

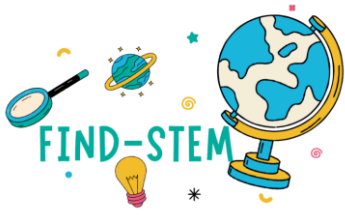
# **Fostering Innovations and Nurturing Diversity in STEM Education**

**- FIND STEM -**

**2024-1-EL01-KA210-SCH-000249907**

**Continuous Professional Development  
Curriculum and Teacher  
Training**

**Module 2: Creative and Inclusive  
Teaching Approaches in STEM**



# Creative and Inclusive Teaching Approaches in STEM

## Description

This module introduces teachers to dynamic, student-centred teaching strategies—**project-based, inquiry-based, and experiential learning**—with an emphasis on **inclusivity** in STEM education.

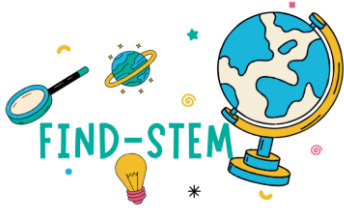
## Key Topics

Collaborative projects; Inquiry-Based Learning Techniques; Real-world problem-solving

## General Learning Outcomes

Upon the completion of the module teachers will:

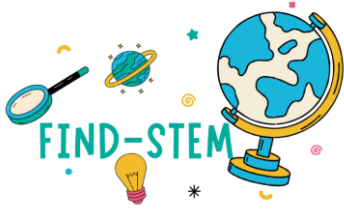
1. Design and implement **project-based learning experiences** that enhance pupil collaboration and problem-solving.
2. Apply **inquiry-based learning techniques** to foster curiosity, independent thinking, and deeper understanding.
3. Utilize **experiential learning strategies** to create hands-on, immersive STEM experiences for diverse learning styles.
4. Develop **strategies to adapt STEM lessons** to be more inclusive and engaging for all pupils, especially those from underrepresented groups.



## Activities

Activity 1	
Project-Based Learning in STEM by Designing a Water Purification System	
<b>Specific Learning Outcomes</b>	Introduce the water cycle and filtration principles
	Encourage problem-solving through hands-on construction
	Use a scientific process to test and refine designs
<b>Teaching Methods and Approaches</b>	Project-Based Learning (PBL) Framework
	Collaborative Learning
<b>Duration</b>	30 min
<b>Delivery format</b>	Face to face
Activity description	
<p>This activity helps teachers apply the principles of problem-based learning, in order to teach STEM in a creative and inclusive manner.</p> <p><b>Session flow:</b></p> <p><b>1. Concept introduction</b>            Project-Based Learning (PBL) in STEM is an instructional approach in which students actively explore real-world problems and challenges through hands-on, collaborative projects that integrate concepts from Science, Technology, Engineering, and Mathematics. Rather than learning content in isolation, students apply interdisciplinary knowledge to design, build, test, and refine solutions over time.</p> <p><b>2. Group challenge</b></p> <ul style="list-style-type: none"> <li>• Divide teachers into <b>small groups (3–5 people)</b>.               <ol style="list-style-type: none"> <li>a. Provide one sample prompt about <i>Water Filtration Challenge</i>;</li> <li>b. Provide materials: sand, gravel, coffee filters, and plastic bottles;</li> <li>c. Each group needs to:                   <ul style="list-style-type: none"> <li>• Brainstorm a project idea for their grade level</li> <li>• Select at least <b>one inclusion strategy</b> (choice in roles, peer mentoring, etc.)</li> <li>• Briefly consider how they would assess student learning</li> </ul> </li> </ol> </li> <li>• Instruct groups to document:               <ol style="list-style-type: none"> <li>a. Type of water filtration system built</li> <li>b. Problem being solved</li> <li>c. Construction process and challenges faced</li> </ol> </li> </ul> <p><b>3. Presentations</b>            Each group presents their water purification systems and explains:           <ol style="list-style-type: none"> <li>a. How it works</li> <li>b. Scientific principles involved</li> <li>c. Improvements they would make</li> </ol> </p> <p><b>4. Reflections</b></p> <ul style="list-style-type: none"> <li>• Ask each group to share:               <ol style="list-style-type: none"> <li>a. A quick summary of their project idea (30–60 seconds)</li> <li>b. The inclusion strategy they selected</li> </ol> </li> <li>• End with a <b>whole-group reflection</b> prompt:</li> </ul>	





c. "What's one idea from another group you'd like to adapt for your classroom?"	
<b>Assessment Methods</b>	<ul style="list-style-type: none"> <li>Peer feedback</li> <li>Group presentations</li> </ul>
<b>Resources</b>	<ul style="list-style-type: none"> <li>Teach Engineering: <a href="https://www.teachengineering.org/activities/view/cub_enveng_lesson01_activity1">https://www.teachengineering.org/activities/view/cub_enveng_lesson01_activity1</a></li> <li>Make a water filter: <a href="https://www.jpl.nasa.gov/edu/resources/project/make-a-water-filter/">https://www.jpl.nasa.gov/edu/resources/project/make-a-water-filter/</a></li> </ul>

