Robotics in STEM **Education**

Here are just a few examples of how robotics can help to teach in all areas of STEM. How many more can you think of?







SCIENCE

Energy changes and transfers

Using simple mechanisms to give a larger force at the expense of smaller or slower movements.

Forces and Friction

NGINE

In the case of the VEX **Robotics Competition and** VEX IQ Challenge, mobile robots are used. For a robot to be mobile, it needs to have friction between its drive wheels and the ground – too little friction and it will slip, too much and it won't be able to turn.

Balanced forces - If your motor and mechanism can't provide the force required to lift a weight, can the addition of counterbalances or elastic/springs assist?



Electricity

The word "engineering" comes from the

Latin ingenium meaning "cleverness"

the application of maths, science and experimentation to devise, test and analyse solutions. Competition robotics takes this a step further by giving a real problem to solve and an environment in

which to test the solutions to the limit.

and ingeniare meaning "to devise". Educational robotics uses two main branches of engineering - mechanical and electrical/electronic and requires

How much current is required to run the motors of the robot and how does this change with the loads being moved? Does the battery have enough capacity to run the motors for long enough for the tasks to be completed?



Electronics

Geometry

Mechanisms on the

robot will require an

understanding of geometry

to ensure that parts move

correctly. It can also be

used to simplify designs

move other parts of the

by using geometry to

robot rather than by

adding motors.

A robot requires sensors to allow it to interact with its environment as well as motors to move, solenoids to control pneumatics and microcontrollers to process the data.

TECHNOLOGY

Programming

The brain of the robot is a microcontroller which processes data received from the sensors and controls the actuators such as motors and pneumatics. A program (code) needs to be created which will form a set of instructions or rules for the robot to follow. To make an efficient robot, the code needs to be refined so that instructions are executed quickly and



Materials It is important to select the correct materials for the job – these could be selected for a combination of their strength, weight, cost and availability.







353mn



accurately.

Robotics provides a practical application for maths and shows how a number of the fundamentals of maths can be used in the real world.



Ratios and Proportions

Robot designs drawn on paper may be at a reduced scale and ideas might be prototyped in smaller sizes to test ideas before building the full scale robot.

Gear ratios are used to improve performance of the robot – what is the difference between a 3:1 gear ratio and a 1:3 gear ratio? If using a 12 tooth pinion, how many teeth will the gear need to have to achieve a 3:1 ratio?

Probability and statistics

The VEX competition requires you to form alliances with other teams - statistics can help make decisions about which teams can complement each other and be the most effective alliance.





www.rapidonline.com

ERapid education

M0283 07/14



Rapid Education, Severalls Lane, Colchester, Essex CO4 5JS • Tel: 01206 751166 • Fax: 01206 751188 • Email: sales@rapidelec.co.uk **Rapid Education** part of the **ONRAD** Group

MATHEMATICS