Games - Capturing data with the micro:bit

In this lesson, students explore how digital systems can help us understand movement in games by designing a simple digital solution using a micro:bit. They will play Barambah Gimbe. Gimbe means 'play' in the language of the Wakka Wakka people of south Queensland. Barambah Gimbe is a traditional Aboriginal instructional ball game from the Yulunga Traditional Indigenous Games from the Australian Sports Commission and uses the micro:bit's accelerometer sensor to collect data about their throwing movements.

Students will then analyse the data to identify how fast or forcefully their arm moves during the game. By writing and modifying code, using inputs (buttons), and logging sensor data, they will design a digital solution to solve a real-world problem—measuring and improving physical performance. This activity helps students learn how a digital tool (micro:bit) can be used to collect, interpret, and make decisions based on data, just like athletes, scientists, and engineers do.

This activity is an adaptation of BBC Bitesize lesson Football academy – make a kick strength data logger.

Curriculum links

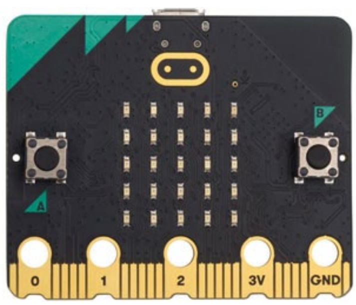
This activity is aligned with elements of the following learning areas and cross-curriculum priorities. We encourage teachers to adapt the content and focus to suit the needs of their students. It can be adapted for students between **Year 3 and Year 6**. More curriculum details are provided in the supporting documents below.

Digital Technologies	Mathematics	Health and Physical Education
Aboriginal and Torres Strait Islander cross curriculum priority		

Required resources

You will need the following materials:

- Micro:bit device (at least one between 2 students).
- Access to Microsoft MakeCode editor on laptop or tablet.
- Access to Barambah Gimbe instructions.



Pre-requisite knowledge

Prior to this session, students should have:

- the ability to create code and transfer it to a micro:bit
- a familiarity with data logging feature of Microsoft MakeCode
- an understanding of simple data sets and the ability to manipulate data in a spreadsheet.

Suggested steps

- Students play Barambah Gimbe and discuss. (See additional information in the supporting materials section).
  - What made certain throws more successful?
  - What strategies did they use that improved accuracy in catching and attaining the greatest height?
  - What information could the micro:bit help us collect about our throwing?
- Explain to students that they will create a digital solution to help them better understand and improve their throwing. They will be programming a micro:bit to log motion data from the inbuilt accelerometer. You can find out more about how this works by watching the micro:bit accelerometer video. https://youtu.be/UT35ODxvmS0
- Guide students in writing a user story and developing design criteria. (See example in the supporting materials section)
  Working in groups, have the students design a solution for attaching the micro:bit to their arm so the device stays in place while throwing the ball.
- Students develop an algorithm (pseudocode) for the program to collect and log acceleration data when a button is pressed. (See **Supporting materials** for example algorithm).
- Students use Microsoft MakeCode to program the micro:bit using their algorithm as a guide.
- Students test and debug their code, checking that the micro:bit logs and records data of their throws while playing Barambah Gimbe. Encourage them to consider their throwing technique while they play. (See example code in the Supporting materials below)
- Once the data is collected, reconnect the micro:bit to the computer and access the MY_DATA file on the micro:bit drive, which you can open in a web browser to view the data in a table or visualise it as a graph. The data can also be downloaded as a .csv file and imported into a spreadsheet.

You can view, graph, and download data directly from a micro:bit using a web browser, even after it's been powered off. See Data logging overview for more information.

- Analysing the data collected by their group in the spreadsheet, students can discuss the results and identify which throws were the strongest and most consistent. Look for patterns and compare throws between students.
- Use these results to set goals or to make adjustments to their throwing technique.
- Play another game of Barambah Gimbe and collect a second data set to evaluate if their changes led to improved consistency or performance.
- Have each group prepare a short presentation to share their findings with the class. They can include a visualisation of their data, a summary of changes they made to improve their technique, and a reflection on whether their digital solution met the design criteria and the user story. Encourage students to explain any changes they would make if repeating the activity.

