based *STEM* policies. Click here to follow the OUTSTE(A)M project and stay up to date for any information regarding the recommendations.

3.5 Annotated bibliography

Here is an annotated bibliography of literature and resources that informed the development of the OUTSTE(A)M Toolkit and the Guidelines. Most of these resources are open access. They are organized thematically and address different aspects of *I-STEM* education in both ECEC and primary education.

3.5.1 The OUTSTE(A)M Literature Review

During the first year of the OUTSTE(A)M project, Dublin City University (DCU) conducted review of the literature about *STEM* in ECEC and Primary Education. The review includes sections on changing definitions of *STEM* in ECEC and primary education; educators' beliefs and attitudes towards *STEM*; barriers to implementation; professional development and pedagogical strategies; *STEM* and outdoor play and learning; *technology* use in ECEC and primary education.

Click here http://files.eun.org/scientix/OUTSTE(A)M-Literature-Review.pdf to access the OUTSTE(A)M Literature Review.

3.5.2 Language, communication and STEM pedagogy

In addition to drawing on the OUTSTE(A)M literature review when writing the Guidelines, we also consulted freely available online research-informed articles. The following resources were helpful in section about child development and the educators' role when facilitating *stem* learning: In-brief papers from Center on the Developing Child, Harvard University, such as Place Matters: The Environment we Create Shapes the Foundations of Healthy Development; 5-Steps for Brain-Building Serve and Return;

The Principles of Child Development and Learning and Implications That Inform Practice | NAEYC from NAEYC a tip sheet for early childhood educators 'Mathematical and scientific thinking in three and four year-olds published by PennStateExtension and an article titled Keeping Kids Interested in Science is a Matter of Language, published in *Scientific American*.

Open access chapter, Keulen, H. (2024). A Philosophy for the Place of Technology in STEM. In W. Fox-Turnbull & P. J. Williams (Eds.), *Locating Technology Education in STEM Teaching and Learning: What does the 'T' Mean in STEM?* (pp. 7-16). Springer.

3.5.3 Gender equity and STEM

These articles and resources are about gender equity and *STEM* in early childhood: From the Girls in STEM Toolkit (The GiST), an initiative funded by the Australian Government (The GiST), article 'Why is STEM education for girls important; and tools and suggestions about creating gender-inclusive teaching and learning environments, also from Australia, a short online article titled How early exposure to STEM can help close the gender gap in these fields.

3.5.4 Learning environments, outdoor play and risky play

Grey and academic literature informing Guideline sections about Learning environments, outdoor play and *risky play* included: Supporting babies and toddlers STEM Learning experiences, which was developed by OUTSTE(A)M partner Sandra O'Neill, DCU for Ireland's national Early Childhood Education Framework, Aistear; the Loose Parts Play Toolkit and research articles by Norwegian *risky play* researcher Ellen-Beate Sandseter Characteristics of Risky Play (2009); Risky play among four and five year-olds in preschool(2007, p.248-256).

3.5.5 Play based learning, story and intentionality

In OUTSTE(A)M we emphasize the value of story in introducing *STEM* concepts to children in a meaningful way. Conceptual Play World (developed by Australian-based researcher Marilyn Fleer) is a tool that helps educators be intentional when organised play-based STEM activities in ECEC settings. Story creates a context and framework for the play world giving purpose to the children's activities. Instead of learning abstract concepts, children are motivated to learn about things like the sun, moon, and earth because they need to solve a problem within the story, such as rescuing a character on the moon. View this short video in which two educators in Brisbane explain how the children's story, *The Very Hungry Caterpillar* provided a basis for Conceptual Play World with the 3 to 5 year-old children they work with.

3.5.6 Other European STEM related projects

Here are three other European STEM-related projects and initiatives:

Academia de Inventores is a private educational project founded in 2019 in Zaragoza, Spain. Its mission is to promote a hands-on STEAM approach for children and teenagers. The team primarily works with four core learning areas: science, mechanics, robotics, and programming, and strongly encourage the maker spirit. They teach mainly ages 3 to 18, offering practical activities in robotics, electronics, 3D design, and more, with students progressing through levels and creating their own projects and prototypes. We also run extracurricular activities, workshops, summer camps, and teacher training.

The Designing an Inclusive Playground – From Empathy to Innovation Project, which received the Scientix Cultural Legacy Award in the context of the *STEM* Discovery Campaign 2025. The Project aimed to cultivate empathy and social responsibility in preschool learners; link *STEM* education with real-world issues; empower children as active citizens capable of proposing inclusive, sustainable solutions; and engage parents and the wider community in the process of learning for social change.

STEAM from the START proposes a new conceptual framework for *STEAM* which is grounded in the experiences of ECEC educators and supports their confidence and belief in the value of incorporating *STEAM* in their pedagogy.

To access more resources and professional learning and exchange opportunities about STEM in Europe visit the Scientix® website.

And finally…

In educators' own words

'I see STEM everywhere now, I remember saying that at the start, using your STEM eyes. Now I use my STEM eyes, and I see STEM everywhere' **(Educator in Pilot, Ireland)**

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