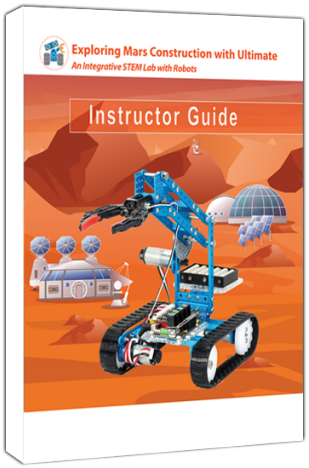
Mission to Mars (M2M) Ultimate 2.0 Curriculum Plan
Build a Mars Habitat with the Ultimate Robot



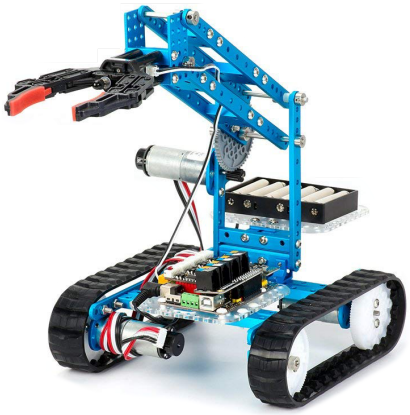
Exploring Mars Construction with Ultimate Robot
Integrative STEM Challenges covering Science, Technology, Engineering, Math, Computer Science: Coding with robots

For: MakeBlock Ultimate 2.0 Robot
Grades: 7+ to 13 **Ages:** 12 to 18+
Level: Introductory to Intermediate

Number of Units: 12 with 52 Missions
Length of Lessons: 55 min to 2 hours (15 to 45 minute activities)
Course Length: 15 weeks and can be divided into 4 week sessions or customized for specific skills and applications (there are advanced Challenges for those who want to go above and beyond)
CS Language: mBlock 5 Block based Scratch code, Arduino C, or Python

Description

Autonomous robots will soon be on Mars constructing habitats for humans. The Ultimate is a robot that can be configured in multiple ways which makes it perfect to model a Mars construction robot. Students use this fun robot to learn about this new technology and the science and engineering behind it. This curriculum explores STEM with an emphasis on physical science and engineering design using a remotely or autonomously controlled construction robot. Students are engaged in PBL and critical thinking as they control the Ultimate robot with mBlock5 block-based coding and Makeblock APP.



Hands-on Minds-On activities guide students to learn how remote and autonomous robots work by using motors and sensors for construction with a robot arm, finding pathways, navigating terranes, early warning detection, and avoiding objects while driving to remote outposts. Each lesson includes an open ended challenge for students to apply new concepts to solve real off-world problems. Fun in-class competitions allow students to demonstrate skills by navigating a maze, delivery of construction materials, and eventually building a mars space habitat.

This integrative STEM curriculum includes the application of math, NGSS science, coding, engineering, technology, arts and ELA realized through engineering design and PBL

- Science Concepts include: foundations for engineering design, critical thinking, Newton's Laws of Motion, Vector vs. Scalar, Displacement (d=change in x/change in time), Speed (s = distance/time), Velocity (v =change in displacement/change in time), Acceleration (a = change in velocity/change in time), Forces (friction, gravity, normal), Equilibrium, Simple Machines, Electrical Energy, Kinetic Energy (KE = 1/2mv2), Potential Energy

(U=mgh), Work (W = F x Displacement), Work-energy theorem (W = KE), Conservation of Energy, Momentum (P = mv), and Conservation of momentum.

- Students use Math and tools to measure and weigh, convert measurements, calculate, record data in charts, and create graphs. They use math formulas to program the robot to move in a straight line, at angles, in geometric patterns, arcs, and circles.
- Computer Science concepts include sequences, commands, program flow, sensor data, decision making, math formulas, loops, variables, functions, lists, and arrays.
- Engineering, computer science, and other STEM careers are highlighted and real-world examples of STEM applications are provided.

Curriculum comes with a printed teacher guide book, getting started instructions, comprehensive online lessons, slides, short videos to engage, worksheets, exit ticket questions, and project based grading rubrics. Lessons are aligned to CSK-12, NGSS, ELA, and Math standards and teacher lesson plans are based on the 5-E learning model.

Objectives:

1. Experience real problem solving & critical thinking skills by completing a complex challenge
2. Analyze and apply proper safety procedures in a project-based STEM classroom
3. Develop essential elements of a course portfolio and engineering design notebook (see description in project)
4. Explore career options for engineering, computer science, and STEM careers
5. 21st Century: Demonstrate communication, collaboration, and teamwork skills
    a. Describe the importance of effective communication skills and apply communication skills to teamwork and presentation of ideas
    b. Apply leadership skills to class- and work-related situations.
    c. Utilize team building skills in class- and work-related situation
    d. Reflect and improve upon teamwork skills
    e. Research, design, and create a fully functional robotics system with a team
6. Engineering: Explore principles of robotic systems.
    a. Create a robot within size and parameters defined by materials provided
    b. Create scale drawings of robot (with CAD or by hand).
    c. Ask questions from observations to determine how mass, weight and center of gravity affect the operation of a robot.
    d. Analyze mathematical and physical concepts to include measuring Torque, Speed (velocity), Wheel rollout, Gears and gear ratios, Angular velocity
    e. Design and assemble elements of a robot to include: Physical framework, Motor controllers, Wiring system, Electronics and control system, and additional Fabricated elements (e.g. 3D printed).
    f. Develop or utilize an existing remote/manual control system for robot.
7. Computer Science/Coding: Develop and demonstrate proper use of programming elements of a robot.
    a. Use appropriate language to program (code) a microcontroller
    b. Use flowcharts and pseudocode to address complex problems with algorithms

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