Pose questions

Use these example open-ended questions to prompt student reflection, check for understanding, and encourage discussion to help students explain their thinking and build on each other's ideas.

- How did the user story help you plan your design?
- What did you notice about the data collected? What did it tell you about your throwing technique?
- How did your throws change after looking at the data?
- What patterns did you notice in the group data?
- How do you think athletes or coaches might use this kind of data in real life?

- How could you adapt your design to collect acceleration data for a different purpose?
- Explain your design for attaching the micro:bit to your arm? What changes would you make?

Why is this relevant? (Real world connections)

Measuring throwing data helps us understand how force, speed, and technique affect performance. It's used in sport to improve skills, in health to track recovery, and in technology to develop smart devices. Just like athletes and engineers, we can collect and analyse this data to learn, improve, and solve real-world problems. Using *Barambah Gimbe* as a context for collecting data connects contemporary technology with traditional practices (instructive First Nations Australian games), highlighting the educational value of cultural knowledge and movement-based learning.

Assessment

Observation can be used to check students' ability to carry out tasks aligned to the Australian Curriculum. We have included some suggested questions for teachers to reflect on and to guide these observations.

Checking for understanding

- Can students create an algorithm that follows a clear sequence and uses branching and iteration? Does the algorithm reflect the MakeCode program?
- Did the students design and apply an effective way to wear the micro:bit safely while throwing?
- Was the micro:bit programmed correctly to collect data?
- Does it start and stop data logging using button inputs?
- Can students download the data and explain what the data tells them about their throwing technique?
- Can students compare their results with others and describe what they learned?
- Can they evaluate whether their solution meets the needs of the user and design criteria?
- Can students suggest changes to improve their solution?

For more assessment resources we recommend the Assessment resources on the Digital Technologies Hub.

Supporting materials

Aboriginal and Torres Strait Islander background information

First Nations Australians have a long history of using games, tools, and models as part of play-based learning. These activities are often created for children and are designed to build specific skills or support learning through hands-on, playful experiences connected to particular topics.
(LESSON IDEA -YR F. (n.d.). Retrieved June 17, 2025, from https://aamt.edu.au/wp-content/uploads/2023/07/3.-NAIDOC-Segur-etug-game.pdf)

In our F-2 Maths in Schools online course we explore the rich context of Instructive games using Professor Chris Matthew's Goompi model and 8Ways as integrated frameworks. This content has been developed in partnership with ATSIMA and is designed to assist teachers to build their cultural competency and understanding. You can access our free courses through the Maths in Schools professional learning page on the Mathematics hub website.

ACARA has developed the FIRST framework which helps teachers connect with local First Nations communities to support teaching the Australian Curriculum, especially when including Aboriginal and Torres Strait Islander content. It offers simple, practical steps for developing culturally responsive lessons and encourages respectful collaboration to build confidence and relevance in teaching.

Design thinking

User stories

User stories are brief descriptions of the needs and goals of the users of a product or service. They help define the features and functionalities that will create user value and solve their problems. A suggested format would look like this:

A < insert a user > has < insert a goal > so that < insert a reason >
for whom? do what? why?

Our example for this activity could therefore follow this format:

As <a student playing Barambah Gimbe>, < **I want to** use a micro:bit to collect data about my throwing movements> **so that** < I can improve my technique to make my throws more consistent>.

Design criteria

Students determine the success of their implemented solutions against given design criteria and co-created user stories. Design criteria are the specific requirements that guide the design process and the evaluation of the design solutions.

The following criteria would assist in the evaluation of this task:

- the micro:bit was programmed to collect acceleration data
- the device was securely and safely attached to the student's arm to record throwing data
- the data collected was visualised using a graph or table, observations about patterns or differences between throws are identified
- the data is used to suggest or make changes to improve throwing techniques.

