



STEM Education Course: Engineering Design, Project-Based Learning and Makerspaces



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Introduction:

STEM education covering engineering design, project-based learning and makerspaces is a 5-day course for science, mathematics and technology teaching teams, STEM coordination teams and school leadership teams, ending with a Cross-Subject STEM Unit and Assessment Pack. Many schools teach science, mathematics and technology as separate subjects, run one-off robotics clubs and reward finished models rather than the reasoning behind them, so students rarely meet authentic design problems. Nominees already teach or coordinate STEM subjects and work through case studies built on unit plans, student prototypes and makerspace inventories. CoreConcept Training Center delivers this STEM education course.

Course Objectives:

- Map science, mathematics and technology outcomes to find integration points and choose a suitable level of STEM integration for each unit
- Teach the engineering design process and graded inquiry in lessons, using design briefs that state requirements, constraints and success criteria
- Plan STEM units and design challenges around a project-based learning driving question, milestones and a public product
- Run a school makerspace and robotics and coding activities safely, with tool inventories, induction procedures and prototyping cycles
- Assess student projects with analytic rubrics, engineering notebooks and portfolios while building computational thinking and data skills into tasks
- Widen participation in STEM through inclusive team structures, role models for girls, competitions and external partnerships

Target Audience:

- Science teaching teams that plan investigations and practical work in middle and secondary classes
 - Mathematics teaching teams that link modelling, measurement and data tasks to applied problems
 - Technology, computing and design teaching teams that run coding, robotics and fabrication activities
 - STEM coordination teams that align units across subjects and run makerspaces, clubs and competitions
 - School leadership teams that timetable, staff and resource cross-subject STEM provision
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Course Outline:

Day 1: Integrated STEM Foundations and the School Baseline

- Disciplinary, Multidisciplinary, Interdisciplinary and Transdisciplinary STEM Integration Levels
- STEAM Extension Adding Arts and Design Thinking to Projects
- Curriculum Mapping Matrix Linking Science, Mathematics and Technology Outcomes
- Critical Thinking, Collaboration, Communication and Creativity as STEM Competencies
- School STEM Baseline Audit of Timetable, Staffing and Facilities

Day 2: Engineering Design Process, Inquiry Models and Project-Based Learning

- Engineering Design Process Cycle From Problem Definition to Redesign
- Design Requirements, Constraints and Criteria Written for Student Briefs
- Concept Generation and Decision Matrix for Comparing Student Solutions
- Guided, Structured and Open Inquiry Levels in Science Investigations
- Project-Based Learning Driving Question and Public Product Design

Day 3: Designing STEM Units, Design Challenges and Makerspace Practice

- STEM Unit Planning Template With Anchor Phenomenon and Milestones
- Design Challenge Briefs With Authentic Users and Material Budgets
- Prototyping Cycles With Cardboard, 3D Printing and Electronics Kits
- Makerspace Layout, Tool Inventory and Safety Induction Procedures
- Educational Robotics and Block-Based Coding Activities for Classrooms

Day 4: Computational Thinking, Project Assessment, Inclusion and Partnerships

- Computational Thinking Through Decomposition, Patterns, Abstraction and Algorithms
- Student Data Collection With Sensors, Spreadsheets and Graphs
- Analytic Project Rubrics and Engineering Notebook Portfolios
- Girls in STEM Role Models and Inclusive Team Structures
- STEM Competitions, Industry Partnerships and Community Mentor Networks

Day 5: Case Study: Cross-Subject STEM Unit and Assessment Pack

- Case School Curriculum Map and Integration Opportunity Review
 - Case Unit Driving Question and Engineering Design Challenge Drafting
 - Case Makerspace Resource Plan and Equipment Risk Assessment
 - Case Rubric, Portfolio Checkpoints and Student Exhibition Plan
 - Cross-Subject STEM Unit and Assessment Pack Completion and Defence
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Skills You Will Gain:

- Integrated STEM Curriculum Mapping
- Engineering Design Facilitation
- Inquiry Level Planning
- Design Challenge Writing
- Makerspace Operations and Safety
- Educational Robotics and Coding
- Project Rubric and Portfolio Assessment
- Inclusive STEM Participation

Why Attend This Course:

- Deliver a Cross-Subject STEM Unit and Assessment Pack to the head of department or STEM coordinator, ready for trial with a class next term
- Decide which units to integrate across subjects, which inquiry level fits a task and which makerspace tools a design challenge really needs
- Avoid makerspace accidents, idle robotics kits and project grades that reward polished models over design reasoning
- Share curriculum maps, design brief templates, rubrics and safety induction checklists with science, mathematics and technology colleagues

Conclusion:

Back at school, the participant gives the head of department or STEM coordinator a Cross-Subject STEM Unit and Assessment Pack containing the curriculum map, driving question, design challenge brief, makerspace resource plan, rubric and portfolio checkpoints. Leaders use it to approve timetable time shared between science, mathematics and technology and to allocate makerspace equipment, while teaching teams use its templates to plan further units. After the first class has completed the unit, the team should review student design notebooks, rubric scores by criterion, participation of girls and quieter students, and makerspace safety records.

Frequently Asked Questions FAQ:

What should participants know before the STEM education course?

Participants should already teach or coordinate science, mathematics, technology or computing and be able to plan a unit of lessons. Bringing a current unit plan, a list of available makerspace or laboratory equipment and samples of student project work helps them apply the case work to their own school.

How does this STEM education course differ from a general teaching strategies or gifted education course?

It concentrates on teaching across science, mathematics, technology and engineering through design challenges, inquiry, makerspaces, robotics and project assessment. General teaching strategies courses cover lesson planning and classroom management for any subject, and gifted education courses focus on identifying and extending highly able learners.

Why does STEM education rely on the engineering design process rather than single experiments?

The design process is iterative: students define a problem, generate and compare solutions, build prototypes, test them and redesign. That cycle teaches students to learn from failure and apply science and mathematics to a real need, which a single recipe experiment rarely does.

What do participants take back from the STEM education course?

Participants take back a Cross-Subject STEM Unit and Assessment Pack with a curriculum map, driving question, design challenge brief, makerspace resource and risk plan, analytic rubric and portfolio checkpoints, ready to adapt and trial with their own classes.
