Robotics

By Charlotte Borg

Microsoft Innovation Centre

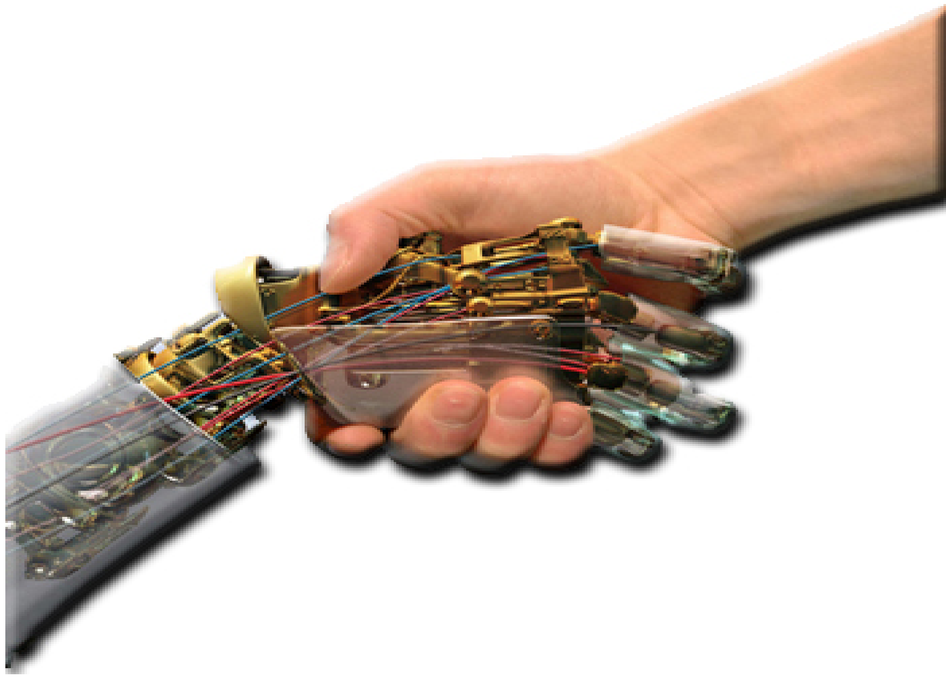
mita MALTA INFORMATION TECHNOLOGY AGENCY TRANSFORMATION • INNOVATION • EXCELLENCE

Institute of Computer Education

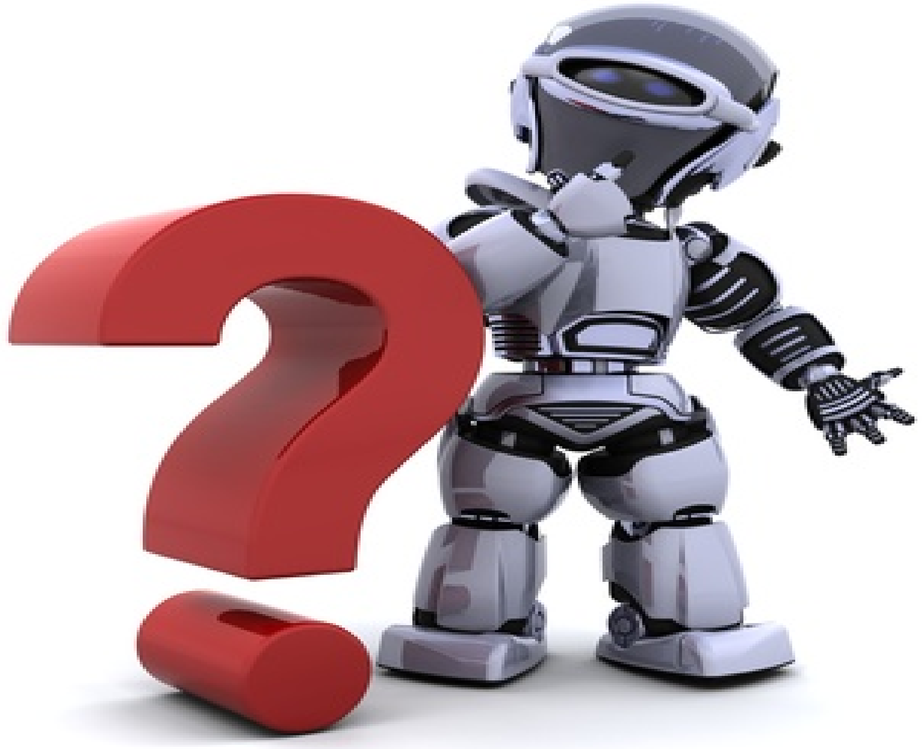
keeping you one step ahead

How I came across robotics

- The state schools' computer studies curriculum changed and robotics were introduced.
- I work in a church school and my department did not want that our students suffer from any differences therefore we worked together as a team and got the money to buy three robots



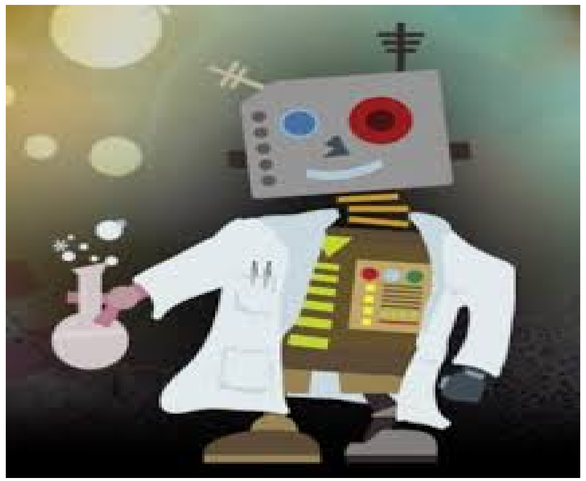
My first impressions



- How am I going to add robotics as well to my super full scheme of work!
- Will precious time be wasted from teaching important concepts?
- How am I going to incorporate robotics in my lessons?
- I never worked with robots, how am I going to teach it to the kids?