Activity 2	
Inquiry-Based Learning Techniques by Explaining Newton's First Law	
<b>Specific Learning Outcomes</b>	Define Newton's First Law of Motion and explain the concept of inertia in their own words.
	Interpret real-life examples that illustrate Newton's First Law.
	Formulate a testable question related to motion and forces
	Demonstrate curiosity by asking questions about how things move in everyday life
<b>Teaching Methods and Approaches</b>	Small group collaboration
	Structured roleplay with rotation
<b>Duration</b>	40 min
<b>Delivery format</b>	Face to face

**Activity description**

This activity helps teachers apply the principles of inquiry-based learning techniques, in order to teach STEM in a creative and inclusive manner.

**Session flow**

- 1. Concept introduction**

**Inquiry-Based Learning** is a student-centred educational approach where learning is driven by questioning, exploration, and evidence-based reasoning. Teachers act as facilitators, guiding students as they construct their own understanding of concepts.

- 2. Activity description**

**Step 1: Reframing with Inquiry**

- Present the traditional statement: "An object at rest stays at rest and an object in motion stays in motion unless acted upon by an external force."
- Ask groups to generate inquiry-based questions that could launch student investigations:
  - "Why do you fly forward when a car stops suddenly?"
  - "What would happen if we played hockey in space?"
  - "Can things move forever?"

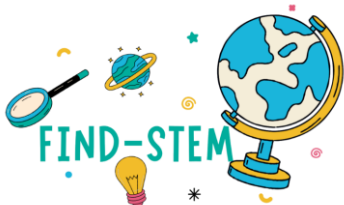
**Step 2: Roleplay**

- One teacher plays a sceptical or curious student:
  - "But if nothing is touching the ball, why does it stop rolling?"
- Others use **inquiry scaffolding** to help guide understanding:
  - "What do you think slows it down on Earth?"
  - "Can you think of a place where there's less friction? What might happen there?"

**Inclusion Tip:**

- Encourage role rotation so everyone practices both asking and supporting.
- Provide sentence stems like: "What do you think would happen if...?" or "How could we test that?"

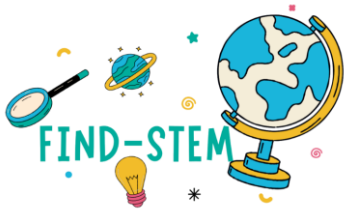




<b>3. Reflection:</b> <ul style="list-style-type: none"> <li>○ Use prompts like:           <ul style="list-style-type: none"> <li>▪ “What strategies felt most natural to you?”</li> <li>▪ “What might you try differently with your own students?”</li> </ul> </li> <li>○ Capture responses in a visible format (e.g., chart paper, Jamboard).</li> </ul>	
<b>Assessment Methods</b>	<ul style="list-style-type: none"> <li>• Peer feedback</li> <li>• Group discussions</li> </ul>
<b>Resources</b>	<ul style="list-style-type: none"> <li>• Heavy helicopters: <a href="https://www.teachengineering.org/activities/view/cub_mechanics_lesson01_activity1">https://www.teachengineering.org/activities/view/cub_mechanics_lesson01_activity1</a></li> <li>• Why don't people fall out of roller coasters when they go upside down?: <a href="https://www.youtube.com/watch?v=zZo-5DZNnEo">https://www.youtube.com/watch?v=zZo-5DZNnEo</a></li> </ul>

