

Programmable Bricks



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Students undertake the design and construction of a robot that is programmed to navigate around obstacles, picking up selected items. This task, which is conducted collaboratively, follows a lesson about strategies to clean up the environment.

What are Programmable Bricks?

Programmable bricks are plastic bricks similar in size to a deck of cards with embedded portable microcomputers. Used in conjunction with standard Lego bricks or other materials, (for example, paper or fabric) models and robots may be constructed to operate on motors and sensors. These may be programmed to behave in certain ways, move in different directions and take readings from light, touch and temperature sensors.

Possible Educational Uses

Programmable bricks have enormous potential for impacting on student creativity, project based learning, team building, problem solving and other higher order thinking skills. More specifically, programmable bricks may be used to:

- Motivate students of all ages and abilities to create and develop their own models based on a range of topics within the curriculum
- Deepen students understanding of scientific concepts and their ability to conduct experiments based on behaviour, feedback and control
- Improve understanding of engineering concepts, for example, how gears, pulleys and levers operate
- Introduce students to basic computer programming and robotics
- Improve oral language development, as students are motivated to learn scientific and technical language while engaging in discussions with peers and with teachers
- Assist the writing process, as students plan strategies and record actions when problem solving
- Empower students to exceed personal limits by making learning more meaningful and connected to the real world
- Facilitate different work styles, learning styles, specifically constructivist learning and collaboration between peers and teachers
- Include all students in mixed ability groups. Students with specific learning or other difficulties can gain tremendous knowledge and boost self-confidence from this type of constructivist learning

Technical Considerations

There are a number of programmable bricks on the market, each with their own unique components. Some of the standard components are as follows:

- **Control buttons** – such as On/Off, Run, Program and View
- **Sensors** – for attaching light, touch, temperature and rotation sensors
- **Display window** – for displaying readings
- **Microprocessor** – to facilitate programming
- **Internal memory** – to store programmes
- **Motors** – to allow movement in different directions and speeds
- **Infra-red transmitter tower** - to enable programmes to be downloaded from the computer to the brick.

Programmable bricks also rely on other pieces of hardware in order to function.

Desktop computer or laptop

A PC or Mac is required for installing the software which enables the programming code to be written. The minimum system requirement for a PC is Windows 95 or later and MAC OS 8.6 for a MAC.

Batteries and cables

Four or six AA batteries are required to power some models such as the RCX microcomputer and the Handy Cricket. Cables are also required to facilitate connection between the programmable bricks and the computer while programming is in operation.

Additional Hardware

Pulleys, wheels, axles, gears and other pieces of hardware may be necessary to advance model design and construction.

Purchasing Considerations

There are numerous starter kits on the market that generally include a selection of construction bricks, beams, gears, axles, wheels, a transmitter tower, a printed manual, CD-ROM (comprising an instructional guide and programming software) in addition to the actual programmable brick. Kits range from €100 upwards, depending on the brand and range of items included in the kit. Other specific purchasing considerations are presented as follows:

- Temperature and rotation sensors may need to be purchased separately depending on the kit
- A box of pulleys and axles, is an additional cost of approx €25 per box
- The number of bricks supplied in a kit may be insufficient. A medium sized box may be purchased for approximately €40
- When purchasing programmable bricks separately, ensure that all necessary components, such as cables are available for that model
- Manuals and teachers' guides are sometimes a separate cost.

Relevant Web Sites

Empowering Minds

<http://empoweringminds.spd.dcu.ie>

Showcases the use of Lego Mindstorms in Irish Primary Schools. Includes research papers, video clips, sound files and documents submitted by participating teachers on the project.

Robots Project

<http://news.bbc.co.uk/2/low/technology/2527875.stm>

Explores a project involving page the design and creation of robots. The theme of the project focused on how robots could help in cities with environmental problems.

NCTE Related Training Courses

<http://www.ncte.ie/ICTTraining/Courses/>

General information about the pilot course relating to programmable bricks.

LegoMindstorms

<http://www.legomindstorms.com>

LEGO® MINDSTORMS® for Schools help countless students grasp science, technology, engineering, and math concepts with hands-on, naturally motivating building sets, programming software, and curriculum relevant activity materials.

Focus on Robotics

<http://news.lugnet.com/robotics>

Features news, related links, reviews and message boards with a focus on all aspects of programmable bricks and associated products.

Note: While the advice sheets aim to act as a guide, the inclusion of any products and company names does not imply approval by the NCTE, nor does the exclusion imply the reverse. The NCTE does not accept responsibility for any opinions, advice or recommendations on external web sites linked to the NCTE site.

This Advice Sheet and other relevant information are available at:

www.ncte.ie/ICTAdviceSupport/AdviceSheets