Some research

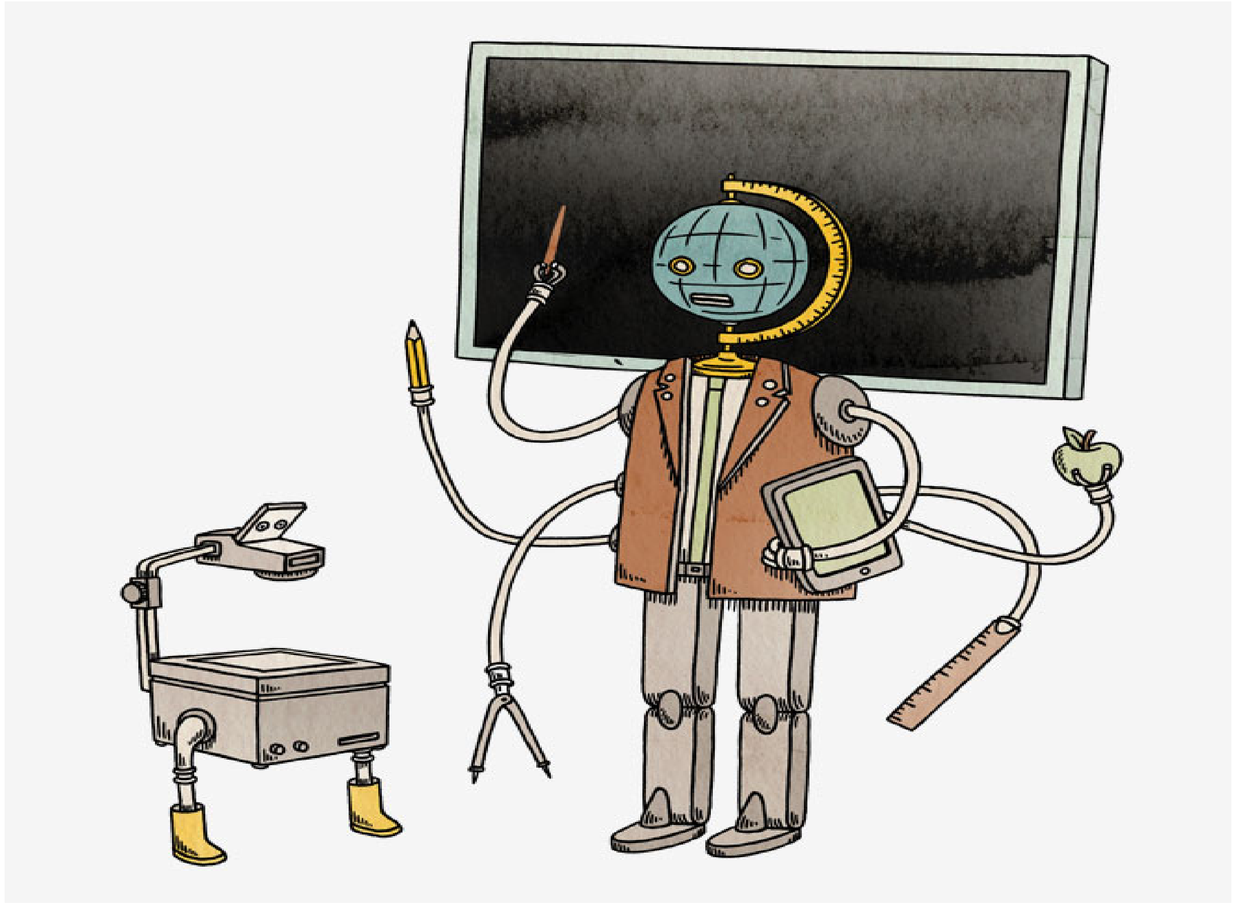
- That summer was quite busy with researching robotics and how to incorporate them in my lessons……what I found out was pretty amazing…….



After trying robotics that year…

- It encourages teamwork where students of different abilities work together towards one goal
- Certain topics that came later in the subject were already grasped through robotics, so basically it did not take a lot of time to explain
- Robotics teaches through discovery therefore it is more interesting for students and will remember it since they learn by doing!
- Brings out innovation and creativity
- Enhances problem solving skills

Some difficulties…



- It is important that when you plan your lesson you have clear objectives, since if you do not give these to the students they will be fascinated more on the robot and the technology rather than the concept you are trying to teach.
- I created structured worksheets to communicate better with students but at the same time they can experiment themselves.

