Science, Technology, Engineering & Maths (STEM)

Mr Bateson

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Brief Introduction

- Electronic Engineering, University of York, 2001-05
- RAF Engineering Officer, 2006-11
- Cybersecurity Consultant, PwC and NCC Group, 2011-16
- Head of Cybersecurity, McLaren, 2016-20
- Information Security Manager, Slaughter and May, 2020-now









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Previous STEM Sessions

1. Emerging technologies.
   - Artificial Intelligence.
   - Self-driving cars.
   - Augmented Reality.
2. Introduction to programming.
3. Codes and codebreaking.
4. Space.
5. Radar and Stealth.
6. Disaster Relief.



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Before We Start

- These STEM sessions aren't on any exam.
- These slides can be downloaded from www.timbateson.co.uk/rafac

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Warm Up Exercise

- Split into 4 teams.
- Each team needs some post-it notes and some marker pens.
- You have 2 minutes (from “go”) to note down some ideas on:

What are Science, Technology, Engineering & Maths about?	What kind of problems do they solve / differences do they make?	Is STEM important? Why / why not?	What kind of skills does someone need to be involved in STEM?

- One idea per post-it note.
- It’s team activity – work together!

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2 minutes left…

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60 seconds left…

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30 seconds left…

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10 seconds left…

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Time’s up!

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Warm Up Exercise – Some Thoughts

Science:

- Asks why things are how they are, and tries to explain them.
- Tries to develop models for what might happen next.

Technology:

- New ways of doing something that are better or easier.
- Examples: the wheel, the pulley, the car, the internet.

Engineering:

- Solves real-world problems.
- E.g. make something go faster, higher or further.

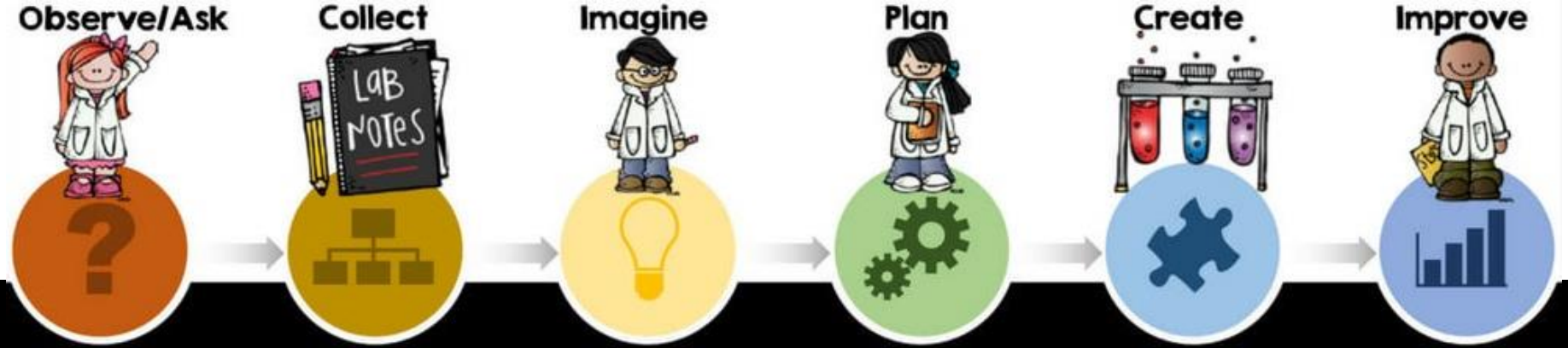
Maths:

- Solves theoretical problems using numerical methods.
- E.g. cryptography, code-breaking.

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The STEM Process



- What is the problem?
- What have others done to solve the problem?
- What are the constraints or limitations/ guidelines?
- Who can help me solve this problem?

- What information will I need to solve this problem?
- What resources do I have/need to solve this problem?

- How can I solve the problem?
- Have I found an out of the box solution?
- Do I have more than one solution?

- What materials do I have/need?
- What steps will I take to solve the problem?
- What could go wrong?

- I will test my plan!
- I will take notes of the process/ my observations!
- I will draw/take pictures as I work for reference later!

- I will reflect on my design.
- What changes can I make to improve my plan/solution?
- What does my data tell me about my first attempt?
- I will create another plan and retest!


