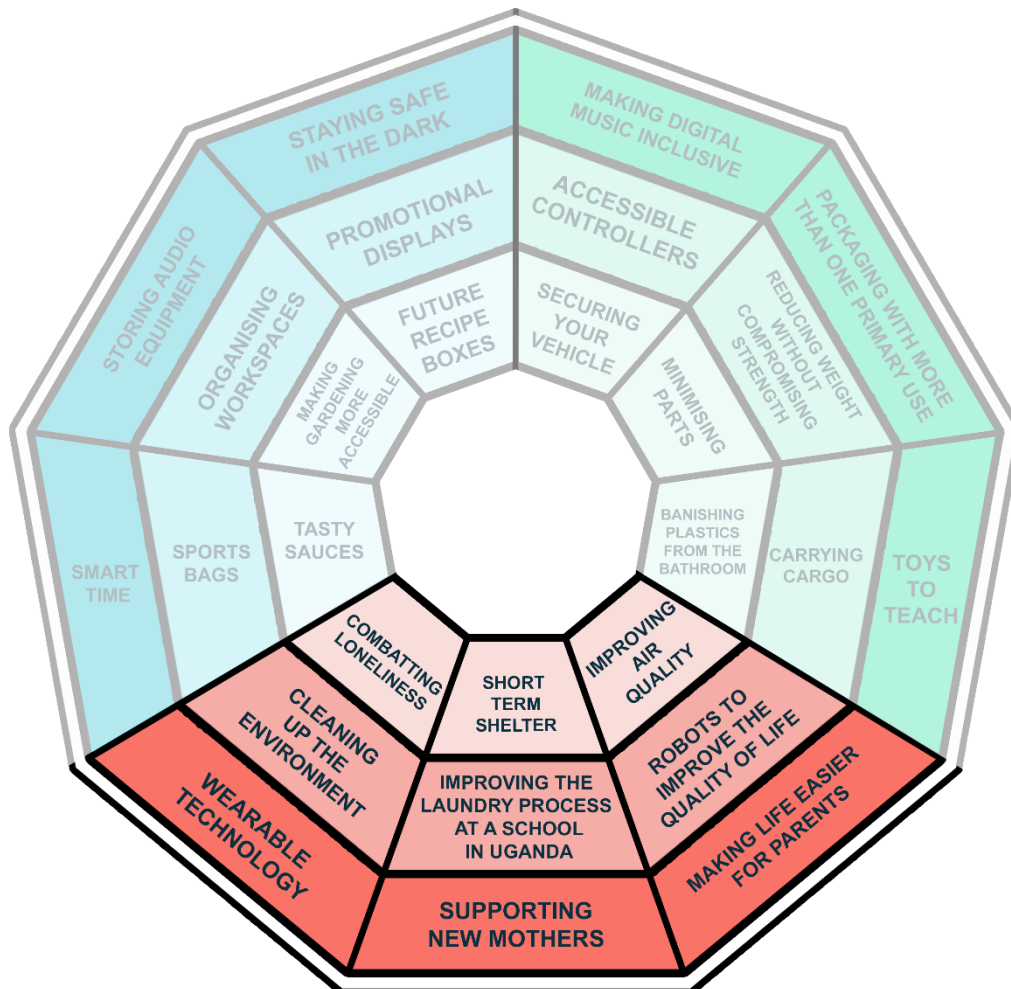


INSPIRED BY INDUSTRY

Supporting an athlete with wearable technology

#InspiredbyThrive



thrive
WEARABLES

Introduction

This context has been put together to allow for a range of opportunities for students to explore modern technology through the use of wearable technology.

Materials

Whilst not exclusive to, it provides good opportunities to explore fabrics and polymers as well as prototyping materials such as card and expanded foam. Fundamental to this though is the exploration of electronics and/or systems and control. This may be through the use of micro:bit or Crumble where they can allow for some prototyping of products that react to external changes. For example, the micro:bit V2 can detect movement, temperature, sound and more.

Potential outcomes

The outcomes are to be conceptual and may not be fully working. For example, if a heart monitor was to be explored, the prototype may detect movement such as with an accelerometer in a micro:bit or a tilt-switch for a Crumble. Whilst this may not be a true representation of how it is done, to allow a concept to emerge it would be suitable for KS3.

It is important that students are given some freedom within this context and so outcomes should vary between students / groups. You may decide to limit your class to 2-3 outcomes however.