More research…

- I was offered to teach a robotics course at ICE and I wanted to incorporate not only the computing part but also other subjects.
- Robotics are an efficient tool to teach cross-curricular subjects and one can find loads of information, even lesson plans on the internet.
- Robotics is an excellent way to experience STEM (Science, Technology, Engineering, and Mathematics) up close and personally.

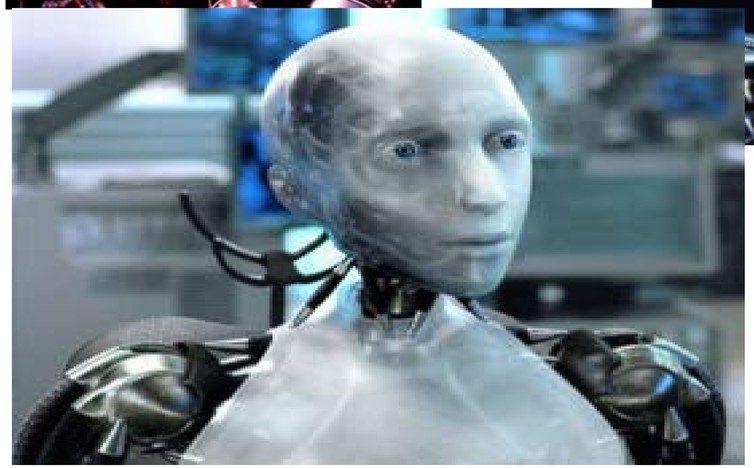
What is a Robot?

- A robot is a machine that is programmed to do specific tasks automatically.
- Normally it gathers information about its environment and uses that information to follow instructions to do work.

No it is not like in the movies, robots cannot do things on their own but people need to program the robot by using some sort of software to instruct the robot to do the actions step by step.

What is real and what is not?

