# 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

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# 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.



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# Activities

| Activity 1 | |
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| **Project-Based Learning in STEM by Designing a Water Purification System** | |
| **Specific Learning Outcomes** | Introduce the water cycle and filtration principles |
| | Encourage problem-solving through hands-on construction |
| | Use a scientific process to test and refine designs |
| **Teaching Methods and Approaches** | Project-Based Learning (PBL) Framework |
| | Collaborative Learning |
| **Duration** | 30 min |
| **Delivery format** | Face to face |

**Activity description**

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

**Session flow:**

1. **Concept introduction**

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.

2. **Group challenge**
   - Divide teachers into **small groups (3–5 people)**.
     a. Provide one sample prompt about *Water Filtration Challenge;*
     b. Provide materials: sand, gravel, coffee filters, and plastic bottles;
     c. Each group needs to:
        - Brainstorm a project idea for their grade level
        - Select at least **one inclusion strategy** (choice in roles, peer mentoring, etc.)
        - Briefly consider how they would assess student learning
   - Instruct groups to document:
     a. Type of water filtration system built
     b. Problem being solved
     c. Construction process and challenges faced

3. **Presentations**

Each group presents their water purification systems and explains:
   a. How it works
   b. Scientific principles involved
   c. Improvements they would make

4. **Reflections**
   - Ask each group to share:
     a. A quick summary of their project idea (30–60 seconds)
     b. The inclusion strategy they selected
   - End with a **whole-group reflection** prompt:



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| c. *"What's one idea from another group you'd like to adapt for your classroom?"* | |
| **Assessment Methods** | • Peer feedback<br>• Group presentations |
| **Resources** | • Teach Engineering: https://www.teachengineering.org/activities/view/cub_enveng_lesson01_activity1<br>• Make a water filter: https://www.jpl.nasa.gov/edu/resources/project/make-a-water-filter/ |

| **Activity 2** | |
|---|---|
| **Inquiry-Based Learning Techniques by Explaining Newton's First Law** | |
| **Specific Learning Outcomes** | 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 |
| **Teaching Methods and Approaches** | Small group collaboration |
| | Structured roleplay with rotation |
| **Duration** | 40 min |
| **Delivery format** | 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?"



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| **3. *Reflection:***<br>○ Use prompts like:<br>▪ *"What strategies felt most natural to you?"*<br>▪ *"What might you try differently with your own students?"*<br>○ Capture responses in a visible format (e.g., chart paper, Jamboard). | |
| **Assessment Methods** | • Peer feedback<br>• Group discussions |
| **Resources** | • Heavy helicopters: https://www.teachengineering.org/activities/view/cub_mechanics_lesson01_activity1<br>• Why don't people fall out of roller coasters when they go upside down?: https://www.youtube.com/watch?v=zZo-5DZNnEo |

| **Activity 3** | |
|---|---|
| **Experiential Learning in STEM by Using a Station Rotation** | |
| **Specific Learning Outcomes** | 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. |
| **Teaching Methods and Approaches** | Collaborative learning |
| | Active engagement |
| | Guided facilitation |
| **Duration** | 50 min |
| **Delivery format** | Face to face |
| **Activity description** | |

### 1. Concept introduction

**Experiential Learning in STEM** is a hands-on, active learning approach where students gain knowledge and skills in **Science, Technology, Engineering, and Mathematics** through **direct experience, reflection, and application**. It emphasizes learning by doing—students engage in real-world tasks, experiments, and projects that require critical thinking, collaboration, and problem-solving.

### 2. Session flow

- Set up 2–3 mini stations with materials (e.g., magnets, simple circuits, soil samples).
- Teachers rotate through and adapt activities for different learners (e.g., visual aids, tactile tools, simplified instructions).

***Station 1: Magnetic or Not?***

- **Materials:** A tray of mixed objects (paperclips, plastic spoon, coin, rubber band, nail, key, etc.), magnets, recording sheet
- **Task:** Predict and test which objects are magnetic. Sort them into magnetic/non-magnetic piles.

**Inclusive Adaptations:**

- Use a **visual sorting mat** with picture cues.
- Provide a **tactile sorting board** for students with visual impairments.



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- 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.

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| **Assessment Methods** | • Peer feedback<br>• Group discussions |
| **Resources** | • https://www.edutopia.org/article/prioritizing-active-learning-experiences/<br>• https://www.air.org/sites/default/files/Station-Rotation-Research-Brief-Final-July-2020.pdf |



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## 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
- 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




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