Design Thinking for School STEM

STEM Education Workshop for School Educators

Facilitator: Dr. Sandeep Suman
University Department of Mathematics
T.M. Bhagalpur University, Bhagalpur
Email: ssumantmbu@gmail.com

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Session Overview

- Focus: Integrate **design thinking** into STEM for creativity and problem-solving.
- Aligns with CBSE syllabus and NEP 2020 [3, 8].
- Learn experiential lesson design and assessment strategies.
- Explore CBSE-aligned resources and hands-on activities.

Collaboration

Creativity

**Design Thinking**

Innovation

Problem-Solving
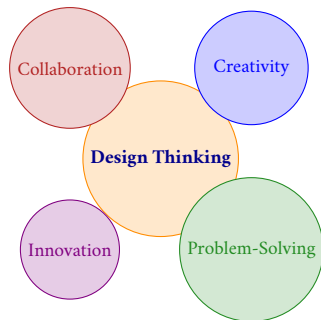
Objectives

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- Apply design thinking in CBSE STEM education.
- Design experiential STEM lessons for school.
- Develop assessment strategies for creativity.
- Explore CBSE-aligned resources.

Introduction to Design Thinking
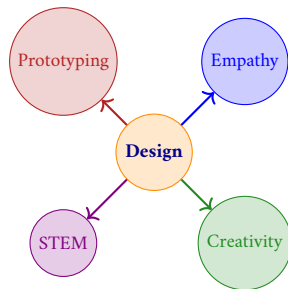
What is Design Thinking?

- A human-centered approach to solve real-world problems creatively [6].
- Encourages **empathy**, collaboration, and iteration in STEM.
- Ideal for school: fosters creativity, critical thinking, and hands-on learning.
- Aligns with STEM goals: connects science and math to practical solutions.
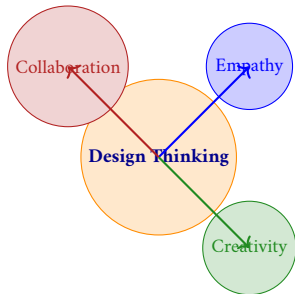
What is Design?

**Design**: Creating purposeful solutions to problems through planning and building [6].

- **User-Centered**: Understand needs (e.g., clean water for communities).
- **Creative**: Brainstorm innovative ideas (e.g., bottle filter).
- **Practical**: Build with simple materials (e.g., sand, straws).
- **Iterative**: Test and refine (e.g., adjust filter or bridge).
- **STEM Link**: Applies science (filtration, force) and math (volume, geometry).

Design Thinking Stages

Five iterative stages to solve problems [6]:

- **Empathize**: Understand users' needs (e.g., interview peers on water access).
- **Define**: State the problem clearly (e.g., "How to purify water affordably?").
- **Ideate**: Brainstorm creative solutions (e.g., sand filter, cloth strainer).
- **Prototype**: Build simple models (e.g., bottle filter with sand).
- **Test**: Try solutions, refine based on feedback (e.g., adjust filter layers).
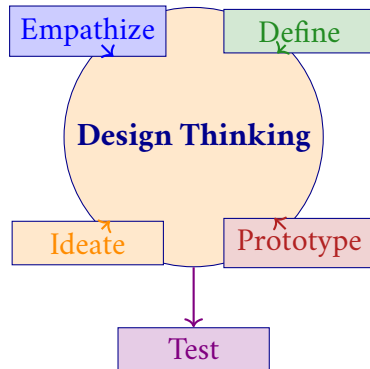
Water Filter Activity

Water Filter: Build a filter to purify water, learning filtration (science) and volume (math).

- **Empathize**: Interview peers on water quality needs (e.g., muddy water).
- **Define**: "How to purify water affordably?".
- **Ideate**: Brainstorm materials (e.g., sand, cloth).
- **Prototype**: Build filter with bottle, sand, cloth.
- **Test**: Check water clarity, measure volume, refine layers.
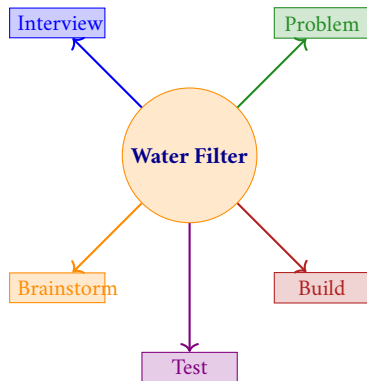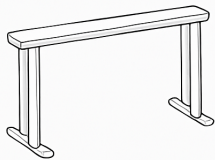
Bridge Model Activity

Bridge Model: Construct a straw bridge, exploring force (science) and geometry (math).