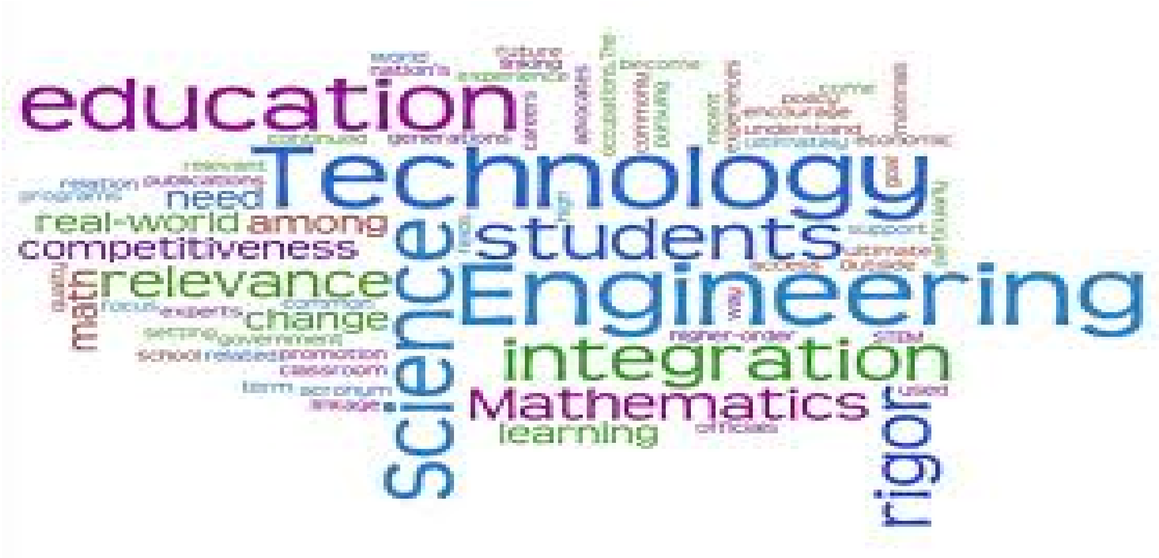
Robots used in fiction



Robots used everyday

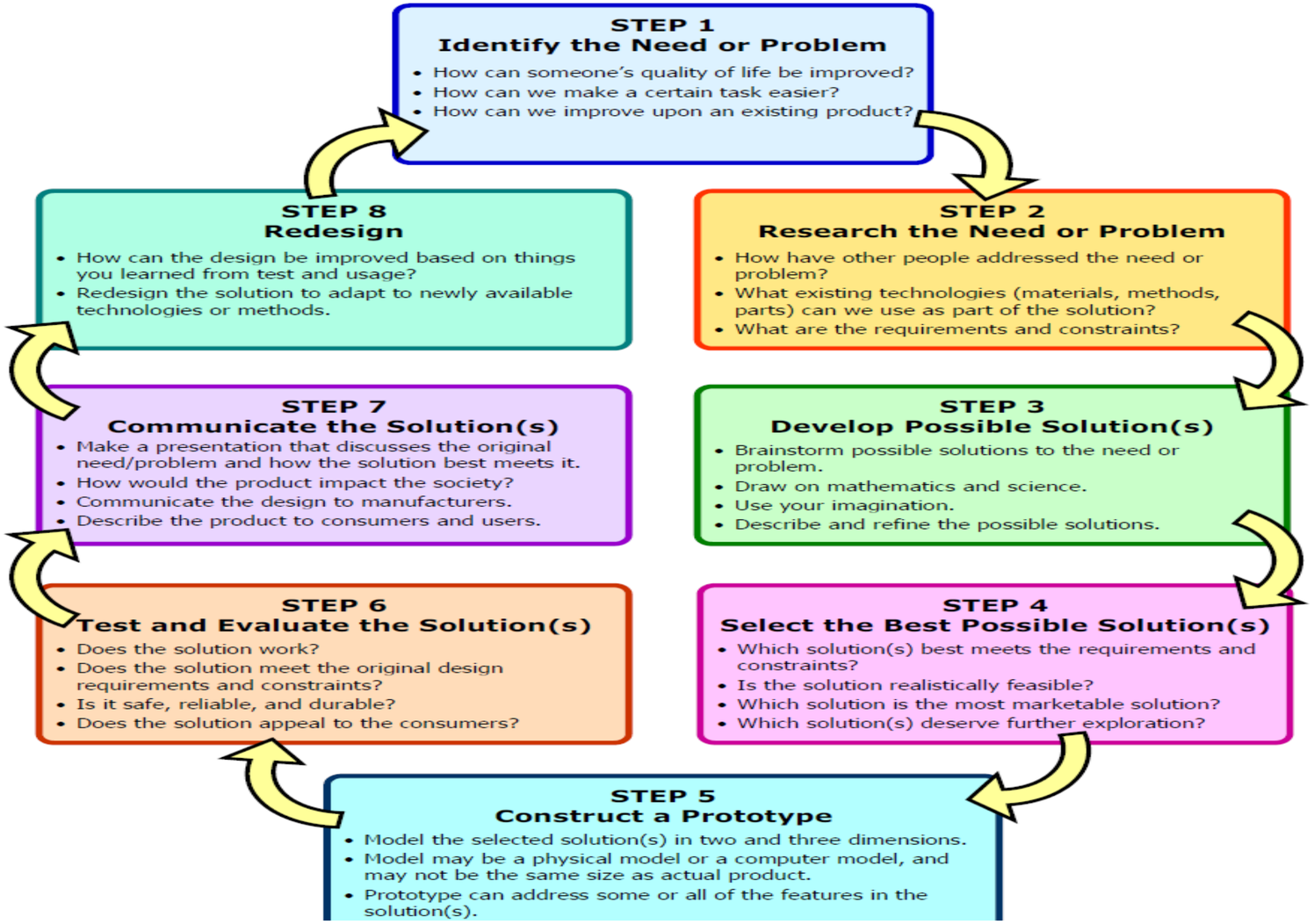
To program robots

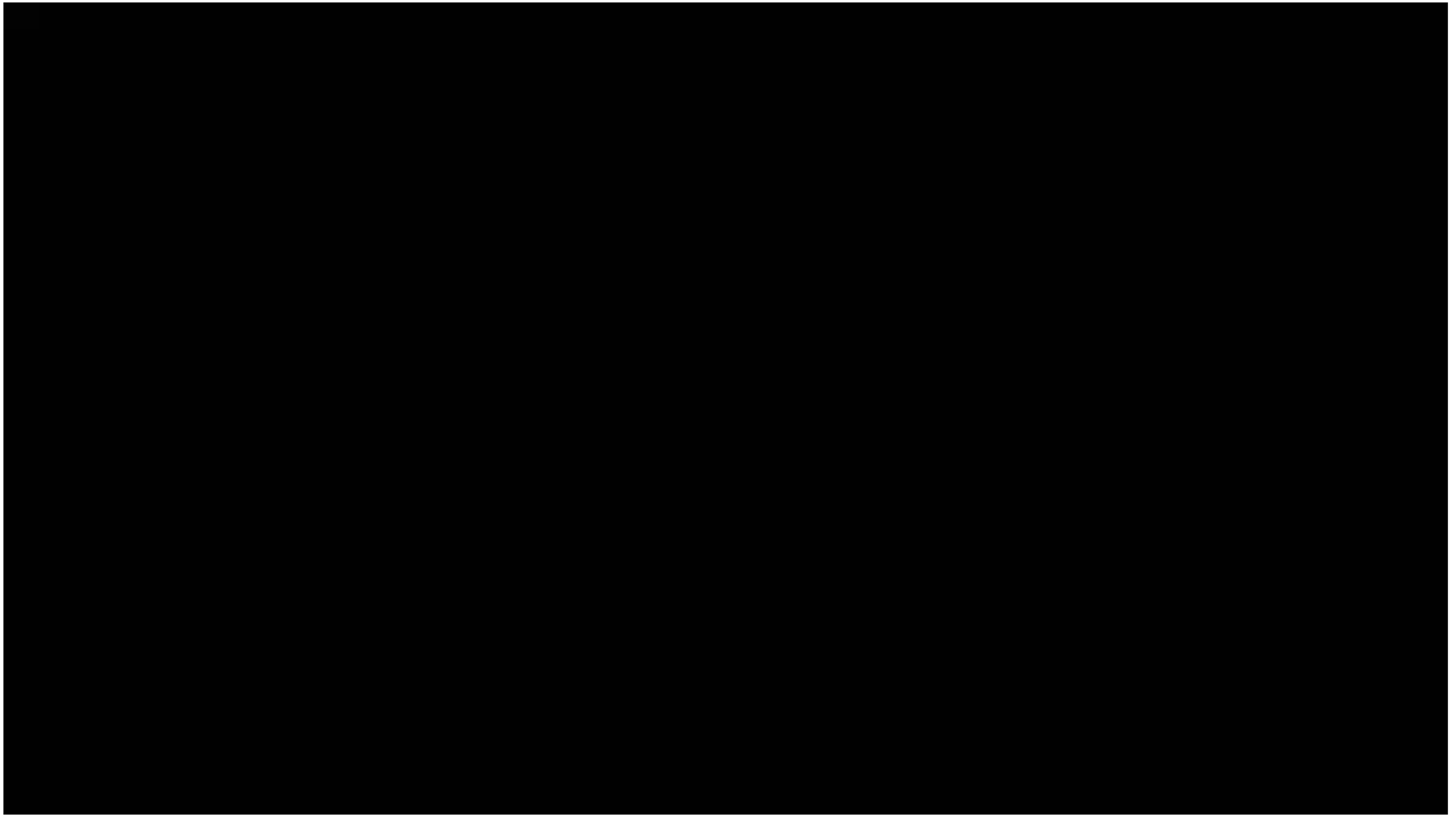
- One must have a vast knowledge on:
  - Science
  - Technology
  - Engineering
  - Maths