<b>Activity 3</b>	
<b>Experiential Learning in STEM by Using a Station Rotation</b>	
<b>Specific Learning Outcomes</b>	Follow structured inquiry procedures at each station to test magnetic interactions
	Describe the basic properties of magnets
	Demonstrate persistence and creativity when problem-solving or overcoming challenges at each station.
<b>Teaching Methods and Approaches</b>	Collaborative learning
	Active engagement
	Guided facilitation
<b>Duration</b>	50 min
<b>Delivery format</b>	Face to face
<b>Activity description</b>	
<p style="text-align: center;"><b>1. Concept introduction</b></p> <p><b>Experiential Learning in STEM</b> is a hands-on, active learning approach where students gain knowledge and skills in <b>Science, Technology, Engineering, and Mathematics</b> through <b>direct experience, reflection, and application</b>. It emphasizes learning by doing—students engage in real-world tasks, experiments, and projects that require critical thinking, collaboration, and problem-solving.</p> <p style="text-align: center;"><b>2. Session flow</b></p> <ul style="list-style-type: none"> <li>• Set up 2–3 mini stations with materials (e.g., magnets, simple circuits, soil samples).</li> <li>• Teachers rotate through and adapt activities for different learners (e.g., visual aids, tactile tools, simplified instructions).</li> </ul> <p><b>Station 1: Magnetic or Not?</b></p> <ul style="list-style-type: none"> <li>• <b>Materials:</b> A tray of mixed objects (paperclips, plastic spoon, coin, rubber band, nail, key, etc.), magnets, recording sheet</li> <li>• <b>Task:</b> Predict and test which objects are magnetic. Sort them into magnetic/non-magnetic piles.</li> </ul> <p><b>Inclusive Adaptations:</b></p> <ul style="list-style-type: none"> <li>• Use a <b>visual sorting mat</b> with picture cues.</li> <li>• Provide a <b>tactile sorting board</b> for students with visual impairments.</li> </ul>	





- Include a **yes/no flip card** for nonverbal responses.

### **Station 2: Magnetic Maze Challenge**

- **Materials:** Paper maze templates, magnetic wands, small metal washers or paperclips
- **Task:** Move the metal piece through the maze using a magnet under the table or board.

#### **Inclusive Adaptations:**

- Offer **maze templates of varying difficulty**.
- Use **larger materials** for students with fine motor challenges.
- Provide **verbal instructions** paired with **step-by-step visual directions**.

### **Station 3 (Optional): Build a Magnetic Toy**

- **Materials:** Magnets, cardboard, pipe cleaners, paper, tape
- **Task:** Design and build a simple toy or character that uses magnetic motion.

#### **Inclusive Adaptations:**

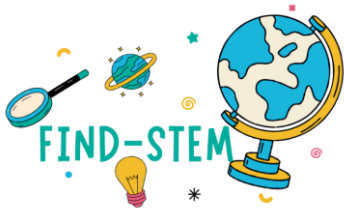
- Allow students to draw or describe their design instead of building.
- Provide **sample models** and design prompts.

### **3. Reflection**

- Ask each group to briefly share:
  - Key discoveries or insights.
  - Adaptations they found effective.
  - Ideas for classroom implementation.

<b>Assessment Methods</b>	<ul style="list-style-type: none"> <li>• Peer feedback</li> <li>• Group discussions</li> </ul>
<b>Resources</b>	<ul style="list-style-type: none"> <li>• <a href="https://www.edutopia.org/article/prioritizing-active-learning-experiences/">https://www.edutopia.org/article/prioritizing-active-learning-experiences/</a></li> <li>• <a href="https://www.air.org/sites/default/files/Station-Rotation-Research-Brief-Final-July-2020.pdf">https://www.air.org/sites/default/files/Station-Rotation-Research-Brief-Final-July-2020.pdf</a></li> </ul>





## Resources

- Teach Engineering: <https://www.teachengineering.org/>
- Mystery Science: <https://www.youtube.com/@MysterySci>
- Edutopia: <https://www.edutopia.org/>

## Summary of key takeaways

- Creativity Enhances Engagement and Understanding;
- Inclusive teaching removes barriers so that all students—regardless of background, gender, ability, or learning style—can participate and succeed;
- Creative and inclusive STEM teaching is not about adding more—it’s about teaching differently to reach more students, foster innovation, and build a future-ready, diverse STEM workforce.

## References

- California Institute of Technology: <https://www.jpl.nasa.gov/edu/resources/project/make-a-water-filter/>
- Centre College: <https://stemresources.centre.edu/physics-resources/newtons-law>
- Design a water filter STEM project: [https://www.youtube.com/watch?v=xwuK\\_M1wvRc](https://www.youtube.com/watch?v=xwuK_M1wvRc)
- Edutopia: <https://www.edutopia.org/article/blog-what-heck-inquiry-based-learning-heather-wolpert-gawron/>
- How to make a simple water filter project for school: <https://www.youtube.com/watch?v=IH-2HyTpmCo>
- Prodigy: <https://www.prodigygame.com/main-en/blog/inquiry-based-learning-definition-benefits-strategies>