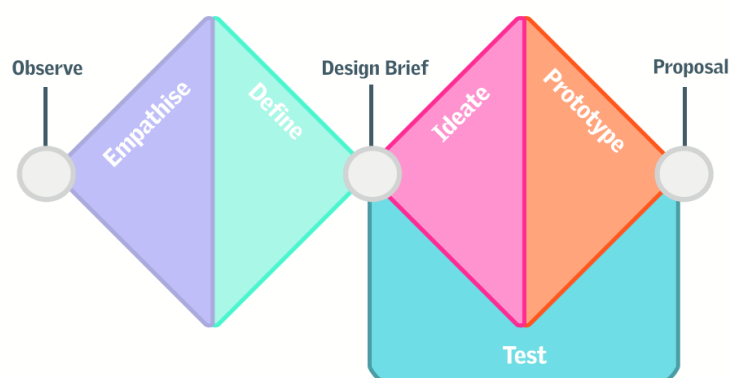
There is an opportunity to look at fabric-based outcomes and explore textiles here. Wearables for the arm, head, waist etc will all involve cutting patterns, working with fabrics to create outcomes. While incorporating the electronics is advisable, again, this should be viewed as a prototype to test a concept. You may wish to explore making a 'what it looks like' prototype with students – or may be an opportunity for CAD work.

Examples may include (but not be limited to):

Pedometers, Athlete's night running light, heart monitor, calming music player, impact detector, remote cox, training game.

Design cycle

The design cycle shown can be worked through in a range of orders. It's advised that the areas are revisited throughout the process depending on your time. We advise that a graphical representation of thinking convergent and then divergent may be shown to your students.



The following are some tips as to the type of activities you could do with your students.

Empathize stage

- Students should be introduced to this term if not already familiar.
- At the start of the context, students should be thinking wide with their thoughts, exploring the problem and not deciding too soon what they 'want to make', but observing what is happening.
- This observation (may be a video, producing a journal for someone to fill in, a phone call interview, email etc) should allow them to 'spot problems'.
- The following videos from Ford are good examples of empathetic design in industry [VIDEO 1](#) [VIDEO 2](#)
- The Big Life Fix [HERE](#) is fantastic for showing empathetic designing. Throughout the process the designers try to immerse themselves in the problem and regularly get feedback from the clients. Observing others is really important rather than just asking people what they want as they may not know!
- If gaining access to research is hard, you may want to observe part of a PE lesson. As a group note down all the potential issues you see – don't think at all about solutions yet, or even if they are able to be solved using technology – this is just a stage to highlight issues and concerns. It may be things like, grip on the court, people needing their inhaler, unable to see because of the sun, getting hurt by tackles...
- Students should get information to help them later in the challenge. They may present this in any way they wish.

Define stage

- This is where students try to get the real root of the problem and decide what they are going to do.
- There may be a whole range of 'athletes' identified. Is a dart's player an athlete? Someone that plays chess? For this context – why not! Allow your students to think creatively. Define the user at this stage and the precise problem they are tackling. You may want to get them to back up the reason it is important – possibly looking at stats and an infographic?
- The '5 why's' may be a good resource to run through with students. You could even pair them up to do this with each other at the define / empathy stage [VIDEO HERE](#)
- For older students, this case study from [DESIGN COUNCIL](#) is great to show how to define the problem and come up with innovative solutions.
- This is a good opportunity to introduce contextual challenges to students and get them to consider all aspects of the problem. It will undoubtedly need some support from you as a teacher. Please get students to share their thinking as clearly as they are able.
- Get students to create a specification. Whilst templates / writing frames are fine at KS3, you will want to avoid this at KS4. Consider using columns such as 'Essential', 'Desirable' and 'Definitely not'.

Ideate stage

- Ideas for the electronics element may initially be through words. You may want to consider listing the inputs and outputs available for your system and do a matching

activity. For example, motion, light, temperature etc, then LED, buzzer, tune etc. It may be that the tune plays when the motion drops to encourage more activity to the athlete...