It’s like in the real world

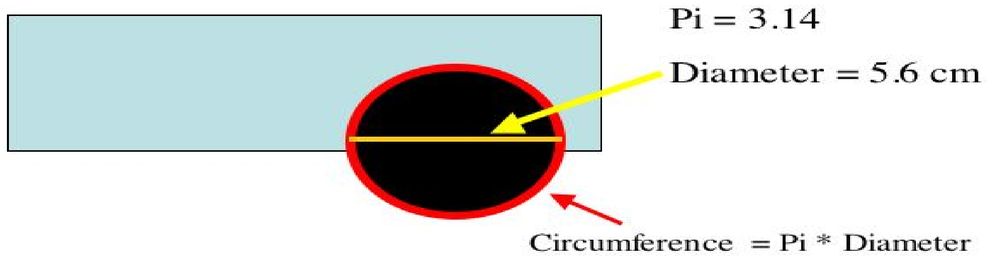
- Students participating in robotics learn about STEM careers and experience the same activities as professionals solving real-world problems.





Maths

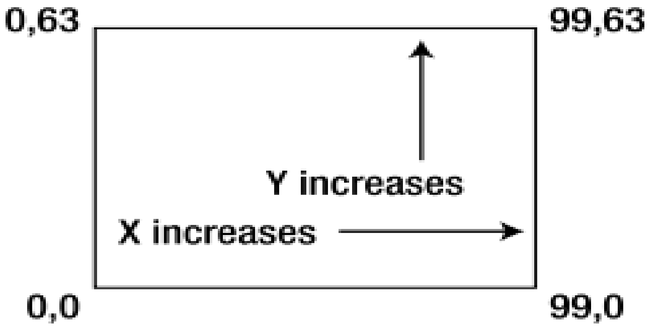
- How boring was the subject before we actually knew its importance in practice???
- Robotics give a visual application of the mathematical concepts
- Such as finding the radius of a wheel, the diameter, the circumference and the degrees the robot has to travel, or converting the degrees into inches.

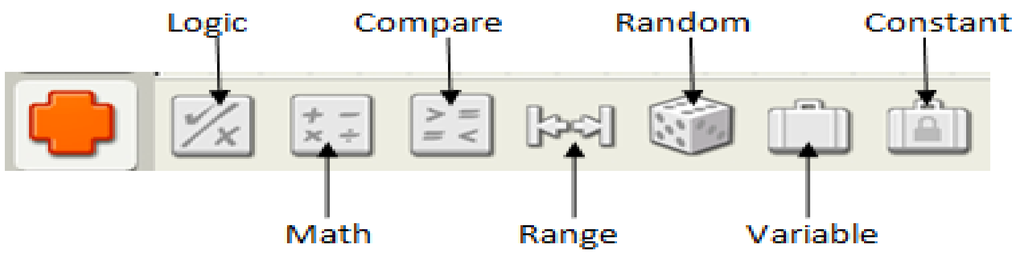


Degrees = $360 \times \frac{distance}{circumference}$

Other practical examples in Maths

- Teaching the x and y coordinates on robot screen
- Using the Math block to add, subtract, divide, multiply, find the absolute, find the square root – this can be used also to teach algebra
- Comparisons - > < =
- Proportions
- Ratios that can be explained through gear ratios





