The Royal Institution
Science Lives Here
Masterclass network

Session Leader Notes

Primary OTS Masterclass: Bats to Bytes

Thank you very much for leading this Masterclass. We hope that you enjoy working with this material as much as we enjoyed putting the activities together. We do appreciate all the effort that our volunteers put into bringing inspirational Masterclasses to students around the country. Don't forget that we'd love to know your thoughts on the Masterclass.

Inspiration for this topic:

Computer scientists and data analysts play a vital role in modern sports, using technology to unlock insights that improve player performance and game strategy. In this session, students will explore how tools like the micro:bit can collect and analyse data and be used to coach students' batting technique. By measuring the movement of a cricket bat and using real-time feedback, they'll discover how computer science can revolutionise sports while building critical data analysis skills.

Overview of Activities:

1. My favourite sports worksheet activity (optional)
2. Micro:bit step counter activity
3. Data science in sports discussion
4. Cricket batting challenge micro:bit activity
5. CreateAI activity
6. Batter recruitment worksheet activity

General Masterclass resources needed:

- Register of children
- Consent forms and emergency information to hand
- Stickers and markers for name badges
- Adult register
- Ri child protection policy
- Paper and pencils
- 2 different coloured post-it notepads (for feedback at the end)
- Drinks and biscuits

Specific resources needed (enough for the number of students attending):

- 1 copy of Worksheet 0 – My favourite sports per student (*optional*)
- 1 copy of Worksheet 1 – Batting Challenge Data Collection per group of students
- 1 copy of Worksheet 2 – Batter Recruitment per student
- Laptops or tablets with internet access (*1 per group*)
- Micro:bit and battery pack (*1 per group*)
- USB-A to micro-USB lead (1 per group, *for connecting micro:bit to a laptop*)
- Cricket bat (*1 per group*) - *you may wish to adapt this activity by using tennis rackets, golf clubs, or hockey sticks*
- Micro:bit Wearable (1 per group, *to attach micro:bit to wrist*)
- Small, soft ball (*optional*)

Support resources:

- PowerPoint slides
- Session script

Things to prepare in advance

- Gather the complete list of resources as detailed above
- Print worksheets, additional information, and any other resources as needed
- Attach micro:bits to the wearables and pre-download the batting challenge Makecode programme onto the micro:bits for activity 4, found here:

https://makecode.microbit.org/84451-94146-43619-00943. Instructions for how to set this up can be found in the 'Guide to setting up the micro:bit' document.

Ask the Ri

Don't forget to collect any questions which arise, and email them to the Masterclass team at the Royal Institution: masterclasses@ri.ac.uk

Feedback

We would very much welcome your feedback on this session. If you have time, please collect feedback from the students at the end of the Masterclass and send it through to us. We would also appreciate feedback on how you have used the session, what you think worked well and what improvements would be useful.

Time plan of Masterclass:

Slides & Time	**Overview**	**Activity (see script for further details)**
Slide 1 5 minutes (5)	**Bats to Bytes** Introduction Worksheet 0 – My favourite sports (optional)	Introduce students to the topic of today's masterclass: data analysis in sports. You may wish to ask if they play any sports, and to think about something in sport that they would like to improve on – maybe they would like to run faster, or hold their breath longer while swimming. Ask how they think technology could help them achieve that goal? Ask them to try to come up with a real/imaginary tool that could make that improvement for them!
Slide 2 15 minutes (20)	**micro:bit Step Counter** Student activity to programme the micro:bit into a step counter.	Show students the basic step counter, and explain that the micro:bit has been programmed to detect certain accelerometer readings as a 'shake'. Every time the micro:bit is shaken, the step count goes up by one. Students work through the tutorial on MakeCode to code their own step counter onto the micro:bit. They can then test this by placing the micro:bit into the wearable kit and attach to their wrist or ankle. Alternatively, they can place the micro:bit into their pocket, or sock, or hold it in their hand gently and walk around calmly.
Slides 3-5 5 minutes (25)	**What is data?**	Ask students if they know what data is, and to give some ideas of examples of data. Explain that we look for patterns in data to help us solve problems, make decisions, and gain information. Explain that we need to collect, then organise, and then analyse data. Go to slide 4 and ask students if they already know any ways that technology has changed sport, or what data they could collect to help athletes improve their performance. Go through the different ways data science could be used in sports – for example to improve player performance, to come up with game strategy, to recruit new players, and to engage new fans. Go to slide 5 and explain that today we are focusing on how data can improve player performance. Talk through the examples of ways we can collect different types of player performance data – e.g. strength of punches in boxing, the heart rate of a runner, and the lung capacity of someone after exercising.
Slides 6-9 5 minutes (30)	**What data can we collect in sports?** Discussion activity	Introduce the next activity, where students will be given some information for a sport that a person plays, and a way they would like to improve their performance. For each example they will need to come up with the data the person could collect, and how they could use the data they have collected. Go through the example on all four slides – goal scoring accuracy in football, the distance a golf ball travels, posture whilst horse riding, and swimming speed.