- Encourage students to think wide initially. No ideas are too silly, too big.
- Ideas can also be produced through making. Get students experimenting with the programmable components and electronics early on.
- The outcome can also feature a visual element and opens opportunities for organic shapes and representing different materials such as fabrics and plastics.
- There are a range of videos on YouTube to help students with sketching techniques. [HERE](#)
- Product design sketching tutorials can be found [HERE](#)
- The Design Museum have some nice, short, case-study videos [HERE](#)
- Students should be encouraged to sketch on anything to hand – envelopes, packaging etc. This may be a good method to stop students potentially being daunted by blank paper.
- Get students to keep sketching. It may not be the whole item, it may be parts of it – a fastening or ways to attach the electronics.
- Encourage zoomed-in parts of the product to focus on details and annotation.
- Annotation may be things they like, things they are not happy with and explanation of parts that are not clear from the picture.
- A range of techniques such as 2D, 3D, Exploded and cross sections are good.
- Research may be needed at this stage. Consider a handling collection such as phone holders for runners. Can they think of things that do a similar job?
- Ideas don't have to be revolutionary and completely new. As Thrive mention – their products need to do something different or be better than what exists. Maybe a new user? Consider 'development' with your class. Maybe they can start with an existing product and improve it. This [VIDEO](#) is a good introduction to this for older students / teachers.
- You could introduce modern / smart materials such as QTC which may generate alternative approaches or ideas for students.

Prototype stage

- A nice video from BBC Bitesize is [HERE](#)
- This short video from The Design Museum looks at the journey a designer had to design and make a collapsible bottle. [HERE](#).
- There are a number of videos by Jude Pullen from Big Life Fix [HERE](#) on how to create shapes in card. However, many may not have access to materials / tools and so C.A.D. may be more suitable.
- The following are all suitable CAD programs:
 - [AUTODESK](#) free for schools/students. Mac & Windows
 - [CREO](#) free for schools/students (PC only)
 - [FREECAD](#) free for schools/students
 - [ONSHAPE](#) free for schools/students
 - [SKETCHUP](#) free for schools/students
 - [SOLIDEDGE](#) free for schools/students
 - [SOLIDWORKS](#)
- There are some good Autodesk Fusion tutorials [HERE](#) and TinkerCad [HERE](#)

- It is worth discussing with students WHY to make a model. What things could it test?
- Size, comfort, aesthetics etc. Choosing the correct model for the correct test is important.
- Throughout the process, ensure students follow procedures for health and safety and understand the process of risk assessment.

Test stage

- Although this is the final stage of the design cycle, encourage students to evaluate throughout and act on their feedback (and consider the feedback of others too). It is not a final thing, but a step to improve further.
- Consider AR (Augmented Reality). If you use windows, PAINT 3D allows you to open .obj files and students can then view their design on an athlete to see how it may appear.
- To help students that are **reluctant to improve their idea**, consider prompts such as “What if money was no object?” “What if you could only use locally sourced materials?” “What if it had to be made in 1 day?” “What if you needed to make 100,000?” “What if it had to be made cheaper?” “What if it had to be made lighter?”.
- This could be a good opportunity to explore mathematical content by getting students to calculate amount of material used, costs etc. Some programs such as Autodesk Fusion allow you to calculate the amount of material you have used [HERE](#).
- How can students get feedback from users? Could they use technology to get a wide range of feedback – e.g. a Google Form? A poll on twitter?
- Get students to think about the main problem they identified earlier – does it actually do that?
- Prompts for younger students e.g. ACCESS FM are suitable approaches. For older students they need to consider a wider range of aspects such as scalability, manufacturing techniques and limitations, ergonomics etc.

Focused Tasks

<u>'Laminating foam'</u>	<u>'Split casing'</u>	<u>'Fabric templates'</u>	<u>'Micro:bit starter'</u>
How to laminate foam to create curved shapes.	Designing 3D casing using split command on CAD programs (represent injection moulded cases).	Creating fabric templates / patterns.	Getting started with micro:bit.
<u>'Crumble starter'</u>	<u>'Working with breadboards'</u>	<u>'Using a canvas in CAD'</u>	<u>'Display stands'</u>
Getting started with Crumble microcontroller.	Using breadboards to prototype electronics.	Adding a background image to be used to base your sketch on in CAD. Think of designing around a wrist photo.	Methods such as line bending and thermoforming to create stands for watches, earrings, headphones etc.
<u>'Designing 3D forms'</u>	<u>'Packaging finishing techniques'</u>		
Using sculptural form tools in 3D CAD packages to create more ergonomic features.	Recreating packaging techniques such as embossing, spot varnishing etc		

Investigative and Evaluative Activities

'Classmate averages'	'Data charts'	'Explore ergonomics in wearables'
Anthropometric study of classmates. Mean, Median and Mode averages. Percentiles.	Create anthropometric data charts based on measurements of the class.	How are a number of wearable technology or clothing made to be comfortable? (adjustable, materials used...)
'Analyse existing wearables'	'Exploring material properties'	'Explore fastenings'
Having a collection of working or non-working wearables. Analyse using ACCESS FM	Handling materials and running tests to explore their working properties.	Having a collection of fastenings and discussing products and selection to the fastening.