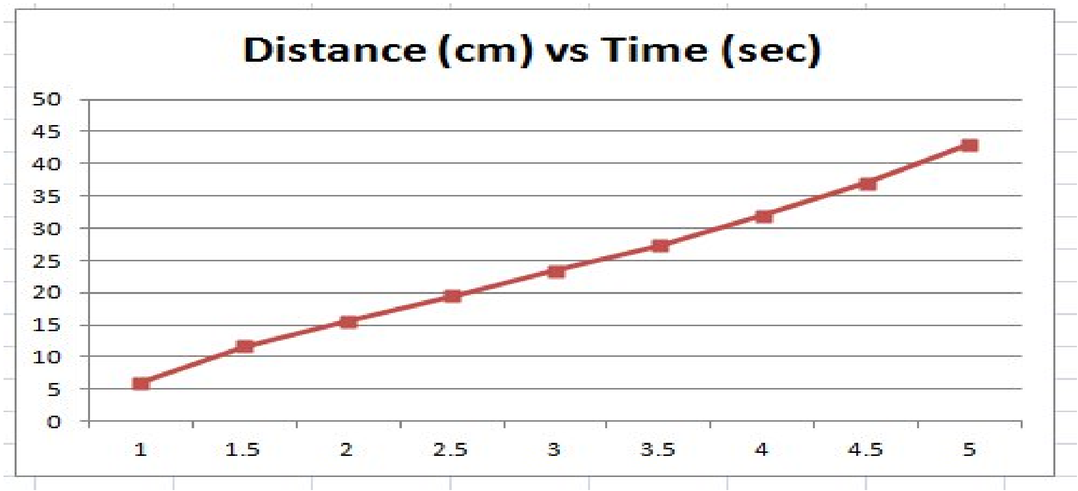
Gear ratio = no of teeth on driven gear / no of teeth on driver gear

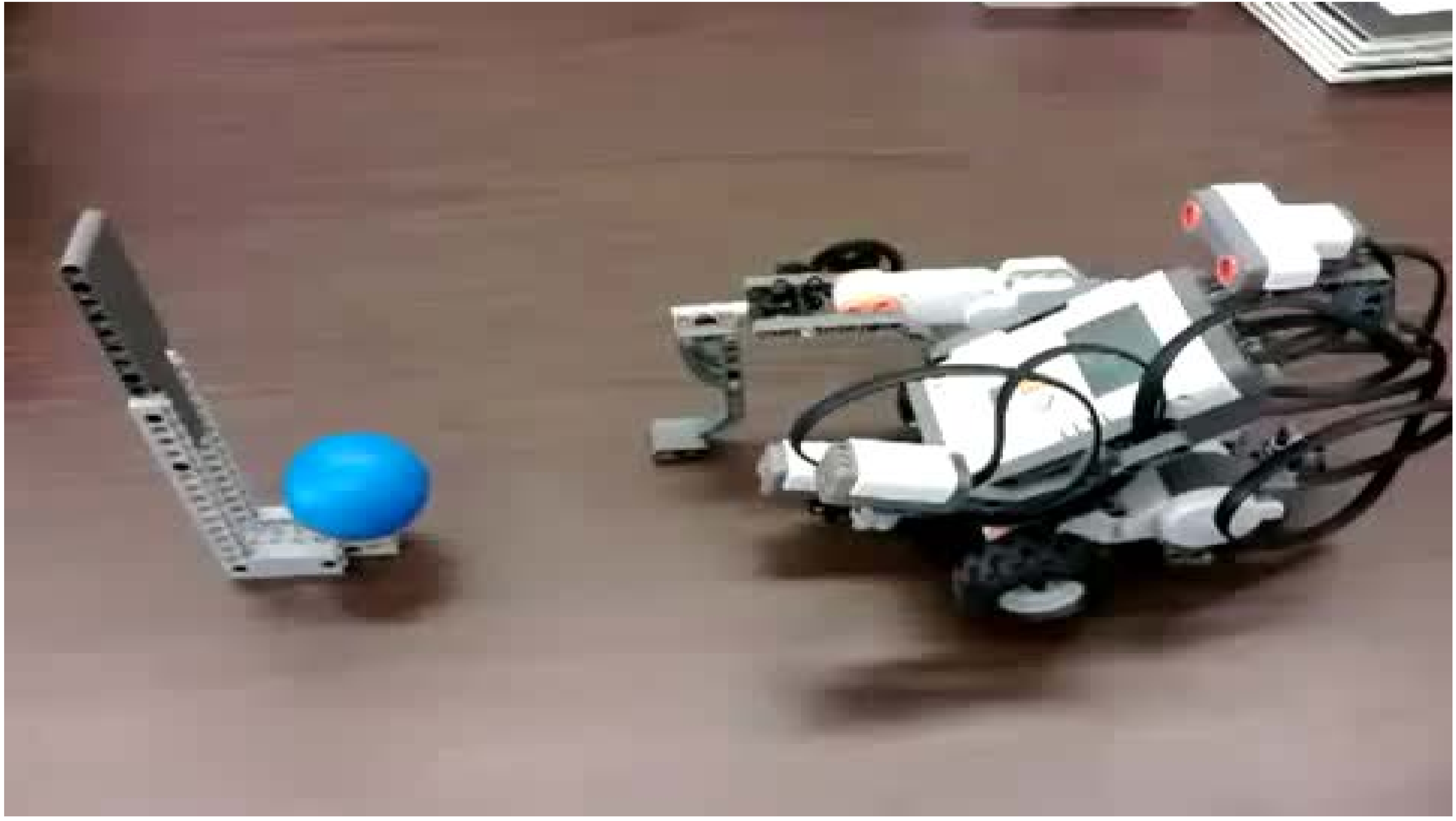
Technology & Computing

- Learning programming logic, flow and concepts from simple tasks to complex algorithms. Important concepts include sequence, selection, iteration, variables, constants and more.
- Learn how to debug
- It also supports various programming languages where students can program the robot with a programming language such as Java.