Video
The Man Who Learnt to Fly (Link)

Challenge 1 – The Brief

- Your challenge: build a road bridge between the desks.
- Rules/requirements:
  - Bridge must be free-standing (can't attach it to anything/anyone).
  - The bridge must not drop >5cm below the surface of the desks.
  - The bridge must resist strong crosswinds.
  - A car must be able to drive across the bridge both ways (1 finger).
  - Bonus marks if 2 cars can pass each other on the bridge (2 lanes).
  - The bridge should be as strong (take as much weight) as possible.
  - You can only use the materials provided.

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Challenge 1 – Materials, Tools & Time

- Materials (per team):
  - 4 half pint plastic cups.
  - 1 A4 sheet of card.
  - 2 sheets of newspaper.
  - 4 drinking straws.
  - 8 paper clips.
  - 1m string.
  - 20cm sticky tape.
  - 1 lump sticky tac.
- You may trade materials with other teams (if they agree).
- A 2nd challenge after break – you will get more materials.
- Tools: pens, paper, scissors, glue stick, geometry set.
  - Can't use tools as part of the bridge!
- Time: **20 minutes** from 'go'!

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Challenge 1 – Scoring (leave up)

- Scoring (out of 500):
  - +50 points for bridging the gap successfully.
  - +50 points for not collapsing for 10 seconds.
  - +50 points for not collapsing in a force 5 gale.
  - +50 points for car being able to drive over (with a 1 finger push).
  - +50 points for car being able to drive over the other way.
  - +50 points for 2 cars being able to pass each other on the bridge.
  - +1 point for every 1p coin the bridge takes (to maximum of 100).
  - -100 points for every breach of the rules.

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Challenge 2 – The Brief

- Your challenge: build a tower/crane able to lift weight to height.
- Rules/requirements:
  - Must be free-standing (can't attach it to anything/anyone).
  - Must be as tall as possible.
  - Must resist strong winds.
  - Must be able to lift 1p coins as high as possible.
  - Must be able to lift as much weight (in 1p coins) as possible.
  - You can only use the materials provided.

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Challenge 2 – Materials, Tools & Time

- Materials (per team):
  - 2 one pint plastic cups.
  - 2 half pint plastic cups.
  - 1 empty drinks can.
  - 1 paper plate.
  - 6 drinking straws.
  - 8 paper clips.
  - 2m string.
  - 20cm sticky tape.
  - 1 lump sticky tac.
  - 20 mini marshmallows.
  - 20 cocktail sticks.
- You may trade materials with other teams (if they agree).
- You may trade materials with the bank (until they run out).
- Tools: as before.
- Time: **25 minutes** from ‘go’!

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Challenge 2 – Scoring

- Scoring:
  - +50 points for not collapsing for 10 seconds.
  - +50 points for not collapsing in a force 5 gale.
  - +2 points for every full cm to the top of the tower (above the desk).
  - +3 points for every full cm that the tower can lift coins.
  - +3 points for every 1p coin the tower can lift in weight (max: 300).
  - -100 points for every breach of the rules.
- Example: a 40cm tower that can lift 60 coins 30cm above the desk would score 450 points.

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Challenge 2 – Bank Exchange Rates

Item	Bank Buys	Bank Sells
Empty drinks cans (each)	80 points	120 points
One pint plastic cups (each)	70 points	100 points
Half pint plastic cups (each)	40 points	60 points
Drinking straws (each)	30 points	50 points
A4 card (sheet)	40 points	60 points
Paper plates (each)	30 points	50 points
Newspaper (sheet)	20 points	30 points
Paper clips (each)	15 points	20 points

Item	Bank Buys	Bank Sells
Sticky tape (per 10cm)	50 points	80 points
Sticky tac (lump)	30 points	50 points
String (per 10cm)	40 points	60 points
Mini marshmallows (x2)	15 points	20 points
Cocktail sticks (x2)	15 points	20 points

- You can use points won on challenge 1, but be careful!
- Prices may change and items may go out of stock.

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Summary

- Discussed what STEM is; what it does; and what skills it uses.
- Reviewed the STEM process.
  - Ask, collect, imagine, plan, create, improve.
- Had a go at building a bridge and/or a crane, given:
  - Some requirements (the brief).
  - Some constraints (time limit, certain materials).
- Used some skills that are relevant to STEM:
  - Problem solving (analyse problem and design a solution).
  - Continuous improvement (build, test, improve design, repeat).

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Any Questions?

(Feel free to ask in private if you prefer)

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