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







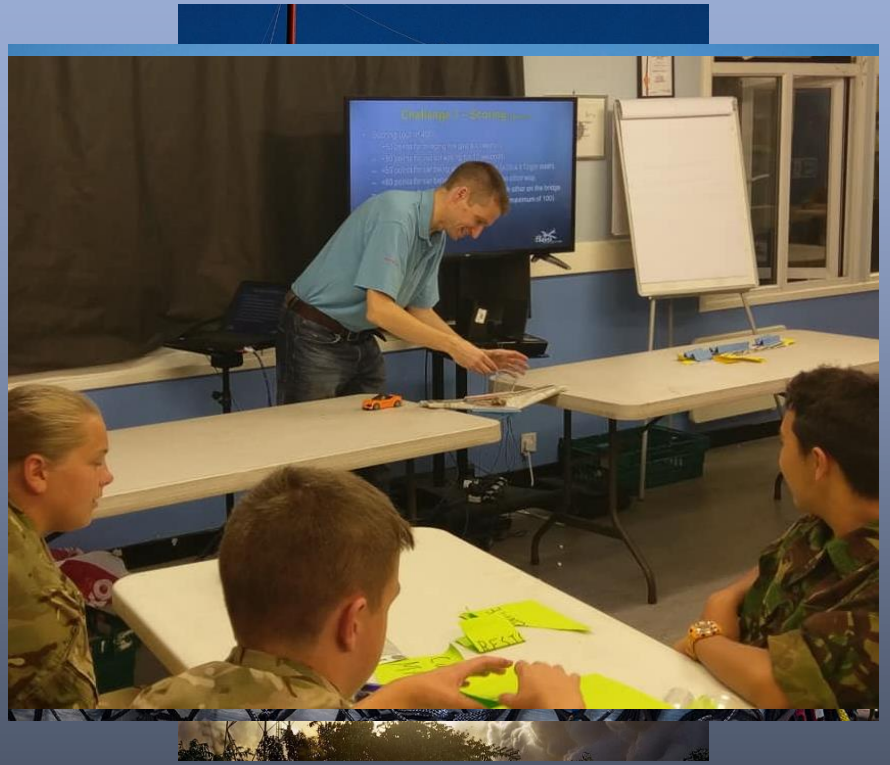


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Previous STEM Sessions

1. Emerging technologies.
2. Codes and codebreaking.
3. Space.
4. Radar and Stealth.
5. Disaster relief.
6. Bridge and crane building.



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This Session

An Introduction
to Programming

- Warm Up Exercise
- 4 Challenges
- A Short Video

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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/
- No need to write everything down – please focus on taking part.

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Warm Up Exercise

- Split into 3 teams.
- Each team needs some post-it notes and some marker pens.
- You have 3 minutes (from “go”) to note down some ideas on:

What does ‘programming’ mean?	Why is programming useful?	Examples of things people program

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

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3 minutes left…

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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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Time’s up!

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Warm Up Exercise

- What did you come up with?

What does ‘programming’ mean?	Why is programming useful?	Examples of things people program

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Challenge 1 – The Brief

- Task: program your character to escape the maze.
- Commands you can use: ‘go forwards’, ‘turn left’, ‘turn right’.
- Rules:
  - Can only step on the white squares.
  - Must write the program before the character enters the maze.
  - If you make a mistake, the character must go back to the start.
- Scoring: 10 points for escaping the maze.
- Time limit: 5 minutes.

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Challenge 1 – Conclusion

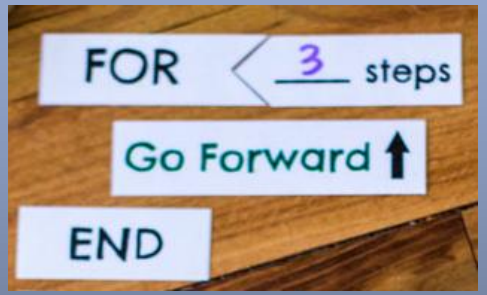
- What did we learn?
  - Using simple commands (language *syntax*).
  - Using a *reference point* other than our own.
  - Planning ahead.

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Challenge 2 – The Brief

- Task: escape the maze using as few lines of code as you can.
- Extra commands you can use:
  'for __ steps', 'end'.
- Same rules as before:
  - Can only step on the white squares.
  - Must write the program before the character enters the maze.
  - If you make a mistake, the character must go back to the start.
- Scoring: 20 points for 1st shortest; 10 for 2nd shortest; 5 for 3rd.
- Time limit: 5 minutes.