Science

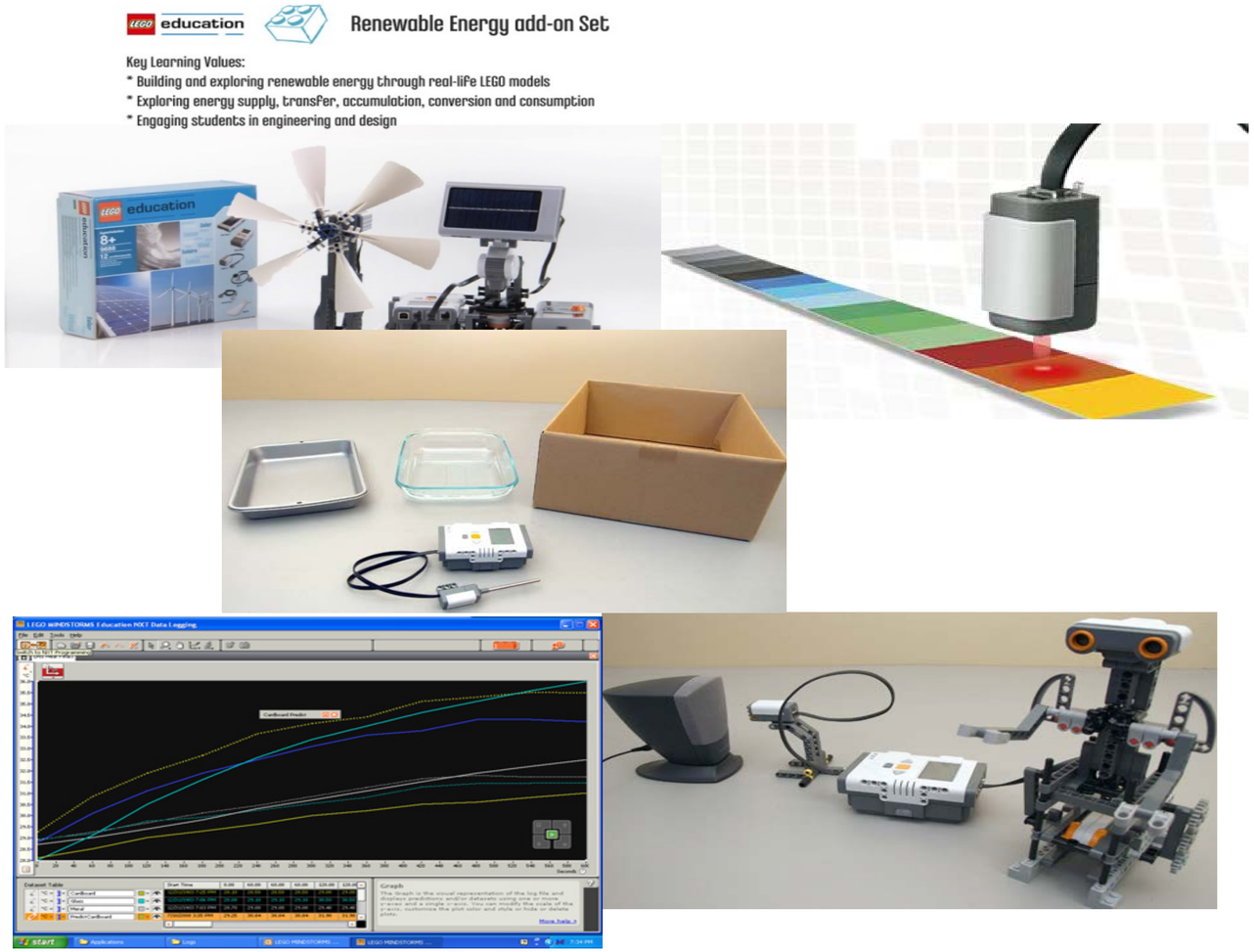
- Experiments can be made using the robot and its sensors
- Both in a Mathematics lesson or Physics lesson one can use a simple Math activity that investigates distance, time and velocity. Students can learn graphs and formulae, but they actually are seeing the results performed by the robot