Slides & Time	Overview	Activity (see script for further details)
Slides 10-13 5 minutes (35)	**What data can we collect in cricket?** Discussion activity	Ask if any students have played (or watched) cricket before. Ask how someone playing cricket might improve their game, and what data they could collect in cricket. Discuss how technology and data analytics currently already play a role in cricket (e.g. tracking performance, improving technique, increasing health and ensuring correct stance to prevent injuries). Go to slide 11 and showcase how LED bails help improve batting and bowling, then go to slide 12 to showcase how we can track the ball's trajectory. Go to slide 13 to showcase how we can add smart sensors to cricket bats. Explain that we are going to turn them all into professional cricketers, by attaching a micro:bit to their wrists and analysing the data they collect when they swing a cricket bat.
Slides 14-15 10 minutes (45)	**Micro:bit accelerometer and three different cricket shots**	Demonstrate how to use the micro:bit and explain what the basic components and uses of the micro:bit are – in particular you should highlight the accelerometer, LEDs and buttons to the students, as these are what will be used in the masterclass activities. Explain what the x, y and z axes represent in terms of movement on the micro:bit, and how we can understand the different points of the swing by measuring the different accelerometer readings throughout the swing. Go to slide 15 and play the videos of the cricket shots to the students, demonstrate the shots to the students, or have a student in the class who plays cricket demonstrate.
Slide 16 25 minutes (70)	**Cricket batting micro:bit challenge** Batting activity Worksheet 1 – Batting challenge data collection	Remind the students about the different axes on the micro:bit and explain that when we collect the data we can analyse the movement by looking at a visual data graph. You may wish to go through the Makecode downloaded onto the micro:bit, demonstrate how the students will turn on and off the micro:bit to log the data, and how to display the data by connecting the micro:bit to the laptop and clicking on the file 'mydata'. The procedure for this can be found in the '*Guide to using the micro:bit*' document. Place students into teams of three, depending on the number of micro:bits available. Each team should be given one cricket bat, a micro:bit with the Makecode programme pre-downloaded, and a micro:bit wearable. Hand out worksheet 1. You may wish to give this data collection sheet with a clipboard, to help them record the data. Each student takes turns swinging the bat while others in the team observe, analyse the micro:bit data, and give encouragement. After each swing, the data is recorded and analysed on a laptop. For each swing they should record which of the three graphs matches the closest to the data from their swing, with each team member giving their opinion. Once all the team members have tried each of the different bat swing types, the students must decide as a team which graph they think represents each bat swing type.
10 minutes (80)	**Break**	**Drinks and biscuits and comfort break.**

Slides & Time	Overview	Activity (see script for further details)
Slide 18 5 minutes (85)	**The batting challenge – Results** Discussion activity	Go through the answers to the batting challenge and discuss the student's results. Talk through any discrepancies or similarities in the data collected and the data provided. Ask the students what they have found in the data, did they find any surprising results, and have they improved their batting skills? Ask for ideas on how they could improve the device - the device does not tell us in real time how straight the swing was – so their next challenge is to improve the device by implementing a real-time feedback system.
Slide 19 25 minutes (110)	**How can AI help us?** CreateAI activity	Discuss with the students how they think AI could help improve their cricket batting coaching device. Talk through CreateAI and demonstrate key features, such as creating a new class for each type of cricket shot, and how to record their data. Explain that the students are going to create their own AI models for their micro:bit, to detect when each type of shot is taken. For more detail on how to use CreateAI, see the 'Guide to using the micro:bit' document.
Slide 20 10 minutes (120)	Further activities Feedback, tidy up, questions time Ask the Ri	Introduce the extension material. Don't forget to collect any questions which arise, and email them to us: masterclasses@ri.ac.uk. We will send you answers as soon as possible. Then these can be reported back to the students at their next Masterclass session. We are also very grateful for any feedback you can provide us on the use of the resources, and we would love to hear your stories of how your masterclasses went!
Extension activities	Worksheet 2 – Batter recruitment.	Hand out worksheet 2 – Batter Recruitment. Students should use the data given on the worksheet to decide which of the cricketers they would recruit to their team. This links nicely to the primary workshop 'Football Manager'. The activities have been designed so that they could easily be adapted for use with different sports – for example a similar activity could be created for hockey, golf, tennis, and any other sport for which movement data can be analysed for different types of shots or movements within the sport.