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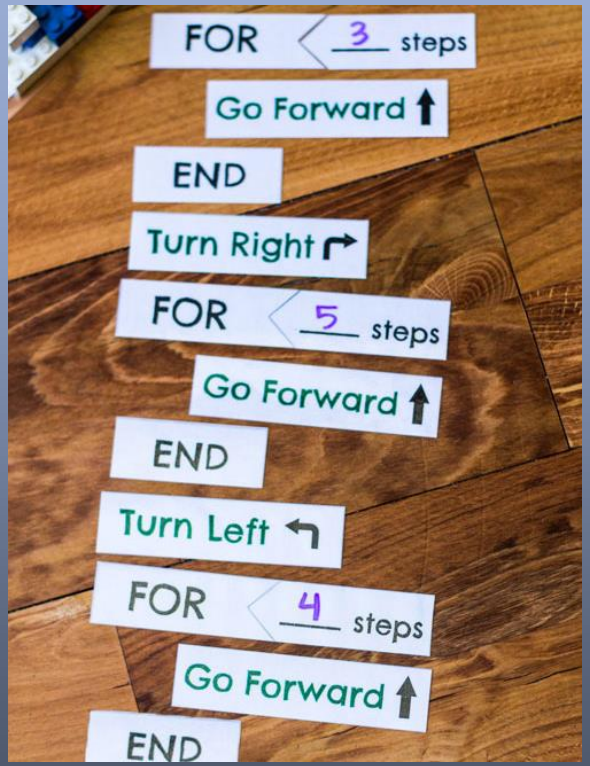
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Challenge 2 – Conclusion

- Example solution:

- What did we learn?
  - Writing efficient code (*code optimisation*).
  - The concept of ‘for’ loops.

```
for(i=1, i<=100, i++) {
  do something;
}
```



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Challenge 3 – The Brief

- Task: escape a maze that you haven't seen before.
- Extra commands you can use:
  'if', 'else', 'else if', 'while'.
- Same rules as before:
  - Can only step on the white squares.
  - Must write the program before the character enters the maze.
  - If you make a mistake, the character must go back to the start.
- Scoring: 20 points for 1st to escape; 10 for 2nd; 5 for 3rd.
- Time limit: 10 minutes.



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Challenge 3 – Conclusion

- Example solution:
- What did we learn?
  - Using if/else statements (*conditionality*).

```
if(condition) {
  do something;
}
else {
  do something different;
}
```

  - Using ‘while’ loops.



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Challenge 4 – The Brief

- Task:
  - Design a difficult (but not impossible) maze for another team.
  - Program your character to escape a maze made by another team.
- Extra things you can use: ‘dice roll’, ‘is greater than __’.
- Same rules as before.
- Scoring: 20 points for 1st to escape; 10 for 2nd; 5 for 3rd.
- Time limit:
  - 10 minutes to design a maze for another team.
  - A further 5 minutes to escape another team’s maze.

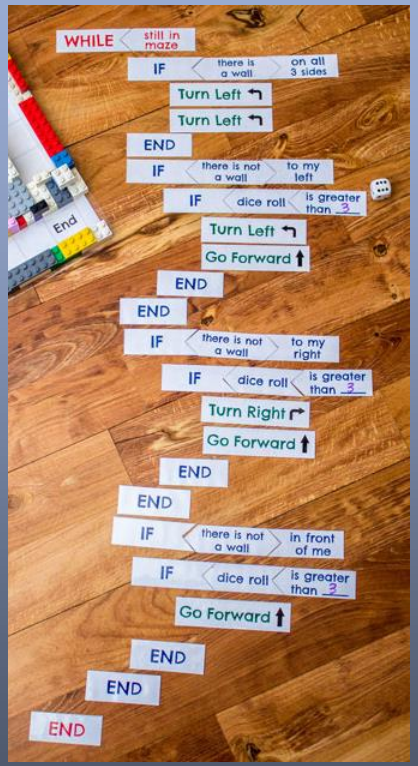
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Challenge 4 – Conclusion

- Example solution:

- What did we learn?
  - The problem of infinite loops.
  - Using randomness (dice rolls) to avoid infinite loops.



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Video
FizzBuzz (Link)

Summary

- Discussed what programming is and when it's useful.
- Used some skills that are relevant to programming:
  - Problem solving (analyse problem and design a solution).
  - Continuous improvement (design, test, improve, repeat).
- Learnt some basic programming principles:
  - The *syntax* of a basic programming language.
  - *Loops* ('for' and 'while').
  - *Conditionality* ('if', 'else' and 'else if').
  - *Code optimisation* (using as few lines of code as possible).

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Any Questions?

(Feel free to ask in private if you prefer)

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