- **Empathize**: Discuss local bridge stability needs.
- **Define**: "How to build a strong bridge simply?".
- **Ideate**: Brainstorm designs (e.g., triangular supports).
- **Prototype**: Build bridge with straws, tape.
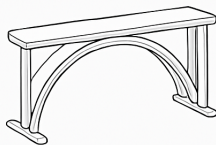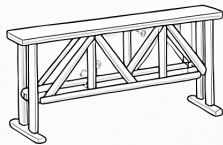- **Test**: Test with weights, refine for stability.
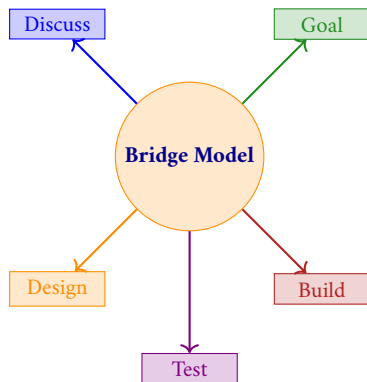
Bridge Design Examples

Beam

Arch

Truss

Suspension

Designing CBSE-Aligned STEM Lessons

Create engaging lessons using design thinking [3]:

- **Driving Question**: Pose a real-world problem (e.g., "How to reduce school waste?").
- **Design Thinking Process**: Guide students through Empathize, Define, Ideate, Prototype, Test.
- **Outcome**: Produce tangible results (e.g., prototype, chart).
- **Reflection**: Assess process, teamwork, and learning.
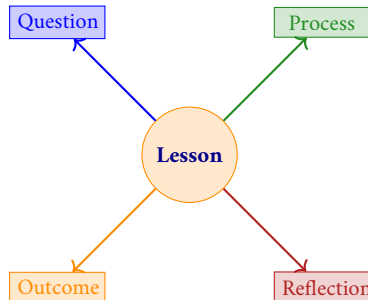
Example Lesson: Reducing School Waste

Apply design thinking to a CBSE-aligned lesson:

- **Driving Question**: How can we reduce cafeteria waste?
- **STEM Concepts**: Waste segregation (science), data handling (math).
- **Process**:
  - Empathize: Survey cafeteria waste.
  - Define: State waste reduction goal.
  - Ideate: Brainstorm solutions (e.g., compost bin).
  - Prototype: Build and test a compost model.
  - Test: Analyze results with graphs.
- **Assessment**: Rubric for science accuracy, data analysis, creativity.
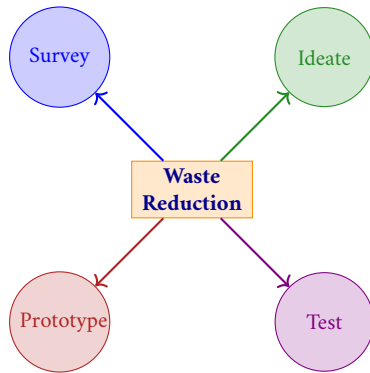
Hands-On Activity: Create a STEM Lesson

Design a CBSE-aligned STEM lesson in groups:

- **Task**: Groups of 4–5 create a lesson using design thinking.
- **Steps**:
  - Select a CBSE STEM topic (e.g., water, geometry).
  - Develop a driving question.
  - Apply design thinking stages.
  - Create a rubric for assessment.
- **Outcome**: Prototype (e.g., model, chart) using materials like cardboard.
- **Time**: 40 min design, 20 min peer review.
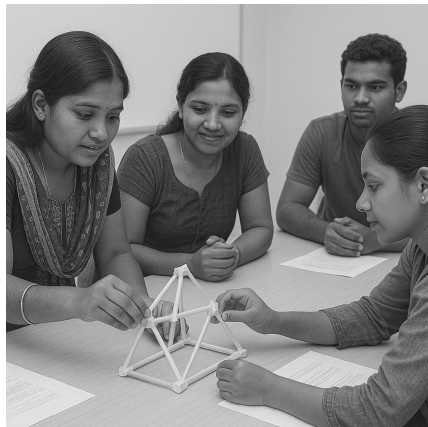
Resources for Design Thinking

- **CBSE/NCERT**: Textbooks, lab manuals [8, 3].
- **Digital Tools**: Scratch (`https://scratch.mit.edu`), GeoGebra (`https://www.geogebra.org`).
- **Materials**: Cardboard, tape, recycled items.
- **Professional**: IDEO Toolkit [6], CBSE modules.
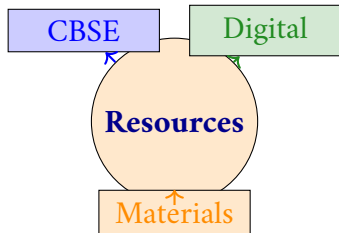
Conclusion and Action Plan

- Design thinking fosters creativity and problem-solving in STEM.
- Aligns with CBSE and NEP 2020 for engaging lessons.
- **Action Plan**:
  - Implement a lesson within 3 months.
  - Share outcomes via ANG Sahodaya WhatsApp group.
  - Submit a brief report on the lesson.

Innovation

STEM

Future

References I

[1] ANG Sahodaya. Training calendar of STEM education, 2025. Internal document provided by ANG Sahodaya.

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[6] IDEO. *Design Thinking for Educators Toolkit*. IDEO, San Francisco, CA, 2nd edition, 2015.

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[8] National Council of Educational Research and Training. *NCERT Textbooks for Classes 6–8.* National Council of Educational Research and Training, New Delhi, India, 2020.

[9] National Council of Educational Research and Training. *Project-Based Learning Guidelines for Middle School.* NCERT, New Delhi, India, 2025.

[10] STEMpedia. CBSE-aligned STEM curriculum for middle school, 2025. Accessed May 2025.

[11] Times of India. Bihar schools launch science and maths clubs for experiential learning, 2022. Accessed May 2025.

Thank you for your engagement!

Let's inspire students with design thinking!