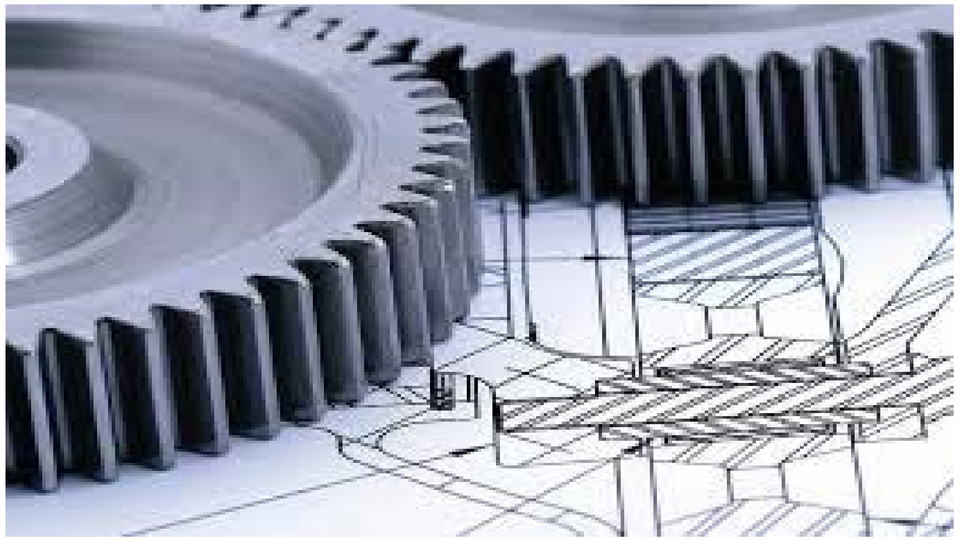
Other practical examples in science

- Investigating alternative energies
- Light and reflectivity – through colour sensor – gives different light intensities for different colours
- Heat energy – through temperature sensors
- Sound energy – through sound sensor
- Ultrasonic waves, and motion through ultrasonic sensor
- The robot can also be connected to a data logging program



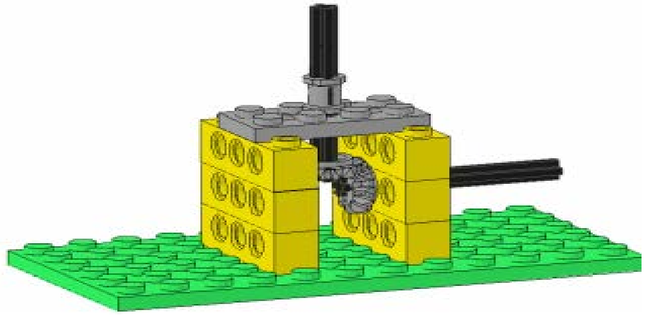
Engineering

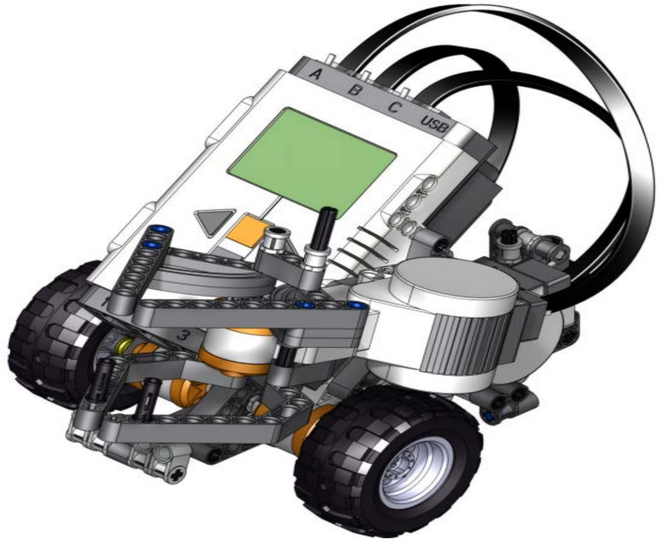
- With robotics students can learn the basics of structural engineering: tension and compression, loading constraints, building to scale, gears, axle, pulleys, lever arms, rotational motion



Other practical examples in engineering

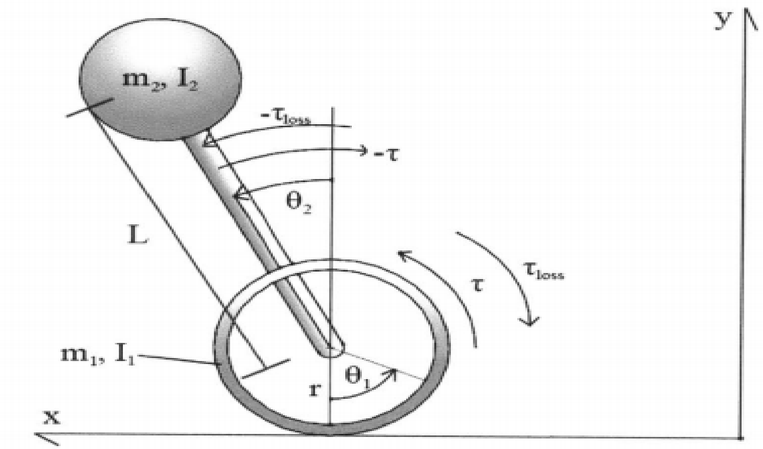
- Constructing and assembling gears with different gear ratios
- Designing and building different robots
- Lever arms and rotational motion





The Segway – STEM at its best

- Science – Moments, forces, light sensor, gravity, mass
- Technology – Programming the Segway
- Engineering – building of the Segway
- Mathematics – angles, formulae and calculations



- The real Segway transporter uses input from gyroscope to control the stability and balance.
- Because gyroscope is not part of the Lego kit, Segway robot makes use of the light sensor. The sensor registers the light intensity when the robot is started. As the robot tilts, the light intensity changes and the robot reacts by adjusting power to two motors.

Music

- Composing your own music with notes and the robot will play it.

And yes….even Dance choreography!!!

Early years and primary

- Starting from primary and continuing to secondary will enhance the students' logic and technical skills of a student

Think about it!

- The 21st Century will be the century of science and technology not just for people who are in the STEM enterprise, but for the average citizens of the world. They have to be science-savvy, they have to be engineering savvy, they have to be technology savvy just to survive in the global competitive landscape."

  – Subra Suresh, Director National Science Foundation