Programming

Algorithms and Pseudocode

Algorithms are a precise description of the steps and decisions needed to solve a problem. Algorithms often involve iterative (repetitive) processes. Algorithms can be represented as pseudocode which is an English language statement that describes the steps in an algorithm in a clear, unambiguous way. It can be easily translated into code using a programming language.

Example Algorithm [Pseudocode]

Start with logging turned off.
Show a "no" icon on the screen so you know it's not logging yet.

When you press button A:
Turn logging on.
Show a tick to let you know it's ready to collect data.

If you press buttons A and B at the same time, and the top logo is touched:
Turn logging off.
Show a skull to show it has stopped.
Clear all the saved data.

While logging is on:
At regular intervals (every 100 milliseconds),
Measure how strong the movement is.
Save that number in the data log under the name "strength".

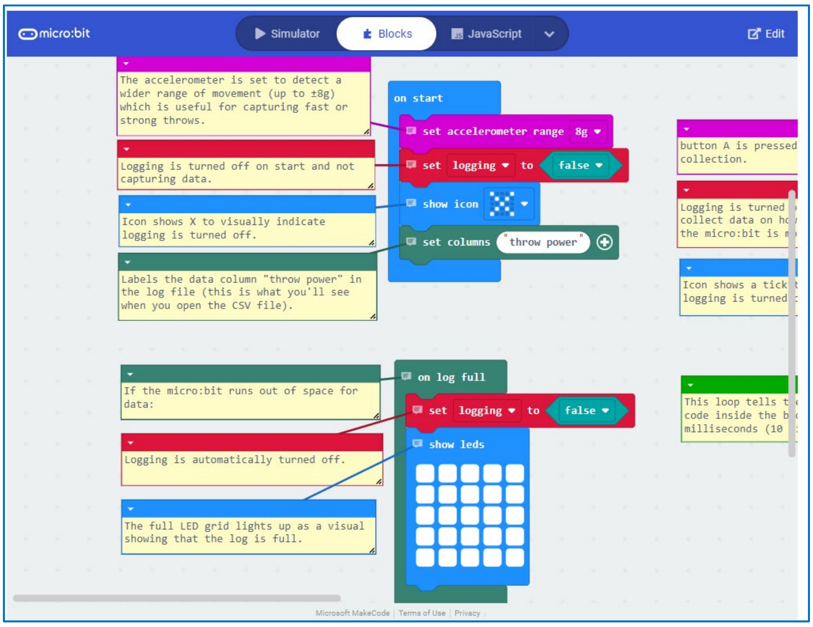
If the data log gets full:
Stop logging automatically.
Show a full grid of lights to let you know it's full and has stopped.

Example code Throw strength data logger project

Access our example MakeCode project [Throw strength Data logger.]

Comments are provided to explain the purpose of each block.

Additional information on accessing the data can be located in the micro:bit user guide. https://microbit.org/get-started/user-guide/data-logging/



Teacher professional learning opportunities

We would like to thank the Australian Government Department of Education for funding our Lending Library and associated resource development.

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STEM PL csermoocs.adelaide.edu.au

We run a range of STEM programs for Australian teachers, including our online CSER MOOC courses, free professional learning events, and our National Lending Library.

Our free, self-paced online courses available from CSER and Maths in Schools in the following areas:

- Decoding Digital Technologies (Primary)
- Digital Technologies + X (Primary)
- Cyber Security and Awareness (Primary and Secondary)
- Teaching AI in the classroom (Primary and Secondary)
- Maths in Schools (Foundation - Year 2, Year 3 - 6 and Year 7 – 10)

www.csermoocs.adelaide.edu.au

Australian Curriculum

Digital Technologies

This activity can be adapted for students between Year 3 and Year 6 **Digital Technologies**.

Students in Year 3 and 4 learn to:

- define problems with given design criteria and by co-creating user stories (AC9TDI4P01)
- generate, communicate and compare designs (AC9TDI4P03)
- discuss how existing and student solutions satisfy the design criteria and user stories (AC9TDI4P05)
- follow and describe algorithms involving sequencing, comparison operators (branching) and iteration (AC9TDI4P02)
- implement simple algorithms as visual programs involving control structures and input (AC9TDI4P04).

By the end of Year 4 students create simple digital solutions and use provided design criteria to check if solutions meet user needs. They follow and describe simple algorithms involving branching and iteration and implement them as visual programs.

Students in Year 5 and 6 learn to:

- define problems with given or co-developed design criteria and by creating user stories (AC9TDI6P01)
- generate, modify, communicate and evaluate designs (AC9TDI6P04)
- evaluate existing and student solutions against the design criteria and user stories and their broader community impact (AC9TDI6P06)
- design algorithms involving multiple alternatives (branching) and iteration (AC9TDI6P02)
- implement algorithms as visual programs involving control structures, variables and input (AC9TDI6P05).

By the end of Year 6 students develop and modify digital solutions, and define problems and evaluate solutions using user stories and design criteria. They design algorithms involving complex branching and iteration and implement them as visual programs including variables.

Health and Physical Education

This activity can be adapted for students between Year 3 and Year 6 **Health and Physical Education.**

Students in Year 3 to 6 learn to:

- refine and apply fundamental movement skills in new movement situations (AAC9HP4M01) HPE Years 3 & 4
- investigate how different movement concepts related to effort, space, time, objects and people can be applied to improve movement outcomes (AC9HP6M03) HPE Years 5 & 6.

By the end of Year 4, students apply fundamental movement skills and demonstrate movement concepts. By the end of Year 6, they refine and modify movement skills and apply movement concepts.

Mathematics

Students in Year 3 learn to:

- acquire data for categorical and discrete numerical variables to address a question of interest or purpose by observing, collecting and accessing data sets; record the data using appropriate methods including frequency tables and spreadsheets (AC9M3ST01)
- create and compare different graphical representations of data sets including using software where appropriate; interpret the data in terms of the context (AC9M3ST02).

By the end of Year 3, students record, represent and compare data they have collected.

Students in Year 4 learn to:

- analyse the effectiveness of different displays or visualisations in illustrating and comparing data distributions, then discuss the shape of distributions and the variation in the data (AC9M4ST02)

By the end of Year 4, they assess the suitability of displays for representing data and discuss the shape of distributions and variation in data.

Students in Year 5 learn to:

- acquire, validate and represent data for nominal and ordinal categorical and discrete numerical variables, to address a question of interest or purpose using software including spreadsheets; discuss and report on data distributions in terms of highest frequency (mode) and shape, in the context of the data (AC9M5ST01).

By the end of Year 5, students collect nominal and ordinal categorical and discrete numerical data using digital tools.

Students in Year 6 learn to:

- interpret and compare data sets for ordinal and nominal categorical, discrete and continuous numerical variables using comparative displays or visualisations and digital tools; compare distributions in terms of mode, range and shape (AC9M6ST01)

By the end of Year 6, they compare distributions of discrete and continuous numerical and ordinal categorical data sets, using digital tools.

Aboriginal and Torres Strait Islander Histories and Cultures Cross-curriculum priority

Through learning about Barambah Gimbe a traditional Aboriginal instructive ball game, this activity connects with the Aboriginal and Torres Strait Islander Histories and Cultures cross-curriculum organising idea - Culture:

- First Nations Australians' ways of life reflect unique ways of being, knowing, thinking and doing. (A_TSIC2)

To deepen connection with this organising idea of Culture and the Health and Physical Education curriculum, students in Years 5 & 6 could be challenged to modify the game and rules of Barambah Gimbe and investigate the effectiveness of these changes.

- devise and test alternative rules and game modifications to support fair play and inclusive participation (AC9HP6M08) HPE Years 5 & 6

Elaboration - investigating the effectiveness of rules used in traditional games of First Nations Australians to promote participation, such as Inkanyi: a cooperative running game played by the Pitjantjatjara / Yankunytjatjara of central Australia where there are no winners and Barambah gimbe: a throwing and catching game from the lands of the Wakka Wakka where catchers can be nominated to increase participation